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Do Elite Colleges Matter? The Impact of Elite College Attendance on Entrepreneurship Decisions and Career Dynamics

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Abstract

Elite college attendance significantly impact on subsequent entrepreneurship decisions and career dynamics. We find that an elite college degree is positively correlated with entrepreneurship (defined as owning an incorporated business) but not with other forms of self-employment. We develop an overlapping generations model that captures self-selection in education and career choices based on heterogeneous ability and family wealth endowments over the lifecycle. Our estimates show that (1) entrepreneurs and other self-employed individuals require different types of human capital and (2) elite colleges generate considerably more human capital gain than ordinary colleges, particularly for entrepreneurs. Distinguishing between elite and ordinary colleges improves our prediction of entrepreneurship decisions. Our simulation shows that moving elite college graduates to non-elite colleges significantly reduce their likelihood of becoming entrepreneurs, but not other self-employment. Overall, providing subsidies for elite colleges is more efficient than subsidizing their non-elite counterparts in encouraging entrepreneurship, improving intergenerational mobility and welfare.

JEL Classification: D15, I20, J24

Keywords: entrepreneurship, elite college, intergenerational transfer.

1 Introduction

Do elite colleges matter? The ongoing lawsuit by Students for Fair Admissions (SFFA) against Harvard University, and the related discussion, suggest that the public believe that elite colleges matter.[1] The large amount of bribery involved in the recent elite college admission scandal may even suggest that a "premium" is placed on graduating from an elite college over an ordinary one.[2]

However, calculating the "elite college premium" is not straightforward, as elite college students are highly selected in terms of their ability and family background, as shown by Chetty et al. (2020). Some studies quantify the impact of elite colleges after controlling for college selectivity. Dale and Krueger (2002) find that there is no earning differential between elite college graduates and ordinary college graduates.[3] This result implies that the elite college premium is negative, as elite colleges charge much higher tuition fees than ordinary colleges. Numerous studies debate these findings (e.g., Black and Smith, 2004, 2006, Dale and Krueger, 2014, Hoxby, 2009, Ge et al., 2018).[4]

In this paper, we analyze the effect of attending an elite college on lifetime income, focusing on the impact on students' entrepreneurship decisions and career dynamics. Elite college dropouts such as Mark Zuckerberg and Bill Gates are often cited as "proof" that one can be a successful entrepreneur without gaining a degree from an elite college. However, Jeff Bezos and Elon Musk are equally praised for demonstrating that elite college graduates have a better chance of becoming successful entrepreneurs.[5] On the one hand, elite colleges may increase students' entrepreneurial human capital. On the other hand, the high tuition fees charged by elite colleges may deter potential entrepreneurs due to the financial constraints.

Identifying the effects of elite colleges on students' entrepreneurship decisions and success is not a straightforward task, as smarter and richer individuals are more likely to attend elite

[1]On November 17, 2014, SFFA filed a lawsuit in the federal district court against Harvard University for race-based discriminatory admission practices. On September 30, 2019, the district court found no evidence of any intentional discrimination. On February 25, 2020, SFFA filed an appeal. For more details of the SFFA vs. Harvard case, see court document Case 1: 14-cv-14176-ADB, Document 672 (filed 09/30/2019) and Case: 19-2005, Document: 00117556565 (filed 02/25/2020).

[2]According to McLaughlin and DeGeurin (2020), federal prosecutors have charged around 50 parents. On top of the expensive tuition, these parents have paid on average $500,000 to get their students into elite schools like the University of Southern California, Stanford, and Yale as part of the bribery scheme.

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

[4]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 econometric methods and find that the literature probably underestimates the effect of college quality. Hoxby (2009) argues that with their resources, elite colleges enable their students to make massive human capital investments and become more competitive. Dale and Krueger (2014) extend their earlier work by examining the returns to college of a more recent cohort and over a longer time horizon. They argue that the college effects on wages are concentrated in certain subgroups, such as African American and Hispanic students. Ge et al. (2018) find that elite college attendance has significant marriage market benefits, especially for women.

[5]Zimmerman (2019) shows that attending an elite business-focused degree program in Chile significantly enhances the probability of attaining a top corporate position among male students from expensive private high schools. Such differences are not found for female students or male students from other types of high schools.

colleges and become successful entrepreneurs. Thus, to control for selection in terms of ability and wealth, we develop an overlapping generations life-cycle model that unifies the seminal work of Keane and Wolpin (1997), which focuses on life-cycle education and career choices, and a series of works by Cagetti and De Nardi (2006, 2009), which emphasize entrepreneurship decisions. In particular, we model how agents self-select different educational and career choices after receiving intergenerational transfers of wealth and acquiring multi-dimensional abilities. Hence, our model evaluates (a) the contributions of different types of education (elite college, ordinary college, or no college) to the accumulation of different types of human capital and (b) the production technologies, riskiness of the income stream, and human and physical capital requirements of various career choices (employment, entrepreneurship, and other self-employment). Our model captures the diversity in education choices, subsequent career dynamics (switching from one career to another), and intergenerational mobility observed in our panel dataset. Our assessment of the relative importance of different factors in the variation of lifetime incomes and career choices contributes to the nature versus nurture debate. Furthermore, our simulation and counterfactual exercises shed light on the importance of elite college attendance to entrepreneurship decisions.

Our analysis proceeds in several steps. First, we show that the income profile (i.e., median, mean, and standard deviation) of entrepreneurs (defined as individuals who own an incorporated business) is different from the income profiles of employees and other self-employed individuals (individuals who possess an unincorporated business). Using a restricted access dataset from the Panel Study of Income Dynamics (PSID), we identify the college at which each respondent studied. We show that elite college graduates are more likely to become entrepreneurs than to engage in other forms of self-employment (Table 3). Moreover, entrepreneurs earn more than employees, while the earnings of other self-employed individuals are similar to those of employees. These findings suggest that it is essential to distinguish between two types of self-employment, namely entrepreneurs who own an incorporated business and other self-employed individuals who possess an unincorporated business, as pointed out by Levine and Rubinstein (2016).[6] These findings are innovative because the literature often focuses on devoted employees (i.e., economic agents who have never been self-employed) when evaluating the effects of elite college attendance. In this paper, we highlight the impact of elite college attendance on entrepreneurship.

Next, we construct an overlapping generations life-cycle model of education and career choices. Education and career choices are typically not random. For example, more able individuals and those from wealthy families are more likely to enroll in elite colleges and become entrepreneurs. In our model, agents inherit multi-dimensional abilities (defined as employee ability, unincorporated ability, and incorporated ability) and wealth from their families. They make educational choices (high school, non-elite college, and elite college) and career deci-

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

sions (employees, entrepreneurs, and other self-employed). Education improves employee, unincorporated, and incorporated human capital, and these human capital gains potentially differ between elite and non-elite colleges.[7]

We estimate our model using the PSID and generate several sets of results. First, our life-cycle model captures both education and career decisions and career dynamics. Although career dynamics (the transitions between being an employee, an entrepreneur, and other self-employed) are often overlooked in the literature, they are worthy of attention because they can provide important insights into the selection into and out of each career. When estimating the model, we match the income level of different career paths, as well as career and income dynamics, such as the conditional probabilities of switching from one career to another and the correlations in the incomes of people switching from one career to another.[8] Our structural model also provides estimates of intergenerational links, such as the conditional probability of a son's educational or career choice given the father's decision. To the best of our knowledge, this unified framework for studying educational alternatives, career dynamics, and intergenerational links is new to the literature.

Second, we estimate the effect of elite college attendance on the accumulation of human capital. Our model predicts that agents born with higher employee ability and financial capacities are more likely to enroll in elite colleges. After controlling for selection in terms of ability and wealth, elite colleges still deliver higher gains for employees, unincorporated, and incorporated human capital compared with non-elite colleges; the increase in incorporated human capital is the largest. The average elite college premium (discounted lifetime income gains from going to an elite college compared with a non-elite college, net of tuition) is positive and equivalent to $136,830 in 2011 dollars, which justifies people's willingness to attend elite colleges despite their high tuition fees.

Third, we show that incorporated and unincorporated businesses operate with very different human and physical capital requirements, which justifies our decision to treat them separately in the model. Incorporated businesses make use of employee human capital and incorporated human capital, whereas unincorporated businesses mostly use unincorporated human capital. Moreover, incorporated businesses have an entry cost of $50,000 (in 2011 dollars), while the corresponding figure for unincorporated firms is not significantly different from zero. Individuals with high employee ability and high incorporated ability sort into incorporated businesses in our model, while individuals with low employee ability and high unincorporated ability sort

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

[8]The distribution of entrepreneurial returns is known to be skewed, and it is difficult to match precisely. Hall and Woodward (2010) find that almost three quarters of venture-backed entrepreneurs receive nothing at firm exit while 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.

into unincorporated businesses.[9] Initial wealth increases the chance of owning an incorporated business but does not affect the chance of owning an unincorporated business.

Fourth, we evaluate the effect of elite colleges on entrepreneurship by conducting decomposition and simulation exercises. Compared with our full model, which includes differences in abilities, wealth, and schooling at age 20, excluding variation in education reduces the explanatory power of the model for the entrepreneurship decision (measured by the conditional variance) by 5.4 percentage points (ppt), whereas the explanatory power for the self-employed decision is unaffected.[10] Moreover, when we group elite and non-elite colleges, the explanatory power of education for the entrepreneurship decision is much smaller (only 2.6 ppt), suggesting that distinguishing elite and non-elite college graduates is vital to understanding their entrepreneurial decisions. We further simulate the changes in career choices by comparing individuals assigned to elite and non-elite colleges. Assigning elite college graduates to non-elite colleges leads to a substantial drop in the probability of becoming an entrepreneur, by 5.6 ppt (45.5%), whereas the chance of becoming other self-employed only declines by 0.9 ppt (6.6%). Moreover, our simulation shows that the effect of elite colleges on entrepreneurship is concentrated for individuals with high incorporated ability and low initial wealth. The above decomposition and simulation exercises jointly suggest that considering elite college attendance is essential to understand entrepreneurship decisions.

Our last set of results comes from two counterfactual experiments: subsidies for elite college students versus subsidies for non-elite college students. We find that subsidizing elite college students increases the number of entrepreneurs and their income indirectly, 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 and reducing intergenerational income persistency. However, these subsidies also increase income inequality.

The remainder of this paper proceeds as follows. As the paper is built on a vast body of 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 the estimation in Section 4. We explain the identification and estimation strategies in Section 5. The estimation results are presented in Section 6, where we discuss the model fit of the targeted and untargeted moments, the elite college premium, and the effects of abilities and initial wealth on education and career decisions. Section 7 analyzes the effect of elite colleges on entrepreneurship through decomposition analysis and a simulation exercise. Section 8 presents the counterfactual analysis of providing subsidies to elite and non-elite colleges. Section 9 concludes the paper.

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

[10] Excluding the ability differences reduces the model's explanatory power for the entrepreneurship decision by more than half, among which incorporated ability is the most crucial factor. In contrast, excluding the variation in initial wealth does not have a significant impact on the explanatory power of the model.

2 Literature Review

This paper builds on the insights of many authors. Having discussed the literature on elite colleges in the introduction, we now focus on the literature on self-employment.[11] Note that the literature on self-employment does not distinguish between entrepreneurs (owning an incorporated business) and other self-employed individuals (owning an unincorporated business). The only exceptions are Levine and Rubinstein (2016, 2018). The earlier study provides a descriptive analysis of the differences between the two types of self-employment and the later study analyzes how abilities and liquidity constraints have different effects on the likelihood of selecting entrepreneurship and other self-employment.[12]

Several authors explore the individual characteristics, including income, wealth, and education, that affect the probability of an individual's becoming 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). In particular, these studies produce mixed evidence of the relationship between education and self-employment. Some studies do not find a significant effect (Dunn and Holtz-Eakin, 2000, Evans and Jovanovic, 1989), while others observe a significant impact (Parker and Van Praag, 2006, Samaniego and Sun, 2019). 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 decisions on self-employment.

Other studies on self-employment 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 of the intergenerational transfer of self-employment. Using Swedish adoption data, Lindquist et al. (2015) compare individuals living with adopted parents with those living with their biological parents and find that post-birth factors are more important than pre-birth factors. Using Norwegian data, Hvide and Oyer (2018) find that most male self-employed individuals start a business in an industry the same as or closely related to that of their fathers.

In addition to micro studies on self-employment, studies on self-employment use the dynamic generation equilibrium framework. Bassetto et al. (2015), Cagetti and De Nardi (2006, 2009), and De Nardi and Yang (2014) find that introducing self-employed individuals into life-cycle models significantly helps the models match stylized facts such as the capital-output ratio and the income distribution in the U.S. Samaniego and Sun (2019) introduce endogenous education choices to the Cagetti and De Nardi framework, and find that the higher labor earnings of college graduates allow them to mitigate credit constraints and become self-employed. They

[11] Please refer to Astebro et al. (2014), Hanushek and Woessmann (2015), Kerr et al. (2018), Oreopoulos and Salvanes (2011), Oreopoulos and Petronijevic (2013), and Van der Sluis et al. (2008) for surveys of the literature on self-employment and education.

[12] They use a static model and do not model the education decision.

also find that the welfare benefits of subsidizing education are greater than those of removing financing constraints on education because subsidies facilitate the accumulation of physical capital and loosen the credit constraints on would-be entrepreneurs. There are also dynamic equilibrium models of self-employment that do not contain a life-cycle structure. Kwark and Ma (2018) incorporate entrepreneurial choice in a dynamic general equilibrium model with both aggregate and idiosyncratic shocks, and document that entrepreneurial activities are related to the movement to higher income groups. Their model can also replicate the income transition matrices over occupational choices. Following Vereshchagina and Hopenhayn (2009), Choi (2017) develops a dynamic occupation choice model and 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, we build a life-cycle model in which different agents have different abilities and monetary endowments inherited from their families, and 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 effects of wealth and ability. Our model mimics the observed intergenerational persistency in education, career, and income. Second, we show that the differences between the two types of self-employment, namely incorporated and unincorporated business ownership, are substantial. Specifically, these two types of businesses have different technologies and risks, and require different types of human capital and entry costs. Our structural model recognizes the differences between these two types of self-employment and explains the corresponding career decisions over the life-cyle. Third, using these analyses as the background, we conduct two counterfactual experiments on subsidies to elite and non-elite colleges. We evaluate their micro effects on entrepreneurs' decisions and performance, and the aggregate effects on welfare, inequality, and intergenerational mobility.

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 individual's 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.[13]

Individuals not in school choose between being an employee, owning an incorporated busi-

[13] 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.

ness (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 continue to run their business 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 $\omega \in [0, 1]$. Children inherit abilities from their parents. When children leave home and begin their own households, parents have the option of giving them a one-time gift of liquid assets, denoted by R.[14] This can be motivated by the observation that many parents help their children pay for college or finance their businesses.[15]

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.[16] 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 transferred from parent to child according to an AR(1) process according to[17]

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

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

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

[14]Since we focus on father-son intergenerational linkage in terms of education, income, and career choice, we abstract from other important decisions and intergenerational channels, such as fertility and parental time allocation that other authors have explored. Among others, see Gayle and Golan (2018), Lee and Seshadri (2019).

[15]Empirical studies confirm the existence of inter vivos transfers for college and other investments. See Hurd et al. (2011) and Haider and McGarry (2018).

[16]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.

[17]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).

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 $\mu_{hs}^j \in \{em, ib, ub\}$ to zero. Potential experience x is determined by age and whether a person attended college.[18]

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[19]

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

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.

College choice 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}).[20] Our formulation embeds both need-based and merit-based financial aid.

In addition to the difference in price, the two types of colleges also have different ability requirements. We assume that colleges cannot observe students' employee ability, but they can observe their SAT scores, which are a signal of their employee ability. Colleges select their students based on their SAT scores, which are a function of the employee ability and a noise.

$$SAT = \kappa A_{em} + \varepsilon \tag{4}$$

[18]We assume that h_{em} only depends on the number of years people have entered the labor market, but not the actual number of years people have worked as employees. We make this simplification for computational tractability. Given that 82% of individuals are employees in our sample, potential experience can be a good proxy for employee experience.

[19]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.

[20]We assume that colleges do not give financial aid based on incorporated ability or unincorporated ability because these abilities 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).

where $\varepsilon \sim N(0, \sigma_\varepsilon^2)$. The selection criteria of elite and non-elite colleges are

$$SAT \geq \overline{SAT}_e \quad \text{for } e \in \{nc, ec\} \tag{5}$$

where $\overline{SAT}_{nc}$ and $\overline{SAT}_{ec}$ are the minimum requirement of SAT scores for non-elite and elite colleges, respectively. The modeling of ability requirements allows us to incorporate the selectivity and capacity constraint of colleges.

Technology In our model, entrepreneurs and other self-employed individuals 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 incomes for entrepreneurs and other self-employed individuals are given by

$$I_j = P_j h_j (h_{em})^{\rho_j} (k_j)^{v_j} e^{\epsilon_j} - C_j 1\{j_{-1} \neq j\} \quad j \in \{ub, ib\} \tag{6}$$

where $\epsilon_j \sim N(0, \xi_j^2)$, $j \in \{ub, ib\}$ are serially uncorrelated. Entrepreneurs and other self-employed individuals have similar income structure. Their income depends on 1) the productivity of the business technology (P_j), 2) their incorporated/unincorporated human capital (h_j), 3) their employee human capital (h_{em}), 4) their physical capital investment in the incorporated/unincorporated business (k_j), 5) an idiosyncratic productivity shock (ϵ_j),[21] and 6) the fixed cost of opening an incorporated/unincorporated business ($C_j \geq 0$) if they were not incorporated/unincorporated business owners in the previous period ($j_{-1} \neq j$). To capture the fact that business investment is risky, we assume that $\epsilon_j, j \in \{ub, ib\}$ is unknown to individuals before they make their career choices. The parameters ρ_j and ν_j, $0 \leq \rho_j, \nu_j \leq 1$ 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 owner's human and physical capital for investment.[22]

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

$$I_{em} = w h_{em} e^{\epsilon_{em}} \tag{7}$$

where w is the market wage rate (per efficiency unit), h_{em} is the employee's human capital, and

[21] 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.

[22] 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.

ϵ_{em} a serially uncorrelated idiosyncratic productivity shock with $\epsilon_{em} \sim N(0, \xi_{em}^2)$. The labor of employees (measured in efficient labor units, i.e., human capital) is aggregated to the market supply of labor L_{em}, so

$$L_{em} = \int_{h \in S^{em}} h_{em} e^{\epsilon_{em}} dh. \tag{8}$$

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

$$F_{em}(K, L) = P_{em} K_{em}^{\alpha} L_{em}^{1-\alpha}. \tag{9}$$

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

$$(k_j - k) \leq \lambda k \quad \text{for} \quad j \in \{ib, ub\} \tag{10}$$

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 $(1 + \lambda)$.[23]

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

$$\begin{aligned} u(c, d) = & \frac{c^{1-\sigma}}{1-\sigma} + b_{ib} 1\{d = ib\} + b_{ub} 1\{d = ub\} \\ & + b_{nc} 1\{d = nc\} + b_{ec} 1\{d = ec\} \end{aligned} \tag{11}$$

[23] We assume that employees do not face a borrowing constraint, following Cagetti and De Nardi (2006, 2009). In our PSID sample, the average debts (excluding mortgage) of employees are $16,093 in 2011 dollar, while the average debts of business owners are $78,170.

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. These shocks affect the non-pecuniary utility of career or school choices and they are i.i.d. across individuals and over time.[24] 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 up to 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.[25]

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 20 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 continuing the business and retirement after 65.

Retirement stage Let W_j represent the expected life-time utility for different career choices: retirement ($j = re$), entrepreneurship ($j = ib$), and other self-employment ($j = ub$). The state variables Ω include 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 non-pecuniary utility individuals would receive if they become business owners.

Employees older than 65 retire and decide how much to consume (c) and save for the next

[24] 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). The consumption shocks to elite and non-elite colleges help to fit the schooling choice observed in the data that cannot be explained by the pecuniary return of schooling. Similarly, the consumption shocks to entrepreneurs and other self-employed help to fit the career choice observed in the data that cannot be explained by the pecuniary return of entrepreneurship and other self-employment, respectively.

[25] We assume that once people die, the government gets their wealth.

period's capital (k'). The value of retirement is

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

where r is the interest rate and p is the pension received by retired person. Following Cagetti and De Nardi (2006), we assume pension to be a ϕ fraction of the average income before retirement. The next period's state variables are $\Omega' = \{t + 1, e, A_{em}, A_{ib}, A_{ub}, k', em\}$.[26]

The value function for a business owner (incorporated or unincorporated) is

$$W_j(\Omega, \epsilon_j) = \max_{c,k',k_j} u(c, j) + \beta\zeta(t)EV(\Omega') \tag{14}$$
$$s.t. \quad c + k' = (1 - \delta)k_j + P_j h_j h_{em}^{\rho_j} k_j^{v_j} e^{\epsilon_j} - C_j 1\{j_{-1} \neq j\} - (1 + r)(k_j - k)$$
$$c > 0, \quad (k_j - k) \leq \lambda k, \quad \text{for } j \in \{ub, ib\}$$

where δ is the capital depreciation rate. $\Omega' = \{t + 1, e, A_{em}, A_{ib}, A_{ub}, k', j, b'_{ib}, b'_{ub}\}$.

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

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

The expectations are taken over $\epsilon_{j_{-1}}$ 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 denoted by W_{em}, which is different from (13) as employees are paid a salary during these stages. The salary changes over time as employees accumulate human capital and experience different productivity shocks in each period. Formally, it is

$$W_{em}(\Omega, \epsilon_{em}) = \max_{c,k'} u(c, em) + \beta EV(\Omega') \tag{15}$$
$$\text{s.t.} \quad c + k' = k(1 + r) + wh_{em}e^{\epsilon_{em}}, \quad c > 0$$

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

[26]Given that retired workers cannot be self-employed, b'_{ib} and b'_{ub} do not affect their value functions. Therefore, the next period's state variables do not include b'_{ib}, and b'_{ub}.

observe the productivity shocks $\epsilon_{em}, \epsilon_{ib}$, and ϵ_{ub}.

$$V(\Omega) = \max\{EW_{em}(\Omega, \epsilon_{em}), EW_{ib}(\Omega, \epsilon_{ib}), EW_{ub}(\Omega, \epsilon_{ub})\} \tag{16}$$

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

$$\begin{aligned} W_{em}(\Omega, \epsilon_{em}) &= \max_{c,k',R} u(c, em) + \beta EV(\Omega') + \omega EJ(\tilde{\Phi}|A_{em}, A_{ib}, A_{ub}) \\ s.t. \quad c + k' + R &= k(1+r) + wh_{em}e^{\epsilon_{em}}, \quad c > 0 \end{aligned} \tag{17}$$

where $J(.)$ is the value function of the child and $\tilde{\Phi} = \{\tilde{A_{em}}, \tilde{A_{ib}}, \tilde{A_{ub}}, R, k', \tilde{b}_{nc}, \tilde{b}_{ec}\}$. 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 for children ($\tilde{b}_{nc}$ and $\tilde{b}_{ec}$). 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 "business-owner parent" at age 50 is

$$\begin{aligned} W_j(\Omega, \epsilon_j) &= \max_{c,k',k_j,R} u(c, j) + \beta V(\Omega') + \omega EJ(\tilde{\Phi}|A_{em}, A_{ib}, A_{ub}) \\ s.t. \quad c + k' + R &= (1-\delta)k_j + P_j h_j h_{em}^{\rho_j} k_j^{v_j} e^{\epsilon_j} - C_j 1\{j_{-1} \neq j\} - (1+r)(k_j - k) \\ & c > 0, \quad (k_j - k) \leq \lambda k, \quad \text{for } j \in \{ub, ib\} \end{aligned} \tag{18}$$

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.

$$J(\Phi) = \max\{H_{hs}(\Phi), H_{nc}(\Phi), H_{ec}(\Phi)\} \tag{19}$$

where $\Phi = \{A_{em}, A_{ib}, A_{ub}, k, k^p, b_{nc}, b_{ec}\}$. k is the initial wealth, the monetary transfer individuals receive from their parents. k^p is parent's wealth, which affects the financial aid.

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

$$H_{hs}(\Phi) = EV(1, hs, A_{em}, A_{ib}, A_{ub}, k, em, b_{ib}, b_{ub}) \tag{20}$$

High school graduates directly enter the labor market at age 20. They are similar to employees in the sense that they need to pay entry costs if they want to become a business owner. Therefore, we set $t = 1$ and $j_{-1} = em$. 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

$$H_e(\Phi) = \max_{c,k'} u(c,e) + \beta EV(\Omega') \quad \text{where } e \in \{nc, ec\} \tag{21}$$
$$s.t. \quad c + k' = (1+r)(R - T_e + f_e(k^p, A_{em})), \quad c > 0$$

where T_e is college tuition, f_e is financial aid, and $\Omega' = \{2, e, A_{em}, A_{ib}, A_{ub}, k', em, b'_{ib}, b'_{ub}\}$. We assume that college students cannot work part time when they are in school and they enter the labor market at age 25 ($t = 2$).

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

$$\int_{h \in S_{em}} k dh = \int_{h \in S_{ib}} b_{ib} dh + \int_{h \in S_{ub}} b_{ub} dh + K_{em} \tag{22}$$

  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

$$L_{em} = \int_{h \in S^{em}} h_{em} e^{\epsilon_{em}} dh. \tag{23}$$

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 entrepreneurship and career dynamics, 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

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

The top 100 universities according to this index are defined as elite.[27] 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 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.[28]

We now present some summary statistics on career choices. Table 1 shows that 18.2% of individuals in our sample do not work as employees.[29] Among them, 31% 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%).[30] The top 3 industries among other self-employed individuals are the same (accounting for 19%, 14%, and 10% of all such individuals, respectively).

We find that not only are the employees different from non-employees but also that the entrepreneurs and the self-employed have very different socioeconomic statuses. Table 1 shows that employees and non-employees are quite different in their age, education, and income

[27] Appendix Table A2 shows the list of elite colleges. 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.

[28] 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.

[29] 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.

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

level.[31] 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. Among the non-employees, 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. Thus, the significant differences in the social-economic status between employees and non-employees are mainly driven by entrepreneurs, as other self-employed individuals are similar to employees. These findings are consistent with other studies such as Hamilton (2000), Levine and Rubinstein (2016), and Moskowitz and Vissing-Jørgensen (2002). These findings also justify our modeling approach to distinguish between different types of self-employment.

Table 2 shows the intergenerational relationships in education and career choices. The upper panel demonstrates the intergenerational persistence in education. Compared with individuals whose fathers have a non-elite college degree, those with fathers have an elite college degree are 14.4 ppt more likely to graduate from an elite college. They are 23.0 ppt more likely than those whose fathers have a high school degree. 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. Controlling for father's education and career, Table 3 shows that graduating from an elite college is associated with a higher probability (2.0 ppt) of being an entrepreneur compared with high school graduates. In comparison, graduating from a non-elite college increases the likelihood of 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. Appendix Table A3 shows that having an elite college degree is associated with a higher income for employees, entrepreneurs, and other self-employed individuals. In contrast, 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 3. This result 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 income, its impact on income is much smaller than that of elite college attendance, as shown

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

in Appendix Table A3. Hence, we focus on the choice between elite and non-elite college attendance and abstract away from graduate school attendance.

To summarize, we find that elite college graduates have a higher chance of becoming an entrepreneur. Besides, we see intergenerational persistence in education and career choices. In other words, the positive correlation between elite college attendance and entrepreneurship is subject to a selection bias. In the next section, we will explain how we identify and estimate a model with endogenous education and career choices to identify the real effect of elite college attendance on entrepreneurship.

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 A4 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 A5. We assume that a pension is 40% of average income 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.[32] They show that the total equity of start-up firms accounts for 45% of their total capital,[33] so we set our collateral constraint parameter λ to 1.22.[34]

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

[32]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.

[33]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.

[34]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.[35] Our financial aid formula is

$$\text{Financial aid of college} = D(e) - 32.5 \times \text{family wealth in thousands} \\ - 7432 \times \text{SAT score at bottom 1/3} + 6875 \times \text{SAT score at top 1/3}$$

where $D(nc) = 13,901$ and $D(ec) = 20,224$. Students from poorer families and with higher SAT scores (a signal of employee ability) 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.

The PSID collects information on students' SAT scores. We standardize the SAT score, so it has a mean of zero and a standard deviation of one. We use the observed bottom 1% of the SAT score of elite/non-elite college graduates as the minimum requirement of SAT scores for elite/non-elite colleges. The minimum requirement for elite colleges is 0.289, and that of non-elite colleges is -1.532.

Appendix Table A6 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 unobserved abilities (time-invariant characteristics) and wealth and then fit the model's predictions to panel data.

We first track the same individuals 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 that of the productivity shocks, more of the employee income variation is driven by employee ability variation. We should observe a high-income correlation between two adjacent periods for employees.[36] 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 peri-

[35] 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 minimal.

[36] The correlation of earnings between two periods for employee stayers is not exactly mapped to the dispersion of employee ability because entry and exit of employment are endogenous. 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.

ods 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-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.

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

where $\Phi = \{A_{em}, A_{ib}, A_{ub}, k, k^p, b_{nc}, b_{ec}\}$ are the initial conditions when young adults make the schooling decision, including abilities, own wealth, parent's wealth, and consumption shocks to colleges. Π is the set of students with Φ 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.

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

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 identify 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 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 the offspring's welfare. The joint distribution of SAT scores and initial wealth at age 20 identifies the relationship between employee ability and SAT scores (κ) because $Cov(SAT, k_0) = \kappa Cov(A_{em}, k_0)$. The variance of SAT scores identifies the distribution of the noise, because $Var(SAT) = \kappa^2 Var(A_{em}) + \sigma_\varepsilon^2$.

We estimate the model by the simulated method of moments (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 for the parent generation. We 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 (1) the education and career decisions and their income and wealth over the life-cyles, and (2) the children's abilities and the monetary transfers from parents to children. Thus, the model shows how wealth and abilities are transferred across generations. 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.

Second, we compute the simulated moments and compare them to the sample aggregate statistics, which include

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

- intergenerational mobility in education and career and parental monetary transfers as a fraction of parental wealth

6 Estimation Results

6.1 Parameter Estimates and Model Fit

Table 4 shows the 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 the Appendix Figures A1 to A4. Our model also addresses the following topics: (1) income correlation and career transition, (2) intergenerational persistence in education, career, and income, (3) the elite college premium, and (4) the choice of an incorporated or unincorporated business. Furthermore, we provide an analysis of how abilities and initial wealth affect subsequent education and career choices.

6.2 Income Correlation and Career Transition

Economic agents change careers and hence their level of income over their life-cyle. The first panel of Table 5 shows that our model well fits the career transitions between two adjacent periods. For example, 87.0% of employees in our data remain employees in the next five-year period, with the model predicting 87.1%. Our data show that 53.0% (52.0%) of entrepreneurs (other self-employed individuals) are still in business five years later, while the model predicts 56.6% (54.1%). The model also predicts low transition rates between entrepreneurs and other self-employed individuals. The five-year transition rate from other self-employed individuals to entrepreneurs is 9.3% in the data and 6.2% in the model. The five-year transition rate from entrepreneurs to other self-employed individuals is 12.7% in the data and 12.0% in the model.

Our model also fits the income correlation between periods t and $t + 5$ for stayers and switchers (between career types), as shown in the second panel of Table 5. For stayers (those who remain in the same career over the five years), 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 being an entrepreneur (other self-employed), the income correlation is 0.60 (0.49) in the data and 0.55 (0.42) in the model.[37]

We also provide the fit for some untargeted moments related to income transitions. The first panel of Table 6 shows that our model fits the income transitions for stayers and switchers. The average employee income in the period t for those who remain employees in the 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

[37] Our findings are in line with the related studies, such as Karahan et al. (2019). Our contribution is to highlight the differences in income correlation between different career paths (employees, entrepreneurs, and other self-employed).

they start an incorporated business. The average employee income in the period t for other self-employed individuals in the period $t + 5$ is $54,745 in the data and $52,269 in the model, suggesting that other self-employed individuals 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 other self-employed individuals in period t, stayers have a medium-income while those with the lowest income become employees.

6.3 Intergenerational persistence

The last two panels of Table 5 show that our model explains a large share of the intergenerational persistence in education and careers. The data show that 78% of the offspring of high school graduates are also high school graduates, while the model predicts 71%. Similarly, the persistence in receiving a non-elite college degree is 39% in the data and 32% in the model, and the persistence in receiving an elite college degree is 22% in the data and 18% in the model. Our model mimics the intergenerational persistence in careers, with 63% of the individuals in our data with fathers who are devoted employees (i.e., employees throughout their lifetime) also being devoted employees, whereas the model predicts 64%. Similarly, the persistence in entrepreneurship (those who own an incorporated business at some point) is 25% in the data, and the model counterpart is 28%. The persistence 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.

The second panel of Table 6 shows that our model sheds light on the intergenerational income elasticity between fathers and sons, which is another set of untargeted moments. We calculate the intergenerational income elasticity by regressing the average income of sons aged between 30 and 50 years (as a proxy for their permanent income) on the average income of fathers in the same age range.[38] The intergenerational income elasticity is 0.39 in the data and 0.41 in the model. The model predicts that income persistence differs across different types of families. It is highest for families in which both the father and the 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 the income variation is more substantial for non-employees (entrepreneurs and other self-employed individuals) than for employees. These results suggest that it is essential to consider career dynamics when studying intergenerational income elasticity.

6.4 Elite College Premium

Our estimates also contribute to the elite college premium literature. Consistent with our discussion of the potential self-selection bias, Table 7 shows how people with different combinations of abilities and initial wealth sort into different education and career paths. Elite college grad-

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

uates have much higher employee ability (0.800) than non-elite college graduates (0.485).[39] High school graduates have the lowest employee ability (-0.307). Moreover, there is weak positive sorting in incorporated ability but no positive sorting in unincorporated ability. Elite college graduates have slightly more incorporated ability (0.023) than non-elite college graduates (0.007) and high school graduates (-0.012). Recall that agents must pay back their student loans before receiving business loans. Therefore, some individuals with high incorporated ability may skip college and instead work after completing high school to accumulate assets to start a business. This weakens the positive sorting in incorporated ability. In addition to the selection of abilities, we find robust sorting in terms of initial wealth. The bottom panel of Table 7 shows that elite college students have much higher initial wealth than the other two types of students. On average, elite college students have \$77,758 at age 20, while non-elite college and high school students only have \$23,488 and \$16,447, respectively. This finding is consistent with Chetty et al. (2020), who also find that the degree of segregation by parental income is very high across colleges, and selective colleges have few students from poorer backgrounds.

However, after taking the self-selection issue into account, we still find that elite colleges increase employee, incorporated, and unincorporated human capital much more than non-elite colleges do. Table 4 shows that graduation from elite college leads to an increase in employee/incorporated/unincorporated human capital by 40%/56%/39%, while graduation from ordinary college leads to a 31%/28%/28% increase. Among the three types of human capital, elite college leads to the most significant increase in incorporated human capital (by 28 ppt) compared to the other two types of human capital (9 ppt increase for employee human capital and 11 ppt increase for unincorporated human capital). Thus, ignoring the effect of elite colleges on entrepreneurship may underestimate the returns from attending elite college.

Moreover, the average incorporated ability of entrepreneurs is lower for elite college graduates (1.011) than non-elite college graduates (1.350) and high school graduates (1.539), as shown in Table 7. In this sense, elite college attendance lowers the entry barrier of entrepreneurship, with individuals with lower levels of education needing to be genuinely talented to start an incorporated business. The same patterns can be found in the unincorporated ability of other self-employed, i.e., elite college graduates who own an unincorporated business have the lowest unincorporated ability among the three levels of education, suggesting that elite colleges also lower the entry barrier for other forms of self-employment.

Our model also delivers summary statistics relevant to the elite college debate. We define the elite college premium 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 attends a non-elite college.[40] We

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

[40] We simulate the lifetime income and career choices of 10,000 elite college graduates conditional on the simulated consumption and productivity shocks of each career choice. We then simulate their lifetime income and career choices contingent on the same sets of shocks, assuming that they only have an ordinary college degree. We calculate the change in the DPV of lifetime income at age 20 after elite college graduates are assigned to non-elite

find that the elite college premium is positive and equivalent to $136,830 (in 2011 dollars, net of tuition) at age 20. Although elite colleges charge much higher tuition fees ($81,140 more over four years) than non-elite colleges, they provide higher returns in terms of employee, incorporated, and unincorporated human capital. Therefore, the net return of going to an elite college is positive.

6.5 Incorporated vs. Unincorporated Businesses

In this section, we discuss how economic agents choose between the two forms of self-employment. We find that incorporated businesses combine 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 businesses, whereas the corresponding number for unincorporated businesses is only 0.02. Our model predicts 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, as shown in Table 7. These predictions are in line with the results of Levine and Rubinstein (2016) 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 who never become self-employed. Moreover, given that the two types of businesses use different human capital, transitions between the two types of businesses are rare, as shown in the first panel of Table 5. This result is also consistent with the findings of Levine and Rubinstein (2016).

An additional determinant of the choice between becoming an incorporated or unincorporated business owner is the fixed costs, which capture both the direct costs of incorporation, such as annual fees and the preparation of more elaborate financial statements, and the indirect agency costs associated with the separation of ownership and control. Fixed costs are not directly observable by econometricians. Fortunately, our structural estimation can recover them. More specifically, we find that the cost of opening an incorporated business is $50,000 (in 2011 dollars), while it is virtually zero for unincorporated firms.[41] Thus, our estimates are consistent with the observation that incorporated business owners tend to be wealthier and older.

6.6 Effects of Abilities and Initial Wealth on Education and Career Decisions

This paper sheds light on how individuals with different abilities and initial wealth sort into different education and career types. In this section, we present some visualizations of the sorting. To illustrate how abilities and initial wealth jointly affect education and career decisions, we divide individuals' initial wealth 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.

colleges. The calculation includes tuition expenditure but not the consumption value of colleges.

[41] To put things in perspective, $50,000 in fixed costs would be equivalent to 3.8 years of elite college after-aid tuition.

Figure 1 shows how employee ability and initial wealth jointly affect decisions about college attendance and self-employment. The upper-left panel shows that the chance of graduating from an elite college increases with greater employee ability and initial wealth. Individuals with below-average ability would not enroll in an elite college due to the minimum requirements for the SAT scores. Based on our estimation, employee ability is mapped on to SAT scores according to $SAT = 2.85A_{em} + \varepsilon$ and the noise ε has a standard deviation of 0.247. Although we impose ability restrictions for entering elite colleges, these restrictions are not binding for most people, as only agents with relatively high abilities enroll in elite colleges in our model. For those who prefer to join an elite college, 95% of their SAT scores are above the cutoff of elite colleges. Individuals with relatively low abilities are discouraged by the high tuition costs.[42] At any given level of employee ability above the mean, individuals with higher initial wealth are more likely to attend an elite college. The likelihood that an individual with high employee ability (above one standard deviation) graduates from an elite college is 15% for the bottom initial wealth group, 18% for the middle group, and 23% for the top group. The pattern that low- and middle-income students "undermatch" to elite colleges is also found in Chetty et al. (2020), who show that at any given level of SAT/ACT scores, children from higher-income families attend more selective colleges.

The upper-right panel of Figure 1 shows that the likelihood of graduating from a non-elite college increases with employee ability and is highest for the top initial wealth group. Individuals with ability below one standard deviation would not attend an non-elite college because they do not meet the minimum requirement for the SAT score.[43] The lower-left panel shows that conditional on employee ability, the chance of owning an incorporated business increases with initial wealth, whereas the lower-right panel shows that contingent on employee ability, the opportunity to own an unincorporated business does not vary by initial wealth. These relationships are a result of entrepreneurship being more capital intensive than other forms of self-employment because entrepreneurship has an enormous entry cost. Even more importantly, we find that conditional on initial wealth, the chance of becoming an entrepreneur increases with employee ability, whereas the chance of being other self-employed declines with employee ability.

Figure 2 demonstrates the joint effects of incorporated ability and initial wealth on education and career choices. The upper-left and upper-right panels show that conditional on incorporated ability, individuals from high-income families are more likely to attend elite colleges and non-elite colleges, respectively. We find no apparent sorting behavior in terms of incorporated ability in either graph. The bottom two panels show that holding initial wealth fixed, incorporated ability increases the likelihood of being an entrepreneur but reduces the possibility of being other self-employed. Moreover, conditional on incorporated ability, initial

[42] However, these ability constraints become binding in the counterfactual experiments when we lower the education costs.

[43] Again, the ability constraint of non-elite colleges is not binding for most people. For those who prefer to enroll in a non-elite college, 99% of their SAT scores are above the cutoff.

wealth is positively associated with the probability of being an entrepreneur but has no impact on the likelihood of being other self-employed.

Figure 3 presents the interaction between unincorporated ability and family wealth for education and career choices. The upper-left panel shows that conditional on unincorporated ability, the probability of having an elite college degree is much higher for individuals from the top initial wealth group. However, we do not find stable sorting behavior in unincorporated ability for all three initial wealth groups. The upper-right panel shows the fraction of non-elite college graduates, with positive sorting in unincorporated ability evident for the high initial wealth group but not for the other two groups. The lower-left panel shows that the likelihood of being an entrepreneur declines with unincorporated ability. In contrast, the lower-right panel shows that the probability of being other self-employed increases with unincorporated ability. Moreover, conditional on unincorporated ability, initial wealth is positively associated with the likelihood of being an entrepreneur but has no impact on the possibility of being other self-employed.

In sum, we find sorting behaviors in education and career choices. Individuals with high employee ability and initial wealth sort into elite colleges. Individuals with high employee ability and incorporated ability are more likely to own an incorporated business. In contrast, individuals with low employee ability and high unincorporated ability are more likely to own an incorporated business. Initial wealth increases the chance of owning an incorporated business but does not affect the prospect of owning an unincorporated business.

7 Effect of Elite Colleges on Entrepreneurship

We have shown that abilities and initial wealth affect individuals' education decisions and their subsequent career choices. In this section, we evaluate the importance of different factors using two approaches. We first decompose the variation of lifetime income and career choices into abilities, initial wealth, and schooling. We then simulate the career choices and income over the life-cycle when individuals are assigned to different types of colleges, while holding the other variables constant.

7.1 Decomposition analysis

Following Lee and Seshadri (2019), we decompose the degrees to which differences at age 20 can explain lifetime outcomes. The "state variables" for an individual at age 20 include: 1) individual abilities, $\vec{A}$, a vector that consists of three types of abilities, A_{em}, A_{ub}, and A_{ib}; 2) wealth transfers received from one's parents at age 20, k_0; and 3) education type, s (high school graduate, non-elite college graduate, or elite college graduate). The outcome variables we consider are an individual's career choices, including whether he owns an incorporated business or unincorporated business, and lifetime income, defined as the present-discounted sum of earnings at all ages up to retirement.

We compute the fractions of career choices and lifetime income that can be attributed to various combinations of these initial conditions by calculating the conditional variances.[44] We first examine the degree to which abilities, wealth, and schooling at age 20 can jointly explain self-employment and income. We then drop these initial conditions one by one to assess the relative importance of each.

The upper panel of Table 8 shows the decomposition results of our baseline model. First, we analyze how the initial conditions affect career choices. The first two rows of the upper panel of Table 8 present the decomposition results on entrepreneurship and other self-employment, respectively. Column (1) shows that abilities, wealth, and education at age 20 can explain 40.4% of the decision to be an entrepreneur and 33.3% of the choice to be other self-employed. This result suggests that there is a lot of uncertainty in people's career paths as they experience different shocks to the productivity and consumption value of their careers over their life-cycle.

Among the three state variables, we find that schooling has a pronounced effect on the decision to become self-employed, and this effect is mostly concentrated on the choice of entrepreneurship. Comparing column (2) with column (1), we find that excluding the variation in education reduces the conditional variance of being an entrepreneur by 5.4 ppt, but does not affect the conditional variance of being other self-employed. Thus, education level has more influence on the decision to be an entrepreneur than the decision to be other self-employed. This result is consistent with the previously reduced form estimation indicating that the probability of being other self-employed is similar across education groups, as shown in Table 3.

In column (3), we leave out initial wealth, which is the transfer the individual receives from his or her parent at age 20, and surprisingly, it barely affects the conditional variance. The conditional variance only declines by 0.6 ppt for entrepreneurship and 0.8 ppt for other self-employment. This result may arise because education and abilities fully capture the explanatory power of initial wealth for career choices. In contrast, we find that abilities play an important role. In column (4), we leave out abilities, and the explanatory power of the model declines by 26.3 ppt and 22.2 ppt for entrepreneurship and other self-employment, respectively. To understand the relative importance of employee, unincorporated, and incorporated abilities, columns (5) to (7) further exclude each of the three abilities one by one. In particular, excluding employee ability reduces the conditional variance of entrepreneurship by 10.1 ppt, but only by 1.0 ppt for other self-employment. Recall that incorporated businesses use employee human capital but not unincorporated businesses. Not surprisingly, leaving out unincorporated ability reduces the conditional variance of other self-employment by 21.9 ppt, but barely changes the conditional variance of entrepreneurship. Similarly, leaving out incorporated ability reduces the conditional variance of entrepreneurship by 21.1 ppt, but hardly affects that of other self-employment. Overall, career choice decisions are mainly driven by career-specific ability, and the decision to become an entrepreneur is in addition driven by employee ability and schooling.

[44] To compute the conditional variances, we regress the outcome variables on the initial conditions. We divide each dimension of the initial conditions into small groups and use group dummies in the regressions to increase flexibility. We have seven groups for ability, eight groups for initial wealth, and three groups for education.

Next, we analyze the explanatory power of abilities, wealth, and education at age 20 on lifetime income. The variance of lifetime income explained by the initial conditions is sizable in our model, at 50.3% (column 1). Despite the life-cycle uncertainty (the shocks on the productivity and consumption value of different careers), a large portion of individuals' lifetime outcomes can be explained by the initial conditions when they become independent.[45] When we exclude education in the initial conditions, the conditional variance of lifetime income declines from 50.3% to 41.5% (by 8.8 ppt), as shown in column (2). This result is different from that reported by Lee and Seshadri (2019), who find that college choice only reflects selection, as the college choice margin can be explained almost entirely by the other variables in their decomposition analysis. Our model distinguishes between elite and non-elite colleges and allows the two types of colleges to affect the accumulation of various kinds of human capital (employee, unincorporated, and incorporated) differently. As different career paths, which deliver very different income processes, demand multiple types of human capital, the distinction between elite versus ordinary colleges and the distinction between different career paths increase the explanatory power of education.

Similar to career choices, we find that leaving out the initial wealth barely affects the conditional variance of lifetime income (0.5 ppt decline, as shown in column (3)), while leaving out abilities has a significant impact. Removing the three abilities reduces the explanatory power by 25.6 ppt, as shown in column (4). This result is consistent with Lee and Seshadri (2019), who also find a sizable explanatory power of ability but a small one of wealth.[46] In columns (5) to (7), we re-examine the model's explanatory power by excluding the three abilities one by one. We find that employee abilities play a more significant role in explaining lifetime income than the other two abilities.

Lastly, we re-perform the above analysis by grouping elite and non-elite colleges, as shown in the bottom panel of Table 8. Comparing the upper and bottom panels reveals the importance of distinguishing elite and non-elite colleges. As shown in column (1), when we do not differentiate between elite and non-elite colleges, the explanatory power of the initial conditions for the entrepreneurship decision drops from 40.4% to 37.8%, while that for other self-employment is not affected. Moreover, the fraction of variance in lifetime income explained by all of the initial conditions drops from 50.3% to 47.9% when we group the two types of colleges. When we differentiate the two types of colleges, excluding education reduces the conditional variances of entrepreneurship and lifetime income by 5.4 ppt and 8.8 ppt, respectively. When we combine the two types of colleges, excluding education only reduces the conditional variances of entrepreneurship and lifetime income by 2.8 ppt and 6.2 ppt, suggesting that the explanatory power of education for entrepreneurship and lifetime income drops by 48% and 30%, respec-

[45] Lee and Seshadri (2019) can explain 74% of the lifetime income. Our model explains a smaller fraction because we do not model parents' investment in their children's human capital before college. Our model also allows for productivity shocks on unincorporated and incorporated business owners in addition to the productivity shocks on employees, which increases the uncertainty in lifetime income.

[46] Lee and Seshadri (2019) only allow for one dimensional ability.

tively. Therefore, considering elite college attendance is critical to understand entrepreneurship decisions and lifetime income.

As pointed out by Lee and Seshadri (2019), one caveat of this analysis is that it cannot reveal the exact contribution of each state variable at age 20 because they are intercorrelated. Appendix Table A7 shows that abilities and initial wealth are positively correlated. Education decision is also affected by abilities and wealth. Nonetheless, this decomposition exercise is still informative because we use a difference-in-differences type of analysis. For instance, comparing the change in the explanatory power of being an entrepreneur and that of being other self-employed when leaving out education shows that education is essential to the decision to become an entrepreneur, but less important to the choice to engage in other forms of self-employment. Similarly, comparing the changes in the model's explanatory power in accounting for the entrepreneurship decision when we group elite and non-elite colleges shows that differentiating elite and non-elite colleges is essential for understanding entrepreneurship and lifetime income. If there is any bias in the estimation of the explanatory power of education, this bias will be differenced out in the difference-in-differences framework.

7.2 Simulation Analysis

To quantify the significance of the effect of elite college education on the entrepreneurship decision and lifetime income, we conduct the following simulations: 1) predict the changes in career choices and lifetime income of elite college graduates if they attended non-elite college instead; and 2) compare the career choices and lifetime incomes of individuals with fixed levels of abilities and initial wealth if they are assigned to elite colleges with those assigned to non-elite colleges. The results are shown in Table 9.

If elite college graduates attend non-elite colleges, their chance of becoming an entrepreneur drops significantly, falling by 5.6 ppt (45.5%), from 12.3% to 6.7%. However, their likelihood of engaging in other forms of self-employment only declines slightly, by 0.9 ppt (6.6%), from 13.6% to 12.7%. Moving elite college graduates to non-elite colleges also leads to a substantial decline in their lifetime income, which is reduced by 16%.

The above analysis mimics the average treatment effect of elite colleges on elite college graduates. However, there may exist heterogeneity in the "treatment effect" of an elite college education. To address this issue, we conduct additional simulations. Specifically, we simulate the career choices and income of individuals with given levels of abilities and initial wealth over the life-cycle, assuming that all of them attended elite colleges, or all of them attended non-elite colleges. We compare the differences between these two simulations, which shed light on the importance of elite college attendance for a given group of individuals. We repeat this exercise for individuals with different combinations of abilities and initial wealth. For each of the three abilities (employee, unincorporated, and incorporated), we define a low type and a high type, with the low type being one standard deviation below the mean and the high type being one standard deviation above the mean. For the initial wealth, the low type has $10,000 at age 20, while the high type has $30,000.

We find that individuals with low incorporated ability have little chance of becoming an entrepreneur, and the effect of elite colleges on entrepreneurship for that group of people is quite limited. The impact of elite college on entrepreneurship is most significant among individuals with high incorporated ability, low abilities in the other two dimensions, and low initial wealth (denoted by(L, L, H, L)). Moving these people from elite colleges to non-elite colleges reduces the probability of becoming an entrepreneur by 24.6 ppt. The effect drops to 5.9 ppt when the same individuals have high initial wealth. When individuals have high unincorporated and incorporated abilities but low employee ability (denoted by $(L, H, H, \cdot)$), the effects of elite college on entrepreneurship are also much more extensive for poorer individuals than more affluent individuals (12.7 ppt vs. 0.8 ppt). Elite colleges not only enhance the entrepreneur human capital but also improve employee salaries and allow potential entrepreneurs to accumulate capital faster before they open a business. The differential effects of elite college between the poor and rich suggest that the later channel serves as an essential mechanism in affecting the entrepreneurship decision, which is consistent with the findings of Samaniego and Sun (2019).[47]

Furthermore, for individuals with high employee and incorporated abilities (denoted by $(H, \cdot, H, \cdot)$), elite college significantly improves the probability of becoming an entrepreneur (by 13 - 15 ppt), regardless of initial wealth and unincorporated ability. In contrast, the effect of elite college on other self-employed is almost zero. Overall, we find that elite college barely affects the probability of engaging in other forms of self-employment, except for students with low employee ability, high unincorporated ability, and low initial wealth ((L, H, L, L) and (L, H, H, L)).

Lastly, elite college significantly improves the lifetime income for almost all types of individuals. Similar to the results for the entrepreneurship decision, the improvement in lifetime income is largest among low-income individuals and individuals with high incorporated abilities.

In sum, the above findings suggest that going to an elite college increases the chance of becoming an entrepreneur and improves lifetime income, but does not affect the likelihood of engaging in other forms of self-employment. The effects of elite college attendance on the entrepreneurship decision and lifetime income are concentrated on individuals with high incorporated ability and low financial capacity.

8 Counterfactual Analysis

Entrepreneurs are subsidized in many ways in different countries and the effects are mixed (Lerner, 2009 and Lerner and Schoar, 2010). Based on our structural model, we consider how an education subsidy would affect entrepreneurship and other aggregate variables. In particular, we consider subsidies to elite and non-elite college students. We consider a subsidy rate from 0

[47] When individuals become more prosperous, the need for physical capital accumulation weakens.

to 1, with the subsidy covering all tuition when the rate reaches 1. In both experiments, we use a labor income tax to finance the subsidy so that the government is budget balanced. Unlike the simulation exercises in the previous section, which take prices as given, we study the individual and aggregate outcomes in the new stationary equilibrium with new prices.[48] The results are shown in Figures 4 and 5 and the details are in the Appendix Tables A8 and A9.

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 vast 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 significant increase in the number of non-elite college graduates but does not have a tremendous impact on the number of elite college graduates. A 50% subsidy to elite college students increases the fraction of elite college graduates from 5.8% to 18.5% (by 12.7 ppt) and reduces the fraction of non-elite college graduates from 26.2% to 22.4% (by 3.8 ppt). The same subsidy rate for non-elite college students increases the fraction of non-elite college graduates by 7.6 ppt and does not affect the fraction of elite college graduates. Thus, elite college subsidies encourage potential non-elite college graduates and high school graduates to go to elite colleges. In contrast, non-elite college subsidies mostly encourage high school graduates to go to non-elite colleges. Note that in the counterfactual experiments, the ability constraints (minimum requirements for SAT scores) become more and more binding as the number of students with low employee ability who are willing to attend college increases due to the school subsidies.

The lower left and right figures of Figure 4 present the effects of subsidies on career choices. Elite college subsidies have a more considerable impact on the number of entrepreneurs and other self-employed individuals than non-elite college subsidies do. The effect of elite college subsidies on entrepreneurship is more extensive than on other forms of self-employment. A 50% subsidy to elite college students increases the fraction of entrepreneurs from 5.5% to 7.9% (by 2.4 ppt) and the fraction of other self-employed individuals from 11.6% to 12.3% (by 0.7 ppt); the same subsidy rate for non-elite college students only increases the fraction of entrepreneurs by 0.3 ppt and the fraction of other self-employed individuals by 0.3 ppt. These results are consistent with the findings in the previous section, where we show that elite colleges are more effective in raising entrepreneurs than non-elite colleges, and the effect of elite colleges on self-employment is mostly concentrated on entrepreneurship.

The three figures at the top of Figure 5 show the effects of subsidies on entrepreneur income and dynamics. Providing college subsidies has two effects on entrepreneur income and dynamics. First, individuals who go to an elite or non-elite college can acquire more human capital, which increases the chance that they enter and stay in business. Second, college subsidies encourage marginal entrepreneurs (those with relatively low incorporated ability) to enter the

[48]However, we do not take into account the transitional costs incurred when we move from the old steady-state to the new one.

sector. They may enter later because they need more time to accumulate physical capital, and their business is more likely to fail. Therefore, the net effect of college subsidies on the entry and exit of entrepreneurship is ambiguous. Our counterfactual analysis shows that providing elite and non-elite college subsidies not only encourages more people to become entrepreneurs, but also allows them to enter earlier and stay longer, suggesting that the first channel dominates the second.

Moreover, elite college subsidies are more efficient than non-elite college subsidies in improving entrepreneur income, reducing the age of starting entrepreneurship, and increasing the duration of entrepreneurship. A 50% subsidy to elite college students increases entrepreneur income by 37.4%, reduces the age of starting entrepreneurship by 0.73 years, and increases the average duration of entrepreneurship by 0.29 years. However, the same rate of subsidy to non-elite college students only increases entrepreneur income by 4.5%, reduces the age of starting entrepreneurship by 0.06 years, and increases the average duration of entrepreneurship by 0.06 years.

The bottom three figures in Figure 5 present the aggregate effects on society, including intergenerational income elasticity, welfare, and the income Gini coefficient. We find that intergenerational income elasticity declines as the subsidy rate increases for both types of subsidies, and the effect is more substantial for elite college subsidies. A 50% subsidy to elite and non-elite college students reduces the intergenerational income elasticity by 2.2 ppt and 1.7 ppt, respectively. The intuition is straightforward. College subsidies (particularly elite-college subsidies) encourage more students from low-income families to enter college, which weakens the impact of hereditary transfer (in abilities and wealth). This result echoes the finding of Chetty et al. (2020) that removing the segregation in parental income across colleges can significantly reduce intergenerational income persistence. Moreover, both types of subsidy improve social welfare, which is optimized at the 100% subsidy rate in both cases. This finding is consistent with Abbott et al. (2019), who also find that more generous financial aid is welfare improving. A 50% subsidy to elite college students improves social welfare by 16.1%, while a 50% subsidy to non-elite college students improves social welfare by 3.6%. Figure 5 demonstrates that elite college subsidies provide more considerable welfare gains than non-elite college subsidies at all levels of subsidies. Elite college subsidies can better help high ability students from low-income families. In particular, those with high incorporated ability but low initial wealth face high fixed costs and financial constraints in starting an incorporated business. This constraint can distort the incentive to become an entrepreneur, and therefore the incentive to go to an elite college. Although elite-college subsidies may reduce such distortion and improve social welfare, they increase income inequality because they mostly benefit individuals with high ability. A 50% subsidy to elite college students increases the Gini coefficient by 1.2 ppt, whereas a 50% subsidy to non-elite college students only increases the Gini coefficient by 0.1 ppt.

In sum, 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. Elite college subsidies also lead to a more significant reduction in intergenerational income persistence and a more significant increase in social welfare than non-elite college subsidies. However, elite college subsidies also increase 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 choices of elite and non-elite colleges). We model the colleges' capacity constraints by assuming that there are minimum requirements for SAT scores for elite and non-elite colleges. However, it is possible that when more students enroll in colleges, the cost of going to an elite college will increase, and colleges will adjust their tuition fees. The education quality could also decline. Therefore, we believe that our counterfactual experiments are more meaningful at lower subsidy rates. To capture the equilibrium responses of elite and non-elite colleges, we would need to model the education market and obtain more information on the cost of going to college. However, adding supply-side decisions to our current model, which already has much heterogeneity across agents, would compromise tractability. We leave this issue for future research.

9 Conclusion

In this paper, we study whether and how elite colleges matter. Our analysis focuses on the effect of elite college attendance on entrepreneurship decisions and career dynamics. We construct and estimate an overlapping generations life-cycle model that captures selection into different types of education and careers based on abilities and wealth, which are inherited from parents. Our model distinguishes between elite and non-elite colleges, which lead to different levels of human capital accumulation. Our model also allows for different career paths (employee, entrepreneur, and other self-employed) that require different types of human capital. We use a restricted access panel dataset to estimate the model. We find that elite colleges contribute more than non-elite colleges to the accumulation of different kinds of human capital, particularly the human capital required by entrepreneurs. Consequently, elite college attendance increases the likelihood of elite college graduates' becoming entrepreneurs relative to non-elite college graduates. Our estimate of the elite college premium is positive, which justifies people's willingness to attend elite colleges despite their high tuition fees.

Our decomposition analysis shows that education has sizable power to explain self-employment decisions, predominantly the decision to pursue entrepreneurship. Moreover, distinguishing between elite and non-elite colleges substantially increases the explanatory power of education for the entrepreneurship decision. Our simulation exercise further shows that moving elite college graduates to non-elite colleges would significantly reduce their chance of becoming entrepreneurs, but would have little impact on their opportunity to engage in other forms of self-employment. In the counterfactual analysis, 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 (1) increasing the number of entrepreneurs, (2) improving the income of entrepreneurs, (3) reducing the age of entering entrepreneurship, (4) increasing the duration of entrepreneurship, (5) reducing intergenerational income persistence, and (6) bringing a larger increase in social welfare. The only drawback is that elite college subsidies increase income inequality. Overall, our paper suggests that elite colleges are essential engines for producing more and successful entrepreneurs but that high tuition fees and borrowing constraints prevent some would-be entrepreneurs from attending elite colleges.

Our analysis has some limitations. We consider three types of skills in this paper (employee human capital, incorporated human capital, and unincorporated human capital) to differentiate the 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, according to Lazear (2004, 2005), entrepreneurs possess many skills but may not excel 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 entrepreneurs/other self-employed individuals 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. He suggests that overconfidence is more prevalent in occupations with noisier estimates of ability, such as entrepreneurship. Dillon and Stanton (2017) also consider the initial uncertainty in entrepreneur earnings and continuous learning about the entrepreneurial earnings process. As we attempt to integrate insights from the human capital and entrepreneurship literature, we abstract from the signal extraction considerations to keep the model simple. We also abstract from the reality that many students do not finish their college education (Hanushek et al. (2003)). Future work should explore how the inclusion of these issues affects the parameter estimation and corresponding 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: Intergenerational Persistency in Education and Career Choices

Education choice Son \ father	High school	Non-elite college	Elite college
High school	77.5%	51.3%	41.5%
Non-elite college	20.0%	38.5%	36.9%
Elite college	2.7%	10.2%	21.5%
Career choice Son \ father	**Employee**	**Entrepreneur**	**Other self-employed**
Employee	62.7%	49.6%	54.9%
Entrepreneur	14.1%	24.6%	14.5%
Other self-employed	23.2%	25.8%	30.6%

This table shows the probability of sons choosing a given education level or career conditional on father's education level or career. Father's education or career choices are shown in columns and son's are in rows.

Table 3: 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 4: Parameter Estimates

	Employee	Entrepreneur	Other self-employed
Productivity (P)	2186 (532)	2.1 (0.5)	20.0 (8.1)
Return to non-elite college (μ_{nc})	0.31 (0.11)	0.28 (0.09)	0.28 (0.07)
Return to elite college (μ_{ec})	0.40 (0.19)	0.56 (0.16)	0.39 (0.17)
Return to potential experience (γ_1)	0.32 (0.08)	-	-
Return to experience squared (γ_2)	-0.032 (0.01)	-	-
Return to capital (ν)	-	0.75 (0.22)	0.58 (0.20)
Contribution of EM human capital to EN (ρ)	-	0.20 (0.06)	0.02 (0.01)
Std of productivity shock (ξ)	0.75 (0.20)	0.75 (0.29)	0.58 (0.18)
Fixed cost (C)	-	60000 (22500)	0.00 (0.00)
Std of consumption shock (η)	-	0.0005 (0.0002)	0.0009 (0.0003)
Std of ability (σ^a)	0.34 (0.12)	0.36 (0.16)	0.35 (0.14)
Intergenerational ability transfer (θ)	0.61 (0.17)	0.32 (0.10)	0.29 (0.06)
Std of consumption shock for college (η)	0.010 (0.003)/0.0010 (0.002) (NC/EC)		
Weight on offspring's welfare (ω)	0.004 (0.001)		
Output elasticity of capita (α)	0.246 (0.082)		
Mapping from employee ability to SAT scores (κ)	2.850 (0.571)		
Std of noise in SAT scores (σ_ε)	0.247 (0.062)		

This table presents the parameter estimates and the standard errors of the estimates are shown in parentheses. EM: employee, EN: entrepreneur, IB: incorporated business owner, UB: unincorporated business owner, NC: non-elite college, EC: elite college.

Table 5: Model Fit: Targeted Moments

	Data	Model
Career transitions		
Employee - employee	87.0%	87.1%
Employee - entrepreneur	3.3%	3.5%
Employee - other self-employed	9.8%	9.4%
Entrepreneur - employee	34.3%	31.4%
Entrepreneur - entrepreneur	53.0%	56.6%
Entrepreneur - other self-employed	12.7%	12.0%
Other self-employed - employee	38.7%	39.7%
Other self-employed - entrepreneur	9.3%	6.2%
Other self-employed - other self-employed	52.0%	54.1%
Income correlation by career transitions		
Employee - employee	0.710	0.704
Employee - entrepreneur	0.602	0.549
Employee - other self-employed	0.493	0.421
Entrepreneur - employee	0.530	0.622
Entrepreneur - entrepreneur	0.697	0.723
Entrepreneur - other self-employed	0.090	0.190
Other self-employed - employee	0.567	0.371
Other self-employed - entrepreneur	0.483	0.399
Other self-employed - other self-employed	0.410	0.501
Intergenerational persistency in education choices		
High school - high school	77.5%	70.0%
High school - non-elite college	20.0%	25.5%
High school - elite college	2.7%	4.6%
Non-elite college - high school	51.3%	59.1%
Non-elite college - non-elite college	38.5%	31.7%
Non-elite college - elite college	10.2%	9.2%
Elite college - high school	41.5%	49.3%
Elite college - non-elite college	36.9%	32.5%
Elite college - elite college	21.5%	18.3%
Intergenerational persistency in career choices		
Employee - employee	62.7%	64.3%
Employee - entrepreneur	14.1%	17.0%
Employee - other self-employed	23.2%	18.7%
Entrepreneur - employee	49.6%	50.7%
Entrepreneur - entrepreneur	24.6%	27.7%
Entrepreneur - other self-employed	25.8%	21.6%
Other self-employed - employee	54.9%	55.8%
Other self-employed - entrepreneur	14.5%	17.8%
Other self-employed - other self-employed	30.6%	26.4%

The career transition panel presents the career transitions from period t to period $t + 1$, where one period is five years.

The income correlation by career transitions panel presents the correlation between incomes in period t and period $t + 1$ by career transition types.

The intergenerational persistency in education/career choices panel presents the probability of sons choosing a given education level/career conditional on father's education level/career.

Table 6: Model Fit: Untargeted Moments

	Data	Model
Lagged income by career transitions		
Employee - employee	54,582	53,260
Employee - entrepreneur	75,482	73,382
Employee - other self-employed	54,745	52,269
Entrepreneur - employee	109,868	113,727
Entrepreneur - entrepreneur	123,262	120,773
Entrepreneur - other self-employed	87,824	81,805
Other self-employed - employee	55,017	54,123
Other self-employed - entrepreneur	88,547	80,038
Other self-employed - other self-employed	59,587	62,637
Intergenerational income elasticity		
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

The lagged income by career transitions panel presents the income in period t by career transition from period t to period $t+1$.

The intergenerational income elasticity panel presents the income elasticity conditional father's and son's career types. 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.

Table 7: Average Ability and Wealth at Age 20 by Education and Career

	Employee	Entrepreneur	Other self-employed	Total
Employee ability				
High school	-0.284	-0.129	-0.552	-0.307
Non-elite college	0.482	0.608	0.436	0.485
Elite college	0.776	1.066	0.690	0.800
Total	0.002	0.156	-0.191	0.000
Incorporated ability				
High school	-0.069	1.539	-0.060	-0.012
Non-elite college	-0.084	1.350	-0.042	0.007
Elite college	-0.114	1.011	-0.099	0.023
Total	-0.076	1.453	-0.057	0.000
Unincorporated ability				
High school	-0.135	-0.168	0.999	0.008
Non-elite college	-0.111	-0.207	0.936	-0.002
Elite college	-0.138	-0.054	0.753	-0.012
Total	-0.128	-0.172	0.966	0.000
Wealth at age 20				
High school	15,976	17,930	16,956	16,447
Non-elite college	22,343	26,212	24,167	23,488
Elite college	69,177	93,439	77,446	77,758
Total	20,315	28,767	23,621	21,758

This table presents the average ability and initial wealth at age 20 by education and career types. Average ability is normalized to be zero. Initial wealth is in 2011 dollars.

Table 8: Variance conditional on individual state at age 20

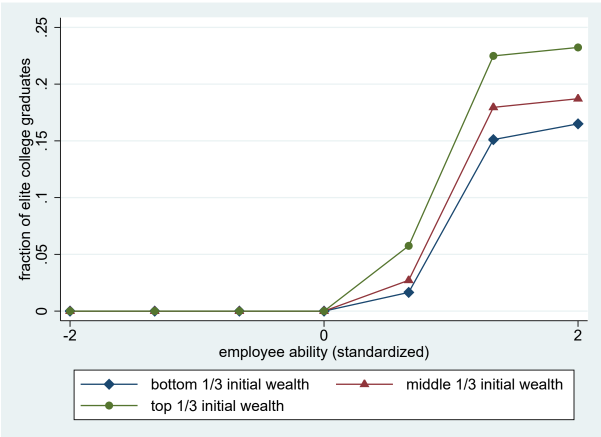
Baseline	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variance explained by (%):	$(\vec{A}, k_0, s)$	$(\vec{A}, k_0)$	$(\vec{A}, s)$	(k_0, s)	(A_{ub}, A_{ib}, k_0, s)	(A_{em}, A_{ib}, k_0, s)	(A_{em}, A_{ub}, k_0, s)
Ever own an incorporated business	40.4	35.0	39.8	14.1	30.1	38.6	19.3
Ever own an unincorporated business	33.3	33.3	32.5	11.1	32.3	11.4	31.2
Lifetime income	50.3	41.5	49.8	24.7	33.0	47.0	45.3
Combine elite and non-elite colleges	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variance explained by (%):	$(\vec{A}, k_0, s)$	$(\vec{A}, k_0)$	$(\vec{A}, s)$	(k_0, s)	(A_{ub}, A_{ib}, k_0, s)	(A_{em}, A_{ib}, k_0, s)	(A_{em}, A_{ub}, k_0, s)
Ever own an incorporated business	37.8	35.0	37.1	11.6	27.6	36.0	16.6
Ever own an unincorporated business	33.3	33.3	32.5	11.1	32.3	11.4	31.2
Lifetime income	47.9	41.5	47.0	19.0	27.1	44.6	43.1

This table presents the variance of career choices and lifetime income conditional on different combinations of initial states at age 20. Initial states include abilities $\vec{A}$, initial wealth k_0, and schooling s. $\vec{A}$ includes employee ability A_{em}, unincorporated ability A_{ub}, and incorporated ability A_{ib}.

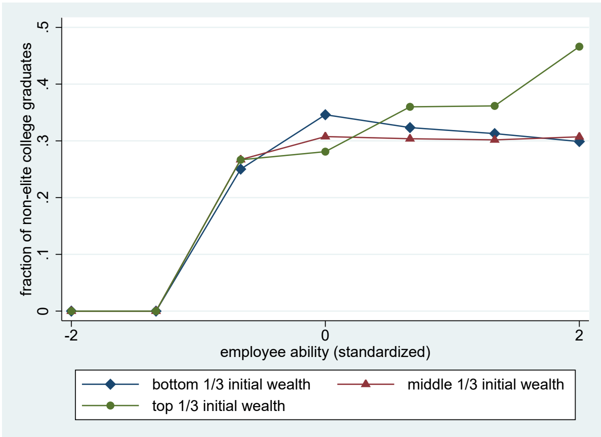
Table 9: Counterfactual: Effect of Elite Colleges on Entrepreneurship, Other self-employment, and Lifetime income

	Entrepreneur (%)			Other self-employed (%)			Lifetime income
	Elite college	Non-elite college	Diff	Elite college	Non-elite college	Diff	(% change)
Elite college graduates	12.3	6.7	-5.6	13.6	12.7	-0.9	-15.98
(L, L, L, L)	0.1	0.0	-0.1	1.2	0.0	-1.2	-10.80
(L, L, L, H)	0.1	0.0	-0.1	1.2	2.2	1.0	-10.16
(H, L, L, L)	0.7	0.1	-0.5	4.1	2.7	-1.4	-11.11
(H, L, L, H)	0.7	0.1	-0.5	4.1	2.7	-1.4	-11.11
(L, H, L, L)	0.2	0.0	-0.2	21.4	10.0	-11.4	-18.29
(L, H, L, H)	0.2	0.2	0.0	21.4	29.3	7.9	-4.52
(L, L, H, L)	24.6	0.0	-24.6	0.5	0.0	-0.5	-27.26
(L, L, H, H)	24.6	18.7	-5.9	0.5	1.2	0.7	-3.03
(H, H, L, L)	0.3	0.1	-0.3	21.5	19.5	-2.0	-12.80
(H, H, L, H)	0.4	0.1	-0.3	21.6	19.5	-2.1	-12.80
(L, H, H, L)	12.7	0.0	-12.7	14.4	4.0	-10.4	-24.02
(L, H, H, H)	12.7	11.9	-0.8	14.4	30.2	15.8	-4.32
(H, L, H, L)	29.1	14.6	-14.5	2.3	1.8	-0.5	-21.83
(H, L, H, H)	29.5	14.6	-14.9	2.3	1.8	-0.5	-21.94
(H, H, H, L)	23.9	11.0	-12.9	18.0	17.9	-0.1	-20.68
(H, H, H, H)	24.0	11.0	-13.0	18.0	17.9	-0.1	-20.90

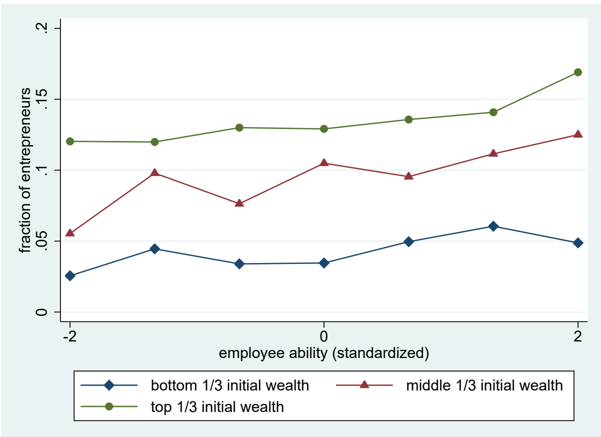
We simulate the career choice and earnings over the life-cyle when individuals attend elite colleges and when they attend non-elite colleges. The first row presents the results of elite college graduates. The following row presents the results of individuals with a fixed level of initial abilities and wealth. The four elements in the parentheses refer to employee ability, unincorporated ability, incorporated ability, and initial wealth, respectively. Low abilities refer to one standard deviation below the mean and high abilities refer to one standard deviation above the mean. Low wealth represents an initial wealth of 10,000 USD at age 20 and high wealth represents 30,000 USD initial wealth.
The first three columns present the probability of being an entrepreneur if the individual attended elite colleges, that if he attended non-elite colleges, and their difference. The next three columns present the probability of being other self-employed if the individual attended elite college, that if he attended non-elite college, and their difference. The last column presents the percentage change in the lifetime income if the individual's education changed from non-elite to elite colleges.



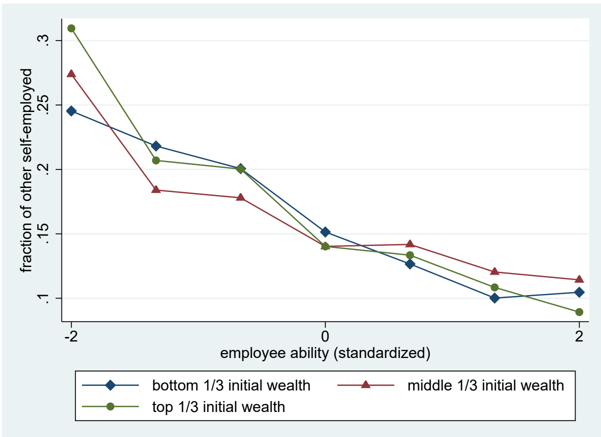
(a) Fraction of elite college graduates



(b) Fraction of non-elite college graduates

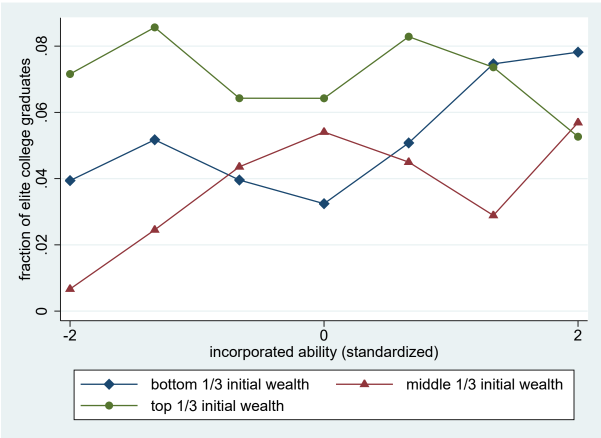


(c) Fraction of entrepreneurs

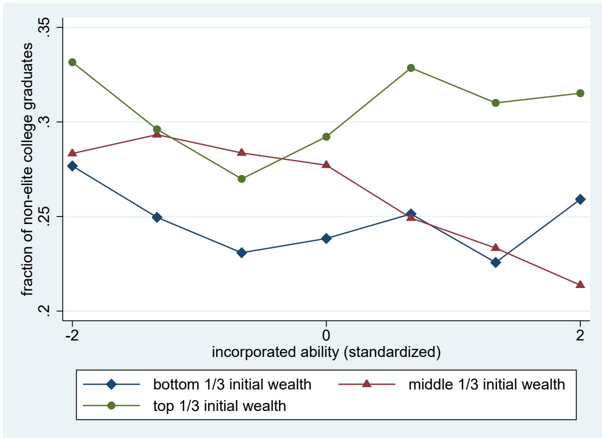


(d) Fraction of other self-employed

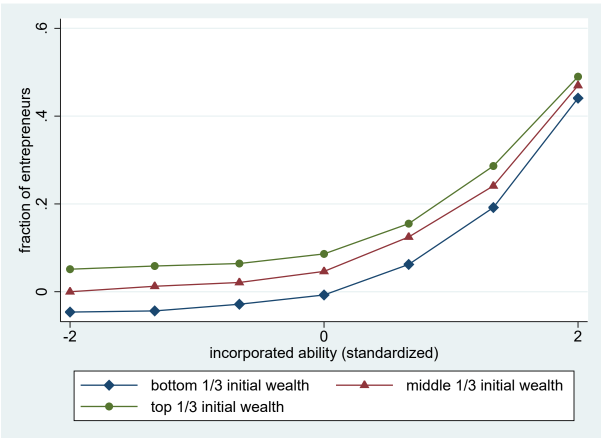
Figure 1: Education and career choices by employee ability and initial wealth



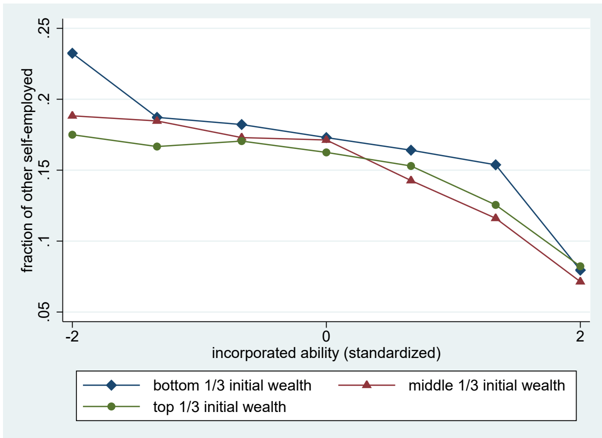
(a) Fraction of elite college graduates



(b) Fraction of non-elite college graduates

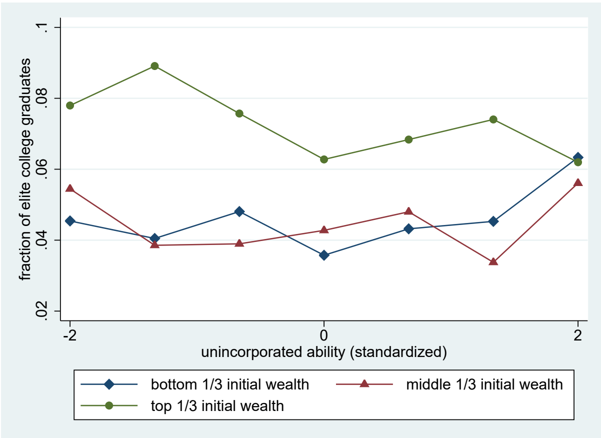


(c) Fraction of entrepreneurs

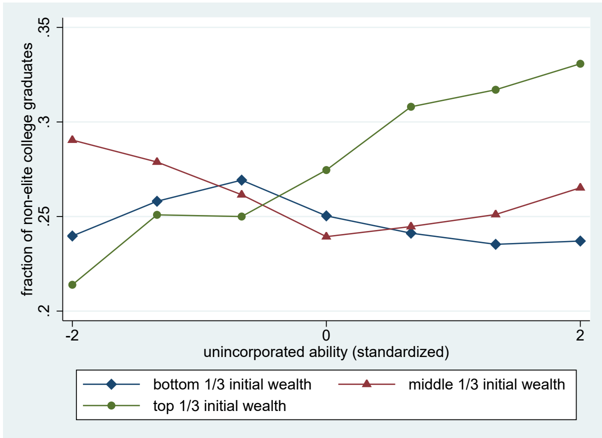


(d) Fraction of other self-employed individuals

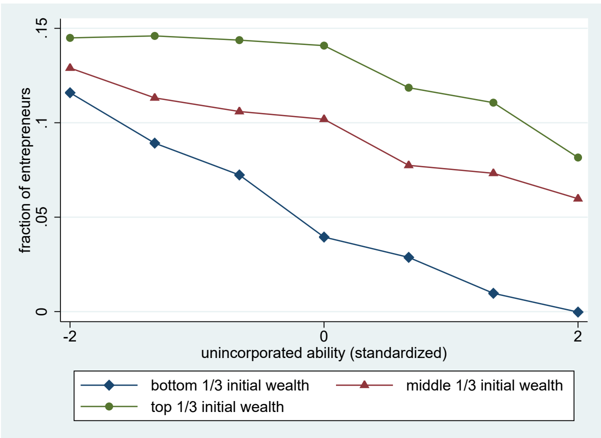
Figure 2: Education and career choices by incorporated ability and initial wealth



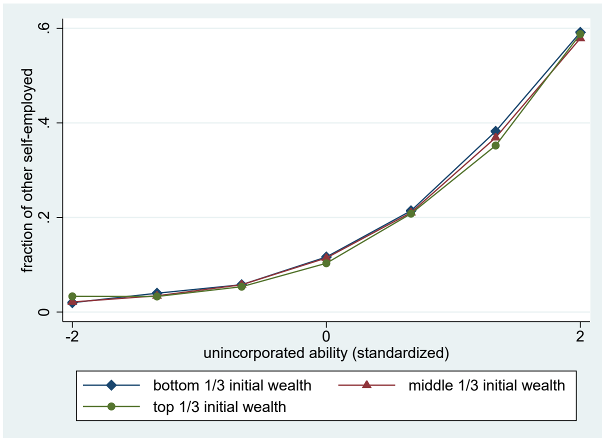
(a) Fraction of elite college graduates



(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 unincorporated ability and initial wealth

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

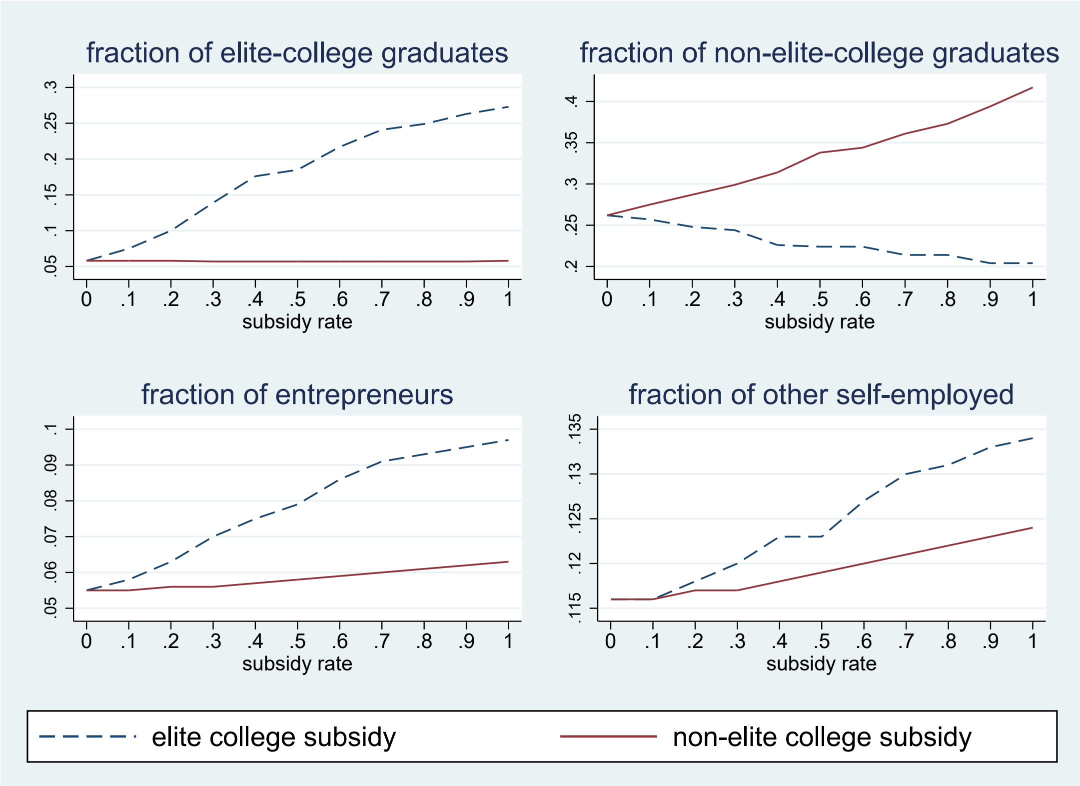


Figure 5: Counterfactual: Subsidy to Elite/non-elite College Students (Cont'd)