Quantitative Economics 12 (2021), 1347–1397 1759-7331/20211347

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

Naijia Guo
Department of Economics, The Chinese University of Hong Kong

Charles Ka Yui Leung
Department of Economics and Finance, City University of Hong Kong

Elite college attendance significantly impacts students' entrepreneurship decisions and career dynamics. We find that an elite college degree is positively correlated with entrepreneurship (i.e., owning an incorporated business) but not with other self-employment forms. Our overlapping generations model captures self-selection in education and career choices based on heterogeneous ability and family wealth endowments over the life cycle. 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. Providing subsidies for elite colleges is more efficient than subsidizing their ordinary counterparts to encourage entrepreneurship, enhance intergenerational mobility, and enhance welfare. In contrast, although start-up subsidy increases entrepreneurship, it does not improve their performance, and it is inferior to education subsidy in generating efficiency, equality, and intergenerational mobility.

Keywords. Entrepreneurship, elite college, intergenerational transfer.

JEL classification. D15, I20, J24.

Naijia Guo: guonaijia@cuhk.edu.hk
Charles Ka Yui Leung: kycleung@cityu.edu.hk

We are grateful to (in alphabetical order) Grey Gordon, Jeremy Greenwood, Eric Hanushek, Chih-Sheng Hsieh, Minchung Hsu, Fatih Karahan, Ed Lazear, Michio Naoi, Phuong Ngo, Masao Ogaki, Paul Oyer, Elena Pastorino, Ponpoje Porapakkarm, Christopher Taber, Xuan Song Tam, Cheng Wang, Kuzey Yilmaz, Donghoon Yoo, seminar participants at Chinese University of Hong Kong, City University of Hong Kong, Hitotsubashi University, Hong Kong Baptist University, Jinan University, Keio University, Monash University, National Graduate Institute for Policy Studies (GRIPS), National Taiwan University, and University of Technology Sydney, and conference participants at the Asian Meeting of the Econometric Society, China Meeting of the Econometric Society, EALE-SOLE-AASLE World Conference, World Congress of the Econometric Society for their helpful comments on previous versions. Insights and suggestions from Peter Arcidiacono (editor) and two anonymous referees significantly improve this paper. This project is supported by the Early Career Scheme of the Hong Kong Research Grant Council (project code: 2191108). Part of this research was conducted while Leung was a visitor at the Hoover Institution, whose hospitality is gratefully acknowledged. Leung's travel has received support from the Center for Research in Econometric Theory and Applications (Grant 109L900201, Taiwan) and the Joint Usage/Research Center (ISER, Osaka University). Chuantao Cui, Joe Ng, Shuangxin Wang, and Shumeng Zhang provide excellent assistance. All errors are our own.

Available at http://qeconomics.org. https://doi.org/10.3982/QE1587

1. Introduction

Do elite colleges matter? The ongoing lawsuit between the Students for Fair Admissions against Harvard University, and the related discussion, suggest that the public believes 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 positively selected in terms of their ability and family background (Chetty, Friedman, Saez, Turner, and Yagan (2020)). Dale and Krueger (2002) argue that there is no earning differential between elite college graduates and ordinary college graduates after controlling for college selectivity. Thus, the implied 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, Isaac, and Miller (2018)).[3]

In this paper, we analyze the effect of attending an elite college on lifetime income, focusing on students' entrepreneurship decisions and career dynamics. We need to overcome several empirical challenges. As elite college attendance is an endogenous choice, becoming and when to become entrepreneurs are also endogenous choices. Furthermore, casual observations do not answer whether elite college attendance would facilitate entrepreneurship.[4] On the one hand, elite colleges may increase students' entrepreneurial human capital. On the other hand, elite colleges' high tuition fees may deter potential entrepreneurs due to financial constraints. As a result, smarter and richer individuals are more likely to attend elite colleges and become successful entrepreneurs.

Thus, to account 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

[1]On November 17, 2014, Students for Fair Admissions (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 versus 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), the Federal prosecutors have charged around 50 parents. On top of the expensive tuition, the average bribery is about $500,000.

[3]Black and Smith (2004) used a matching method to show that the often-used linear specification can lead to biased results. Black and Smith (2006) compared four econometric methods and find that the literature probably underestimates the effect of college quality. Hoxby (2009) argued that elite colleges enable their students to make massive human capital investments and become more competitive with their resources. Dale and Krueger (2014) extended their earlier work by examining the returns to the 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, Isaac, and Miller (2018) found that elite college attendance has significant marriage market benefits, especially for women.

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

by Cagetti and De Nardi (2006, 2009), which emphasize entrepreneurship decisions.[5] In particular, we model how agents self-select different educational and career options after receiving intergenerational transfers of wealth and acquiring multidimensional 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 kinds 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 data set. 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 in terms of mean, median, and standard deviation, entrepreneurs' income profile (incorporated business owners) is different from employees' income profiles and other self-employed individuals (unincorporated business owners).[6] A restricted access data set from the Panel Study of Income Dynamics (PSID) allows us to identify the college at which each respondent studied. Then we show that elite college graduates are more likely to become entrepreneurs than to engage in other forms of self-employment. Moreover, entrepreneurs earn more than employees on average, but they also experience more volatile income streams, while other self-employed individuals are similar to those employees. These findings suggest that it is essential to distinguish between entrepreneurs and other self-employed individuals (Levine and Rubinstein (2017)). As different career paths deliver various average income and different income volatilities, we consider it critical to explicitly model career dynamics (the transitions between being an employee, an entrepreneur, and other self-employed). Therefore, our modeling strategy complements previous studies on wage dynamics, which either focus on employees only (Juhn, Murphy, and Pierce (1993), Low, Meghir, and Pistaferri (2010), Yamaguchi (2010)), or combining employees with self-employed (Dale and Krueger (2002, 2014)). 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 and wealthier individuals are more likely to enroll in elite colleges and become entrepreneurs. In our model, agents inherit multidimensional abilities (defined as general ability, unincorporated ability, and incorporated ability) and wealth from their families. They make educational choices (high school, ordinary college, or elite college) and career decisions (employees, entrepreneurs, or other self-employed). Education improves

[5]We directly model the education and career decisions. Assuming the model is correctly specified, we recover the causal results of elite colleges on entrepreneurship.

[6]Carrington, McCue, and Pierce (1996) also found that the self-employed's annual earnings are more volatile than the employees. Throughout this paper, the terms "other self-employed individuals" and "unincorporated business owners" are used interchangeably.

general, unincorporated, and incorporated human capital, and these human capital gains potentially differ between elite and ordinary 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. We match the income level of different career paths. We also mimic the career and income dynamics in the data, such as the conditional probabilities, as well as the income correlations of 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. This unified framework for studying educational alternatives, career dynamics, and intergenerational links is new to the literature to the best of our knowledge.

Second, we estimate the effect of elite college attendance on the accumulation of human capital. Our model predicts that agents born with the higher general 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 general, unincorporated, and incorporated human capital than ordinary colleges; the increase in incorporated human capital is the largest. The average elite college premium (discounted lifetime utility gains from going to an elite college compared with an ordinary college, net of tuition) is positive and equivalent to $16,712 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 use general and incorporated human capital, whereas unincorporated businesses mostly use unincorporated human capital. Moreover, incorporated businesses have an entry cost of $58,000, while the corresponding figure for unincorporated firms is only $8000 (all in 2011 dollars). Consequently, individuals who are high in general and incorporated ability self-select into incorporated businesses, while individuals who are low in general ability but high in unincorporated ability sort into unincorporated businesses. Initial wealth increases the chance of owning an incorporated business but does not affect the prospect 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 model's explanatory power for the entrepreneurship decision (measured by the conditional variance) by 5.4 percentage points (ppt). In contrast, the explanatory

[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 not easy to match precisely. Hall and Woodward (2010) found that almost three-quarters of venture-backed entrepreneurs receive nothing at the firm exit while a few earn more than a billion dollars. Kartashova (2014) found 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.

power for the self-employed decision is unaffected.[9] Moreover, when we group elite and ordinary colleges, the explanatory power of education for the entrepreneurship decision is much smaller (only 2.6 ppt), suggesting that distinguishing elite and ordinary college graduates is vital to understanding their entrepreneurial decisions. We further simulate the changes in career choices by comparing individuals assigned to elite and ordinary colleges. Transferring elite college graduates to ordinary colleges leads to a substantial drop in the probability of becoming an entrepreneur by 5.6 ppt (45.5%). The chance of becoming other self-employed only declines by 0.9 ppt (6.6%). Moreover, our simulation shows that elite colleges' effect on entrepreneurship is concentrated for the individuals with high incorporated ability and low initial wealth. These 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 college attendance and business start-up. We find that subsidizing elite college students increases the number of entrepreneurs and their income indirectly, reduces the age of first entrepreneurship, and increases entrepreneurship duration. These effects are more extensive than those for ordinary college subsidies. Besides, providing tuition subsidies to elite colleges is more efficient in improving social welfare and intergenerational income mobility. However, these subsidies also increase income inequality.

On the other hand, start-up subsidies for entrepreneurs could substantially increase the fraction of entrepreneurs. The age of first entrepreneurship would decline, but the average income (excluding subsidies) and entrepreneurship duration would decrease. It also has limited effects on education decisions. We also find that subsidies to unincorporated businesses are more efficient in improving social welfare than incorporated businesses. These results reinforce the idea that distinguishing ordinary and elite colleges in the education stage and distinguishing incorporated and unincorporated business in the career stage is valuable in understanding life-cycle choices and policy considerations. We also compare education subsidies with start-up subsidies and find that education subsidies are better in the sense that, for a given level of efficiency, they can generate a higher level of equality and a higher level of intergenerational mobility compared to start-up subsidies.

The remainder of this paper proceeds as follows. The formal model is presented in Section 2, followed by a description of the data used for the estimation in Section 3. We explain the identification and estimation strategies in Section 4. The estimation results are presented in Section 5, 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 6 analyzes elite colleges' effect on entrepreneurship through decomposition analysis and a simulation exercise. Section 7 presents the counterfactual analysis of providing subsidies to different college students and different business start-ups. Section 8 concludes the paper. We relegate supplemental materials, including the literature review and additional empirical results, to the Online Supplementary Material in the Appendix (Guo and Leung (2021)).

[9]While excluding the ability differences reduces the model's explanatory power for the entrepreneurship decision by more than half, excluding the variation in initial wealth does not significantly impact the model's explanatory power. Among different abilities, the incorporated ability is the most crucial factor.

2. Model

2.1 *Model setup*

Economic environment Single-individual dynasties populate the economy. Each life lasts 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 household. He decides whether to enroll in college and, if so, what type of college to attend. There are three levels of education attainment, high school, ordinary college, and elite college, which are denoted $e \in \{hs, nc, ec\}$, respectively.[10]

Individuals not in school choose between being an employee, an entrepreneur (i.e., an incorporated business owner), or other self-employed (i.e., an unincorporated business owner), which are denoted $j \in \{em, ib, ub\}$, respectively. All individuals decide how much to consume (c) and save (k). Also, those who own a business choose an investment level of 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 households, parents have the option of giving them a one-time gift of liquid assets, denoted by R.[11] This can be motivated by the observation that many parents help their children pay for college or finance their businesses.[12]

Human capital Each person is born with three types of ability $(A = \{A_{em}, A_{ib}, A_{ub}\})$. (A_{em}) is the general ability to produce out of labor. Self-employed abilities (including incorporated ability and unincorporated ability, A_{ib} and A_{ub}) capture the capacity to produce with capital. We use A_{ib} to capture the nonroutine skills, cognitive and noncognitive, required by incorporated businesses and A_{ub} to capture the manual skills that are needed by unincorporated businesses.[13] The child's initial ability is broadly defined to include 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

[10] 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 4 to 5 years to get a college degree.

[11] In this paper, 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, Golan, and Soytas (2018), Lee and Seshadri (2019).

[12] Empirical studies confirm the existence of inter vivos transfers for college and other investments. See Hurd, Smith, and Zissimopoulos (2011) and Haider and McGarry (2018).

[13] Levine and Rubinstein (2017) showed that entrepreneurs engage in activities demanding a high degree of nonroutine skills. At the same time, other self-employed individuals perform tasks requiring relatively strong manual skills.

according to[14]

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

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

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

where μ_e^{em} is the general 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 is attending college.

For both incorporated and unincorporated human capital (h_{ib} and h_{ub}), its evolution depends on the corresponding ability (A_{ib}/A_{ub}) and education (e).[15]

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

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

College choice Elite and ordinary colleges charge different tuition 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 general ability (A_{em}).[16] Our formulation embeds both need-based and merit-based financial aid.

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

[15]We assume away learning by doing for incorporated/unincorporated human capital. 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. Also, we assume that incorporated/unincorporated businesses use incorporated/unincorporated human capital and general human capital, and the latter has learning by doing. The empirical evidence for the correlation between entrepreneur experience and performance is controversial. Toft-Kehler, Wennberg, and Kim (2014) and others proposed that such a correlation depends on the type of entrepreneur.

[16]We assume that financial aid does not depend 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 are good predictors of employee performance. See Schmidt and Hunter (1998, 2000, 2004).

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

$$\text{SAT} = \kappa A_{em} + \varepsilon,$$

where $\varepsilon \sim N(0, \sigma_\varepsilon^2)$.[17] Ordinary colleges are not selective, and elite colleges select students based on their SAT scores, with $p(\text{SAT})$ being the admission rate.[18] Therefore, when elite college is the best choice for students, the chance of being admitted is $p(\text{SAT})$, which is exogenous to students. If students are not admitted to elite colleges, they will go for their second-best choice, which could be ordinary college or high school. The modeling of ability requirements allows us to incorporate the selectivity and capacity constraints of elite colleges.

Technology In our model, entrepreneurs and other self-employed individuals operate their firms, so their production technologies generate their income. Employees provide their labor to representative firms, which then combine labor with capital to produce income.

Entrepreneurs and other self-employed individuals have similar income structures. Their income depends on (1) the productivity of the business technology (P_j), (2) their incorporated or unincorporated human capital (h_j), (3) their general human capital (h_{em}), (4) their physical capital investment in the incorporated/unincorporated business (k_j), (5) an idiosyncratic productivity shock (ϵ_j), and (6) the entry cost of opening an incorporated/unincorporated business ($C_j \geq 0$) if they were not incorporated/unincorporated business owners in the previous period ($j_{-1} \neq j$). Formally, it means that

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

where $\epsilon_j \sim N(0, \xi_j^2)$, $j \in \{ub, ib\}$ are serially uncorrelated.[19] To capture the fact that business investment is risky, we assume that ϵ_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 general human capital and physical capital, respectively. We assume that all self-employed individuals are one-person firms that only use the business owner's human and physical capital for investment.[20]

[17] We assume that SAT scores do not depend on initial wealth (k_0) or incorporated/unincorporated ability conditional on general ability due to identification concerns. See more discussions in Section 4.

[18] Fu (2014) showed that the admission rates for ordinary colleges are close to one, and the admission rates of elite colleges vary little by family income.

[19] 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. It seems reasonable to assume that the productivity shocks follow normal distributions.

[20] According to Kochhar, Parker, and Rohal (2015), only 24% of self-employed individuals had at least one paid employee in 2014. Modeling hiring workers' decisions for entrepreneurs is not easy, as the entrepreneurship decision affects salary workers' wage rate 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.

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

$$I_{em} = wh_{em}e^{\epsilon_{em}},$$

where w is the market wage rate (per efficiency unit), h_{em} is the general human capital, and ϵ_{em} a serially uncorrelated idiosyncratic productivity shock with $\epsilon_{em} \sim N(0, \xi^2_{em})$.[21] The labor of employees (measured in efficient labor units, i.e., human capital) is aggregated to the market supply of labor L_{em}, so

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

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

$$F_{em}(K, L) = P_{em}K^{\alpha}_{em}L^{1-\alpha}_{em}.$$

The production function F_{em} has constant returns to scale. With the competitive input markets, aggregate labor's marginal product determines the wage rate w.

Leverage Following Evans and Jovanovic (1989), Kiyotaki and Moore (1997), we assume that entrepreneurs and other self-employed individuals can borrow up to a λ proportion of their assets k, so

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

where λ is the leverage ratio with $\lambda \in [0, 1]$. The maximum leverage ratio, defined as the ratio between the maximum amount of investment and equity, k_j/k, is $(1 + \lambda)$.[22]

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 that cover their tuition and minimum living expenses and borrow commercially.

However, the total amount of debt, which is the sum of student loans and business loans, cannot exceed that leverage ratio of λ. Therefore, anyone who takes out a student loan for college effectively reduces the business loan in the future. Thus, student loans somehow discourage financially constrained students from enrolling in an elite college for entrepreneurs.

[21] Guvenen (2007, 2009) estimated the autoregression coefficient of labor income to be 0.821 using PSID. Since one period is 5 years in our model, the 5-year autoregression coefficient is 0.373 ($= 0.821^5$). Therefore, we assume that income shocks are serially uncorrelated.

[22] 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.

Preferences Every individual has the utility function

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

where $b_d \sim N(0,(\eta_d)^2)$ with $d\in\{ib,ub,nc,ec\}$ are shocks to the consumption value of entrepreneurship, other self-employment, ordinary college, and elite college, respectively. These shocks affect the nonpecuniary utility of career or school choices and they are i.i.d. across individuals and over time.[23] Households discount the future at the rate β.

A household's lifetime utility is given by

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

An individual can live for up to 17 periods (from age 20 to 100 with one 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.[24]

2.2 *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 decide whether to attend an elite college, an ordinary 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 at 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 nonpecuniary utility individuals would receive if they become business owners.

[23] Empirical studies support the view that there are consumption values to college and entrepreneurship. See Benz and Frey (2008), Astebro, Herz, Nanda, and Weber (2014), Jacob, McCall, and Stange (2018), and Gong, Lochner, Stinebrickner, and Stinebrickner (2018). These shocks help to fit the schooling choice and career choice in the data that cannot be explained by pecuniary returns alone.

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

Employees retire at age 65 and decide how much to consume (c) and save for the next period's capital (k'). The value of retirement is

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

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 $\Omega' = \{t + 1, e, A_{em}, A_{ib}, A_{ub}, k', em\}$.[25]

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

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

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:

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

The expectations are taken over $\epsilon_{j_{-1}}$ because individuals do not observe productivity shocks when making their career choices.

Working stage without intergenerational transfers Except for intergenerational transfers, self-employed individuals' maximization problem is the same as before and after age 65. For employees, the forward-looking maximization problem in the working stage is denoted by W_{em}, which is different from (1) 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

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

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

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

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

[25] 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}.

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

$$W_{em}(\Omega, \epsilon_{em}) = \max_{c,k',R} u(c, em) + \beta EV(\Omega') + \omega EJ(\tilde{\Phi}|A_{em}, A_{ib}, A_{ub})$$

$$\text{s.t. } c + k' + R = k(1+r) + wh_{em}e^{\epsilon_{em}}, \quad c > 0,$$

where $J(\cdot)$ 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

$$W_j(\Omega, \epsilon_j) = \max_{c,k',k_j,R} u(c, j) + \beta V(\Omega') + \omega EJ(\tilde{\Phi}|A_{em}, A_{ib}, A_{ub})$$

$$\text{s.t. } c + k' + R = (1-\delta)k_j + P_j h_j h_{em}^{\rho_j} k_j^{\upsilon_j} e^{\epsilon_j} - C_j 1\{j_{-1} \neq j\} - (1+r)(k_j - k)$$

$$c > 0, \qquad (k_j - k) \leq \lambda k, \quad \text{for } j \in \{ub, ib\}.$$

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

$$J(\Phi) = \sum_{e=hs,nc} D_e H_e(\Phi) + D_{ec}\big[p(\text{SAT})H_{ec}(\Phi) + \big(1 - p(\text{SAT})\big)\max\big\{H_{hs}(\Phi), H_{nc}(\Phi)\big\}\big],$$

where $D_e = 1$ if school e is the agent's best choice. When elite college is the best choice ($D_{ec} = 1$), the chance of being admitted is given by $p(\text{SAT})$. If not admitted to elite colleges, the agent will go for his second choice. $\Phi = \{A_{em}, A_{ib}, A_{ub}, k, k^p, b_{nc}, b_{ec}\}$. 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

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

High school graduates directly enter the labor market at age 20. Like others, 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 ordinary or elite colleges take the form

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

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

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 ($t = 2$).

2.3 *Equilibrium*

In equilibrium, the wage w and interest rate r in the nonself-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 nonself-employed individuals) so that

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

  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 nonself-employed sector) so that

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

3. Data

3.1 *Data source and data construction*

Our primary data source is the Panel Study of Income Dynamics (PSID) of The United States. This longitudinal project began in 1968 with a nationally representative sample of over 18,000 individuals living in 5000 families. The PSID tracks these individuals and their descendants, even after they form new families so that we can track the education and life-cycle career choices of parents and children. We focus on white males aged 25–60 with a father identified in the PSID. 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.

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

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

The top 100 universities, according to this index, are defined as elite.[26] 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 C1 provides summary statistics of elite and ordinary 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” (“ordinary college”) education if he/she graduates from an elite college (ordinary college) and not simply if he/she attended an elite college (ordinary college). That is, education is defined by whether the individual receives a college degree.[27]

We determine the primary occupation every 5-years as the occupation that lasts the longest time during the period. Given that our sample focuses on prime-age males, a tiny fraction of them (around 5%) have nonemployment as their primary status. We drop these observations in our analysis, so our sample is restricted to employed and self-employed individuals over the observed periods. The income is measured as the average annual income of the primary occupation over 5 years, including labor income and business income.

Since the PSID tracks all family members, we can match individuals with their fathers even after moving out of the original sampled household. Therefore, we observe the education and life-cycle career paths of sons and fathers, and we can calculate the intergenerational transfer in education and career. We also obtain the parental monetary transfer information from the Rosters and Transfers Parent/Child File of 2013 PSID, which surveys transfers to children. We combine three questions on parental transfer: how much you pay your child to help to pay for school, buying a home, and other expenses. The average amount of parental transfer is $12,581, with 24% receive zero transfer from parents. We obtain individuals’ SAT scores from the Transition into Adulthood module of PSID, which is available biannually from 2005 to 2013, and surveys individuals aged 18 to 28 years old.

We make the following sample restrictions: (1) keep while males aged 25–60; (2) keep individuals with information on father’s education and career; (3) drop nonemployed individuals and high-school dropouts; (4) trim individuals with top 1% and bottom 1% income. Therefore, our sample has 1817 individuals with 19,475 individual-year observations, born between 1949 and 1988.

3.2 *Summary statistics*

We now present some summary statistics. The upper panel of Table 1 shows that 35% of individuals in our sample have a college degree. Among them, 17% graduated from elite

[26]Appendix Table C2 shows our list of elite colleges. Our list is comparable to other rankings, such as the U.S. News Top 100 Colleges, and it does not change much over time. The current list is based on 2016 data.

[27]From now on, “elite/ordinary college attendance (go to an elite/ordinary college)” and “elite/ordinary college completion (receive an elite/ordinary college degree)” are used interchangeably.

Table 1. Summary statistics by career.

	High School Graduates	Ordinary College Graduates	Elite College Graduates
Other self-employed	12.8%	12.4%	11.4%
Entrepreneur	4.0%	7.0%	12.3%
Age	35.7	36.4	37.6
Income (mean)	47,018	73,387	111,416
Income (std)	45,703	68,254	154,135
Father's income	55,842	77,556	105,281
Observations	12,639	5706	1130
Population share	64.9%	29.3%	5.8%
	Employee	**Other Self-Employed**	**Entrepreneur**
Ordinary college	28.3%	28.3%	37.1%
Elite college	4.7%	5.3%	15.2%
Age	35.4	37.3	39.5
Income (mean)	60,314	58,542	117,360
Income (std)	56,618	64,426	149,760
Father's income	63,095	65,777	87,013
Observations	15,930	2454	1091
Population share	81.8%	12.6%	5.6%

Note: Father's income is measured as the average annual income between age 40 to 50. Each individual year is one observation.

colleges. Elite college graduates are 8 ppt and 5 ppt more likely to become entrepreneurs than high school graduates and ordinary college graduates, respectively. However, the chance of being other self-employed is similar across the three education groups. On average, elite college graduates earn 137% and 52% more than high school graduates and ordinary college graduates, respectively. We also show that elite college graduates come from more affluent families—fathers of elite college graduates earn 89% and 36% more than fathers of high school graduates and ordinary college graduates, respectively.

The lower panel of Table 1 shows that 18.2% of individuals in our sample do not work as employees.[28] Among them, 31% are entrepreneurs (i.e., own an incorporated company), and 69% are other self-employed (i.e., own an unincorporated business).[29] Also, employees and entrepreneurs are quite different in their education, income level, and family background. Entrepreneurs are 9 ppt and 10 ppt more likely to graduate from ordinary and elite colleges, earn 95% more than employees, and their fathers earn 38% more than fathers of employees. In contrast, other self-employed individuals have simi-

[28] 86% of the "business owners" in the PSID data spend some time on their business. It suggests that the majority of them participate in the management of their business.

[29] The top 3 industries for entrepreneurs are construction industry (17%), retail trade (13%), and financial services (11%). Medical, dental, and health services only account for 6%. Among other self-employed individuals, the top 3 industries are the same (accounting for 19%, 14%, and 10% of all such individuals, resp.). The top 3 occupations for entrepreneurs are executive, administrative, and managerial occupations (47%), professional specialty (18%), and sales (11%). The top 3 occupations for other self-employed individuals are executive, administrative, and managerial occupations (23%), professional specialty (16%), and sales (13%).

Table 2. Intergenerational persistency in education and career choices.

Education Choice Son \ Father	High School	Ordinary College	Elite College
High school	77.5%	51.3%	41.5%
Ordinary 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%

Note: 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.

lar education levels, own income, and fathers' income compared to employees. These findings are consistent with the literature (e.g., Hamilton (2000), Levine and Rubinstein (2017), Moskowitz and Vissing-Jørgensen (2002)), and 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 an ordinary college degree, those whose fathers have an elite college degree are 11.3 ppt more likely to graduate from an elite college. They are 18.8 ppt more likely than those whose fathers have a high school degree. The bottom panel shows a similar intergenerational persistency in career choice. Offsprings of individuals who have owned an incorporated business have the highest probability of owning an incorporated company, 10.1 ppt higher than a son whose father ever owned an unincorporated business but never own an incorporated business, and 10.5 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, shown in Table 3. Based on the sample of college graduates and controlling for father's education and career, Column (1) shows that graduating from an elite college is associated with a 4.2 ppt higher probability of being an entrepreneur than ordinary college graduates. In comparison, graduating from an elite college does not significantly affect the chance of being other self-employed, as shown in Column (3). Column (5) shows that elite college graduates have 31% higher income than ordinary college graduates.[30] The even columns of Table 3 further explore the heterogeneous effects of elite college by parental income. We find that elite college's impact on entrepreneurship is smaller for individuals from affluent families (those with higher father income), which suggests that elite colleges play a role in mediating intergenerational elasticity in career choices. The effect of elite college on lifetime income does not vary by family income.

[30] Appendix Table C3 shows that having an elite college degree is associated with a higher income for all individuals. The premium is the largest for entrepreneurs.

Table 3. Effects of elite college on career choice and income.

	Entrepreneur		Other Self-Employed		Log Income	
	(1)	(2)	(3)	(4)	(5)	(6)
Elite college degree	0.0416***	0.0442***	−0.0025	−0.0045	0.3059***	0.3168***
	(0.0084)	(0.0048)	(0.0099)	(0.0098)	(0.0229)	(0.0474)
Log father's average income at age 40–50	0.0397***	0.0421***	0.0056	−0.0031	0.1502***	0.1611***
	(0.0060)	(0.0063)	(0.0071)	(0.0074)	(0.0164)	(0.0173)
Elite college * log father's average income		−0.0179***		0.0063		0.0204
		(0.0045)		(0.0172)		(0.0394)
Graduate school degree	0.0035	−0.0038	−0.0023	−0.0025	0.0914***	0.0912***
	(0.0062)	(0.0062)	(0.0074)	(0.0074)	(0.0171)	(0.0171)
Father has high school degree	0.0662***	0.0674***	0.0128	0.0172	−0.0056	−0.0108
	(0.0093)	(0.0094)	(0.0110)	(0.0111)	(0.0257)	(0.0258)
Father has ordinary college degree	0.0650***	0.0656***	0.0031	0.0051	0.0349***	0.0624***
	(0.0102)	(0.0102)	(0.0121)	(0.0121)	(0.0102)	(0.0282)
Father has elite college degree	0.0809***	0.0795***	0.0047	−0.0004	0.0587***	0.0451
	(0.0119)	(0.0139)	(0.0164)	(0.0165)	(0.0183)	(0.0385)
Father ever runs unincorporated business	0.0114	0.0112	0.0680***	0.0686***	−0.1334***	−0.1340***
	(0.0080)	(0.0080)	(0.0095)	(0.0095)	(0.0220)	(0.0220)
Father ever runs incorporated business	0.0655***	0.0658***	0.0394***	0.0382***	0.1039***	0.1024***
	(0.0074)	(0.0074)	(0.0087)	(0.0087)	(0.0203)	(0.0203)
Age	0.0117***	0.0116***	0.0207***	0.0209***	0.1909***	0.1908***
	(0.0031)	(0.0031)	(0.0036)	(0.0036)	(0.0083)	(0.0083)
Age square	−0.0001**	−0.0001**	−0.0002***	−0.0002***	−0.0021***	−0.0021***
	0.0000	0.0000	0.0000	0.0000	(0.0001)	(0.0001)
Constant	−0.6369***	−0.6615***	−0.3953***	−0.3041***	5.2700***	5.1536***
	(0.0861)	(0.0884)	(0.1018)	(0.1044)	(0.2360)	(0.2428)
Observations	8152	8152	8152	8152	8152	8152

Note: We use a linear probability model. The dependent variable for the first column is whether the respondent owns an incorporated business, the dependent variable for the second column is whether the respondent owns an unincorporated business, and the dependent variable for the third column is log annual total income. The sample is restricted to white males aged 25–60 with college degree or above. Each individual year is one observation.
Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

One possible channel through which elite college attendance could affect lifetime income is better access to graduate schools. Using the PSID, we find that having a graduate school degree does not increase the chance of being an entrepreneur, as shown in Column (1) of Table 3. Perhaps it is because professional jobs (such as dentist, physician, accountant, or lawyer) account for less than 10% of entrepreneurs. Likewise, the income gains from attending graduate school are much smaller than that of elite college attendance (9% vs. 31%), as shown in Column (5) of Table 3. Hence, we focus on the choice between elite and ordinary college attendance and abstract away from graduate school attendance.

To summarize, we find that (1) elite college graduates have a higher chance of becoming an entrepreneur, and (2) there is intergenerational persistence in education and career choices. Hence, 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.

4. Identification and estimation

This section explains 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 C5 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. Because each period is 5 years, we set the discount rate to 0.821, equivalent to a 0.95 annual discount rate. The capital depreciation rate is assumed to be 0.266, equal to a 6% yearly depreciation rate. The survival rate is less than one after age 65 and calibrated using survival data from the Health and Retirement Study from 2011; the details are shown in Appendix Table C6. Following Cagetti and De Nardi (2006), we assume that a pension is 40% of average income before retirement, and the utility function parameter σ is set to 1.5.

We set our collateral constraint parameter λ to 1.22 to mimic the stylized fact that, in the Kauffman Firm Survey, the start-up firms' total equity accounts for 45% of their total capital (Robb and Robinson (2014)).[31]

Since the PSID does not have information on respondents' financial aid or the chances of being admitted to elite colleges, we use the estimates of Fu (2014) to calibrate financial aid and elite-college admission rate. Fu (2014)'s estimates are based on the NLSY97 data.[32] Our financial aid formula is

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

where $D(nc) = 13{,}901$ and $D(ec) = 20{,}224$. According to these formulas, students from poorer families and higher SAT scores (a signal of general ability) receive more financial aid when they attend college. On average, elite colleges charge higher tuition on the one hand and provide more generous financial aid than ordinary colleges on the other hand.

We also calibrate elite colleges' admission rates based on the estimates of Fu (2014), which (1) shows that admission rates only depend on SAT scores but not family income,

[31] The Kauffman Firm Survey is a longitudinal survey of new businesses in the United States. It collects annual information on 4928 firms that started in 2004. 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. Recall that our collateral constraint is $k_j \le (1+\lambda)k$. 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.

[32] 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) used a slightly different list 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 elite college list is based on Black and Smith (2006). The difference between our list and the list used by Fu (2014) is minimal.

and (2) reports the admission rates of elite private and elite public colleges separately.[33] We take a weighted average of the admission rates of private and public elite colleges. The weights are the number of students enrolled in each type of college in the PSID.[34] The weighted admission rates of elite colleges are 0.209 for students with SAT scores at the bottom 1/3, 0.559 for the middle 1/3, and 0.756 for the top 1/3.

We calculate the average tuition at elite and ordinary colleges using the IPEDS data in 2003, roughly when the NLSY97 cohorts entered colleges. On average, elite colleges charge \$33,046 (in 2011 dollars) and ordinary colleges charge \$12,761.

Appendix Table C7 shows the parameters that remain to be estimated and the moments used to identify these parameters. Recall that individuals make education choices according to their array of abilities and wealth in our structural model. Hence, specific moments from the data allow us to identify the selection in abilities and human capital gain from an elite college. For instance, the wage gap between elite and ordinary college students reflects the ability difference between elite and ordinary college students and human capital gain from elite colleges. With panel data, we can also use income correlation for stayers (those who do not change jobs) and switchers (those who change jobs between two adjacent periods) to identify the ability distribution. Below, we provide a more detailed discussion of our identification strategy.

First, we track the individuals over time and calculate changes in their income when they stay in the same career and switch careers. The standard deviation of general 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 general ability is large relative to that of the productivity shocks, more of the employee income variation is driven by general ability variation. We should observe a high-income correlation between two adjacent periods for employees.[35] The income variation for entrepreneurs and other self-employed individuals can be decomposed into three parts: general ability variation and the contribution of general ability to entrepreneur income (ρ_{ib}/ρ_{ub}), incorporated/unincorporated ability variation (σ_{ib}/σ_{ub}), and the dispersion of productivity shocks (ξ_{ib}/ξ_{ub}). To identify the σ's, ρ's, and ξ's, we use the income variation and the income correlation between two periods for individuals who are entrepreneurs/other self-employed in both periods along with the income correlation between two periods for individuals who switch between being employees and entrepreneurs/other self-employed. If the σ's are large, we should observe a strong income correlation between two adjacent periods for individuals who remain in the

[33] In Appendix Table A9 of Fu (2014), the admission rates of elite private colleges are 0, 38.5%, and 61.7% for students with SAT scores lower than 800, between 800 and 1200, and above 1200, and the corresponding admission rates of elite public colleges are 53.8%, 80.0%, 92.8%.

[34] Unfortunately, we cannot observe the type of colleges students applied for in the PSID, so we have to use the enrollment numbers as weight.

[35] The correlation of earnings between two periods for employee stayers is not exactly mapped to the dispersion of general ability because entry and exit of employment are endogenous. Therefore, 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. Keane and Wolpin (1997) adopted a similar identification strategy.

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 ordinary and elite colleges (i.e., η_{nc} and η_{ec}) and the human capital gains from ordinary and elite college attendance (i.e., μ_e^j for $e \in \{nc, ec\}$, $j \in \{em, ib, ub\}$) with the following equations. The first set of equations are the education decision:

$$\Pr(\Phi \in \Pi)\, p(\text{SAT}) = \Pr(e = ec),$$
$$\Pr(\Phi \in \Psi) + \Pr(\Phi \in \Pi')\big(1 - p(\text{SAT})\big) = \Pr(e = nc),$$

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 whose first choice is elite colleges, Π' is the set of students whose first choice is elite colleges and the second choice is nonelite colleges, and Ψ is the set of students whose first choice is ordinary colleges. The observed share of students graduating from an elite college equals the share of students whose first choice is elite colleges multiplied by the share of students being admitted. The share of students graduating from a nonelite college equals the share of students whose first choice is nonelite colleges and the share of students denied by elite colleges and admitted by nonelite colleges instead.

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 an ordinary college degree:

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

where f_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. $\tilde{\Pi}$ is the set of students who graduate from an elite college, and $\tilde{\Psi}$ is the set of students who graduate from an ordinary college. Using the panel data, we run income regressions and get individual fixed effects, which are equivalent to f_e^j because f_e^j does not change after an individual finishes his education.

Take the second equation as an example, we have two components on the left-hand side: $E[\log A_{ib}|\Phi \in \Pi] + \mu_{ec}^{ib}$ and $\rho_{ib}(E[\log A_{em}|\Phi \in \Pi] + \mu_{ec}^{em})$. Note that we have recovered the distributions of general, incorporated, and unincorporated abilities ($\sigma_{em}, \sigma_{ub}, \sigma_{ib}$) and the contribution of general ability to entrepreneur income (ρ_{ib}). With the structural model, we can predict what type of individuals will choose to attend elite college and become entrepreneurs, so we recover $E[\log A_{ib}|\Phi \in \Pi]$ and $E[\log A_{em}|\Phi \in \Pi]$. Therefore, the only unknowns are μ_{ec}^{ib} and μ_{ec}^{em} in this equation.

In total, 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 ordinary and elite college attendance on general, 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 nonself-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 transition rates between being an employee and being an entrepreneur/other self-employed pin down the costs of opening incorporated/unincorporated business (C_{ib}/C_{ub}). If C_{ib}/C_{ub} is high, fewer employees will open incorporated/unincorporated businesses. Intergenerational correlations in careers identify the intergenerational transfer in general, 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. We standardize the SAT score, so it has a mean of zero and a standard deviation of one. The joint distribution of SAT scores and initial wealth at age 20 identifies the relationship between general ability and SAT scores (κ) because $\text{Cov}(\text{SAT}, k_0) = \kappa \text{Cov}(A_{em}, k_0)$. The variance of SAT scores identifies the distribution of the noise, because $\text{Var}(\text{SAT}) = \kappa^2 \text{Var}(A_{em}) + \sigma_\varepsilon^2$.

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 make an initial guess of the joint distribution of initial wealth and parent generation abilities. We then simulate 5000 individuals by drawing their initial wealth and abilities from the distribution and their idiosyncratic shocks to the nonpecuniary utility of education and career choices and the productivity shocks to career choices according to the parameters. 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, general ability, incorporated ability, and unincorporated ability as the offspring generation. 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.[36]

[36]With the distribution of the offspring generation's initial wealth and abilities, we simulate the children's life-cycle decisions 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 using the PSID sample and compare them to the sample aggregate statistics, which include: (1) education choice; (2) career choice by education and age; (3) mean and variance of income by education, career, and age; (4) correlation between incomes in period t and $t+1$ by career type; (5) career transitions in period t and $t+1$; (6) intergenerational mobility in education and career; (7) parental monetary transfers as a fraction of parental wealth; (8) correlation between SAT scores and initial wealth at age 20; and (9) variance of SAT scores.[37]

5. Estimation results

5.1 *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 average and standard deviation of income by education and career, as shown in Table 5. Moreover, Appendix Figures C1 and C2 show that the model can fit the career choice and average income by career type over the life cycle. The model predicts that the chance of owning an incorporated or unincorporated business increases with age, as individuals accumulate their physical capital in their early career to overcome the borrowing constraint. The model also predicts the hump-shape income profile of employees and self-employed individuals over the life cycle. The diminishing return to physical capital investment drives the hump-shape income of self-employed individuals.

Our model also addresses the following topics: (1) income correlation and career transition, (2) intergenerational persistence in education, career, and income, (3) return to elite colleges, and (4) the choice of an incorporated or unincorporated business. Furthermore, we analyze how abilities and initial wealth affect subsequent education and career choices in Appendix B.

5.2 *Income correlation and career transition*

Economic agents change careers, and hence their level of income over their life cyle. The first panel of Table 6 shows that our model mimics the empirical career dynamics (i.e., transitions between two adjacent periods). For example, 87.0% of employees in our data remain employees in the next 5-year period, with the model predicting 88.7%. Our data show that 53.0% (52.0%) of entrepreneurs (other self-employed individuals) are still in business 5 years later, while the model predicts 56.6% (53.3%). More than a third of the self-employed become employees 5 years later. The 5-year transition rate from entrepreneurs to employees is 34.3% in the data and 30.4% in the model. The 5-year transition rate from unincorporated business owner to employee is even higher, 38.7% in the

[37] Since we use NLSY97 to calibrate financial aid, admission rates, and college tuition, we should restrict our PSID sample to cohorts born in the 1980s. However, our sample size will shrink by 75%, with only 27 elite-college graduates and 27 individuals who have been entrepreneurs. Therefore, we have to use the full PSID sample to increase the statistical power of our results. When we construct moment (7), we keep only individuals with SAT scores. When we construct other moments, we keep individuals with and without SAT scores.

Table 4. Parameter estimates.

	Employee	Entrepreneur	Other Self-Employed
Productivity (P)	2005 (526)	4.1 (0.5)	20.8 (8.3)
Return to ordinary college (μ_{nc})	0.25 (0.09)	0.28 (0.06)	0.20 (0.05)
Return to elite college (μ_{ec})	0.47 (0.17)	0.56 (0.19)	0.35 (0.16)
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)	–	0.15 (0.06)	0.03 (0.01)
Std of productivity shock (ξ)	0.66 (0.19)	0.73 (0.31)	0.59 (0.19)
Entry cost (C)	–	58,000 (22,500)	8000 (2300)
Std of consumption shock (η)	–	0.0003 (0.0001)	0.0008 (0.0002)
Std of ability (σ^a)	0.38 (0.14)	0.38 (0.15)	0.32 (0.12)
Intergenerational correlation in ability (θ)	0.47 (0.16)	0.41 (0.12)	0.38 (0.05)
Std of consumption shock for college (η)	0.020 (0.006)/0.018 (0.004) (NC/EC)		
Weight on offspring's welfare (ω)	0.040 (0.009)		
Output elasticity of capita (α)	0.246 (0.082)		
Mapping from general ability to SAT scores (κ)	2.050 (0.571)		
Std of noise in SAT scores (σ_ε)	0.627 (0.092)		

Note: 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: ordinary college, EC: elite college. Employee ability refers to general ability and employee human capital refers to general human capital.

data and 40.2% in the model. Consequently, the transition rates between entrepreneurs and other self-employed individuals are low. The 5-year transition rate from other self-employed individuals to entrepreneurs is 9.3% in the data and 6.5% in the model. The 5-year transition rate from entrepreneurs to other self-employed individuals is 12.7% in the data and 13.0% in the model.

Our model also fits the income correlation between periods for stayers and switchers (between career types), as shown in the second panel of Table 6. For stayers (those who remain in the same career over the 5 years), the empirical income correlations are 0.71, 0.70, and 0.41 for employees, entrepreneurs, and other self-employed individuals, respectively, while the model counterparts are 0.69, 0.73, and 0.51. 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 0.56 (0.43) in the model.[38]

Our model also matches well with some untargeted moments on income transitions. The first panel of Table 7 shows that our model fits the average starting age of entrepreneurship and the average duration of entrepreneurship. On average, individuals start their first incorporated business at age 37 and the business lasts for 10 years. The model can also fit the income transitions for stayers and switchers. The average employee income for those who remain employees for two consecutive periods is $54,582 in the data and $52,926 in the model. The average employee income for those who become entrepreneurs 5 years later is $75,482 in the data and $76,920 in the model, sug-

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

Table 5. Model fit: targeted moments.

	Data	Model
Education choice		
High school graduates	64.9%	64.9%
Ordinary college graduates	29.3%	29.6%
Elite college graduates	5.8%	5.6%
Career choice by education		
High school: Employee	83.3%	82.8%
High school: Other self-employed	12.8%	12.8%
High school: Entrepreneurs	4.0%	4.4%
Ordinary college: Employee	80.6%	80.3%
Ordinary college: Other self-employed	12.4%	12.7%
Ordinary college: Entrepreneurs	7.1%	7.0%
Elite college: Employee	76.4%	74.1%
Elite college: Other self-employed	11.4%	12.5%
Elite college: Entrepreneurs	12.3%	13.4%
Average income by education and career		
High school employees	48,502	50,357
High school other self-employed	46,291	47,251
High school entrepreneurs	86,285	83,827
Ordinary college employees	72,436	73,105
Ordinary college other self-employed	73,381	70,055
Ordinary college entrepreneurs	121,670	120,106
Elite college employees	106,891	113,613
Elite college other self-employed	99,778	95,395
Elite college entrepreneurs	186,503	186,646
Income standard deviation by education and career		
High school employees	27,357	30,442
High school other self-employed	43,030	45,789
High school entrepreneurs	98,857	110,881
Ordinary college employees	52,670	57,001
Ordinary college other self-employed	70,210	70,055
Ordinary college entrepreneurs	156,013	139,100
Elite college employees	147,351	149,942
Elite college other self-employed	129,042	130,452
Elite college entrepreneurs	206,590	188,903
Others		
Parental transfer as a share of parent's 5-year income	0.041	0.039
Correlation between SAT scores and initial wealth at age 20	0.255	0.274
Variance of SAT scores (standardized)	1.000	0.992

Note: We standardize SAT scores so it has a mean of zero and a standard deviation of one.

gesting that entrepreneurs have much higher salaried earnings as employees before they start an incorporated business. However, those who are current employees and become unincorporated business owners 5 years later have an average income of $54,745 in the data and $51,693 in the model, suggesting that these individuals have similar earnings as employees before opening an unincorporated business to those who remain employees

TABLE 6. Model fit: targeted moments (cont'd).

	Data	Model
Career transitions		
Employee–employee	87.0%	88.7%
Employee–entrepreneur	3.3%	2.5%
Employee–other self-employed	9.8%	8.8%
Entrepreneur–employee	34.3%	30.4%
Entrepreneur–entrepreneur	53.0%	56.6%
Entrepreneur–other self-employed	12.7%	13.0%
Other self-employed–employee	38.7%	40.2%
Other self-employed–entrepreneur	9.3%	6.5%
Other self-employed–other self-employed	52.0%	53.3%
Income correlation by career transitions		
Employee–employee	0.710	0.691
Employee–entrepreneur	0.602	0.559
Employee–other self-employed	0.493	0.427
Entrepreneur–employee	0.530	0.634
Entrepreneur–entrepreneur	0.697	0.731
Entrepreneur–other self-employed	0.090	0.189
Other self-employed–employee	0.567	0.391
Other self-employed–entrepreneur	0.483	0.398
Other self-employed–other self-employed	0.410	0.512
Intergenerational persistency in education choices		
High school–high school	77.5%	70.2%
High school–ordinary college	20.0%	26.4%
High school–elite college	2.7%	3.4%
Ordinary college–high school	51.3%	59.2%
Ordinary college–ordinary college	38.5%	31.3%
Ordinary college–elite college	10.2%	9.5%
Elite college–high school	41.5%	49.7%
Elite college–ordinary college	36.9%	32.1%
Elite college–elite college	21.5%	18.2%
Intergenerational persistency in career choices		
Employee–employee	62.7%	64.6%
Employee–entrepreneur	14.1%	17.2%
Employee–other self-employed	23.2%	18.2%
Entrepreneur–employee	49.6%	50.9%
Entrepreneur–entrepreneur	24.6%	27.5%
Entrepreneur–other self-employed	25.8%	21.6%
Other self-employed–employee	54.9%	55.6%
Other self-employed–entrepreneur	14.5%	17.9%
Other self-employed–other self-employed	30.6%	26.5%

Note: The career transition panel presents the career transitions from period t to period $t+1$, where one period is 5 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.

(Levine and Rubinstein (2017)).[39] For entrepreneurs in the current period, stayers have

[39]Note that entrepreneurs and other self-employed individuals are older than employees on average (Table 1); we do not observe a significant income difference between stayers and would-be-other-self-

Table 7. Model fit: untargeted moments.

	Data	Model
Age of first entrepreneurship	37.6	37.3
Duration of entrepreneurship	10.0	10.2
Lagged income by career transitions		
Employee–employee	54,582	52,926
Employee–entrepreneur	75,482	76,920
Employee–other self-employed	54,745	51,693
Entrepreneur–employee	109,868	115,724
Entrepreneur–entrepreneur	123,262	119,371
Entrepreneur–other self-employed	87,824	82,848
Other self-employed–employee	55,017	52,429
Other self-employed–entrepreneur	88,547	81,301
Other self-employed–other self-employed	59,587	63,497
Intergenerational income elasticity		
Whole sample	0.39	0.42
Both father and son are devoted employees	0.51	0.56
Father has worked as nonemployee; son is devoted employee	0.32	0.37
Father is devoted employee; son has worked as nonemployee	0.39	0.41
Both father and son have worked as nonemployee	0.31	0.34

Note: 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.

the highest income, while those with the lowest income become unincorporated business owners. For the current unincorporated business owners, stayers have a medium-income, while those with the most insufficient income become employees.

5.3 *Intergenerational persistence*

We also estimate the intergenerational transmission of abilities. As shown in Table 4, the intergenerational correlation of ability for A_{em}, A_{ib}, and A_{ub} are 0.47, 0.41, and 0.38, respectively. These estimates are similar to the estimates in Grönqvist, Öckert, and Vlachos (2017) where they find an intergenerational correlation of 0.42–0.48 for cognitive skills and 0.42 for noncognitive skills.

The last two panels of Table 6 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 70%. Similarly, the persistence in receiving an ordinary college degree is 39% in the data and 31% in the model. 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. 63% of the individuals whose fathers are devoted employees (i.e., individuals who never own a business throughout their lifetime) are also devoted employees themselves.

employed individuals. Hence, age cannot be the driving factor for the income difference between stayers and would-be-entrepreneurs.

The model predicts 65%. Similarly, entrepreneurship (those who own an incorporated business at some point) is also intergenerationally persistent. It is 25% in the data and 28% in the model. The counterpart for other self-employment (i.e., unincorporated but not incorporated business ownership) are 31% in the data and 27% in the model.

The second panel of Table 7 sheds light on the intergenerational income elasticity between fathers and sons. It 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.[40] The intergenerational income elasticity is 0.39 in the data and 0.42 in the model. The model reproduces the fact that income persistence differs across different types of families. The persistence is highest when both the father and the son are employees. It is 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 nonemployees (entrepreneurs and other self-employed individuals) than for employees. These results suggest that career choices may affect intergenerational income elasticity.

5.4 *Human capital gain from elite colleges*

Consistent with our discussion of the potential self-selection bias, the upper panel of Table 8 shows how people with different combinations of abilities and initial wealth sort into various education. Recall that abilities are normalized to have zero mean. Elite college graduates have a much higher general ability (0.782) than graduates from ordinary college graduates (0.492) and high schools (−0.306). Financial aid is positively related to the SAT score, which is, in turn, positively associated with general ability. Other things being equal, students with higher general abilities would face lower tuition and more incentives to enroll in colleges. Compared with the intense sorting in general ability, the sortings in incorporated and unincorporated abilities are less noticeable. There seems to be a weak positive sorting in incorporated ability and a weak negative sorting in unincorporated ability. Elite college graduates have a slightly higher incorporated ability (0.022) than graduates from ordinary colleges (0.008) and high schools (−0.012). The unincorporated ability of elite college graduates is the lowest (−0.010), followed by ordinary college graduates (−0.003) and high school graduates (0.008). In addition to the selection of abilities, we find robust sorting in terms of initial wealth. The last column of Table 8 shows that elite college students have much higher initial wealth than the other two types of students. On average, elite college graduates have \$77,758 at age 20, while ordinary college and high school graduates only have \$23,488 and \$16,447, respectively.[41] Appendix B visualizes some sorting to shed light on how individuals with different abilities and initial wealth sort into different education types.

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

[41] 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 less privileged backgrounds.

Table 8. Average ability and wealth at age 20 by education and career.

	General Ability	Incorporated Ability	Unincorporated Ability	Wealth at Age 20
By education type				
High school	−0.306	−0.012	0.008	16,447
Ordinary college	0.492	0.008	−0.003	23,488
Elite college	0.782	0.022	−0.010	77,758
By career type				
Employee	0.001	−0.076	−0.127	20,315
Entrepreneur	0.162	1.451	−0.173	28,767
Other self-employed	−0.182	−0.055	0.966	23,621

Note: 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.

Considering the students' self-selection, elite colleges still offer more significant gains in general, incorporated, and unincorporated human capital than ordinary colleges do. Table 4 shows that graduation from elite college leads to an increase in the general/incorporated/unincorporated human capital by 47%/56%/35%, while graduation from ordinary college leads to a 25%/28%/20% increase. Among the three types of human capital, return to an elite college is the largest for incorporated human capital (28 ppt) than the other two types of human capital (22 ppt for general human capital and 15 ppt for unincorporated human capital). Thus, ignoring elite colleges' effect on entrepreneurship may underestimate the returns from attending an elite college.

Appendix Table C8 goes further and shows how people with varying combinations of abilities and initial wealth sort into diverse education and career paths. The average incorporated ability of entrepreneurs is lower for elite college graduates (1.001) than ordinary college graduates (1.360) and high school graduates (1.535). In this sense, select college attendance lowers entrepreneurship's entry barrier, while individuals with lower education levels need to be genuinely talented to start an incorporated business. Likewise, elite college graduates who own an unincorporated business have the most inferior unincorporated ability among the three education levels. Thus, elite colleges facilitate people transiting from being employees to self-employment.

5.5 *Incorporated versus unincorporated businesses*

This section discusses how economic agents choose between the two forms of self-employment. Table 4 shows that the contribution of general human capital is 0.15 for incorporated businesses, whereas the corresponding number to unincorporated firms is only 0.03. It means that incorporated businesses combine general human capital and incorporated human capital, while unincorporated businesses mostly use unincorporated human capital. Thus, our results are consistent with Lazear (2004, 2005), that entrepreneurs need to be "jacks-of-all-trade."

The bottom panel of Table 8 further shows that individuals with high general ability but low entrepreneurial ability choose to become employees. Meanwhile, those with the high general ability and high incorporated ability own incorporated businesses. Those with low general ability but high unincorporated ability become unincorporated business owners. Appendix B provides more discussions on how individuals with different abilities and initial wealth sort into different career types.

The ability mix is not the only determinant of a career. The entry cost of starting a business is also essential, but it is not directly observable by econometricians.[42] Fortunately, our structural estimation can recover them. More specifically, we find that the cost of opening an incorporated business is $58,000, while it is only $8000 for unincorporated business (all in 2011 dollars).[43] Thus, our estimates are consistent with the observation that incorporated business owners tend to be wealthier and older.

The fact that the two types of businesses use different mixes of human capital and have different entry costs explain why transitions between the two types of companies are rare, as shown in the first panel of Table 6 and also documented in Levine and Rubinstein (2017).

6. 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 the variations of 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.

6.1 *Decomposition analysis*

In the spirit of Lee and Seshadri (2019), we explain lifetime outcome differences with the "state variables" at age 20. The "state variables" 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, e (high school graduate, ordinary college graduate, or elite college graduate). The outcome variables are an individual's career choices (employee, incorporated, or unincorporated business owner) 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

[42]Entry cost includes both the direct costs of incorporation, such as annual fees and the preparation of more detailed financial statements and the indirect agency costs associated with the separation of ownership and control.

[43]To put things in perspective, $58,000 in entry costs would be equivalent to 1.8 years of elite college tuition.

[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.

Table 9. Decomposition: variance conditional on individual state at age 20.

Baseline Variance explained by (%):	(1) $(\vec{A}, k_0, e)$	(2) $(\vec{A}, k_0)$	(3) $(\vec{A}, e)$	(4) (k_0, e)	(5) (A_{ub}, A_{ib}, k_0, e)	(6) (A_{em}, A_{ib}, k_0, e)	(7) (A_{em}, A_{ub}, k_0, e)
Ever be an entrepreneur	44.4	38.9	43.9	13.9	33.5	42.3	19.5
Ever be other self-employed	39.6	39.6	38.8	11.4	37.7	13.2	36.9
Lifetime income	53.2	45.9	52.5	20.8	29.9	50.9	46.6
Combine elite and ordinary colleges Variance explained by (%):	(1) $(\vec{A}, k_0, e)$	(2) $(\vec{A}, k_0)$	(3) $(\vec{A}, e)$	(4) (k_0, e)	(5) (A_{ub}, A_{ib}, k_0, e)	(6) (A_{em}, A_{ib}, k_0, e)	(7) (A_{em}, A_{ub}, k_0, e)
Ever be an entrepreneur	41.8	38.9	41.2	11.5	31.0	39.7	17.0
Ever be other self-employed	39.6	39.6	38.8	11.4	37.7	13.2	36.9
Lifetime income	50.1	45.9	49.0	15.2	24.1	47.8	43.5

Note: 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 e. $\vec{A}$ includes general ability A_{em}, unincorporated ability A_{ub}, and incorporated ability A_{ib}.

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 9 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 9 present the decomposition results on entrepreneurship and other self-employment. Column (1) shows that abilities, wealth, and education at age 20 can explain 44.4% of the decision to be an entrepreneur and 39.6% of choice to be unincorporated business owners. This result suggests a lot of uncertainty in people's career paths as different people value alternative career paths differently and experience further shocks to productivity over their life cycles.

Among the three state variables, schooling has a pronounced effect on becoming self-employed, especially on entrepreneurship choice. Comparing column (2) with column (1), we find that excluding the variation in education reduces the conditional variance of being an entrepreneur by 5.5 ppt but does not affect the conditional variance of being an unincorporated business owner. Thus, the education level has more influence on being an entrepreneur. This result is consistent with the reduced form estimation in Table 3 that the probability of being an unincorporated business owner is similar across education groups.

In column (3), we leave out initial wealth, which is the transfer an individual receives from his or her parent at age 20, and surprisingly, it barely affects the conditional variance. The conditional variance only declines by 0.5 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 dramatically declines by 30.5 ppt and 28.2 ppt for entrepreneurship and other self-employment, respectively. To understand the relative importance of general, unincorporated, and incorporated abilities, columns (5) to (7) further exclude each of the three abilities one by one. In particular, excluding general ability reduces the conditional variance of entrepreneurship by 10.9 ppt, but only by 1.9 ppt for other self-employment. Recall that incorporated businesses demand employee human capital but not unincorporated businesses. Not surprisingly, leaving out unincorporated ability reduces other self-employment's conditional variance by 26.4 ppt but barely changes entrepreneurship's conditional variance. Similarly, leaving out incorporated ability reduces entrepreneurship's conditional variance by 24.9 ppt but hardly affects other self-employment. Overall, career choice decisions are mainly driven by career-specific ability. In particular, the decision to become an entrepreneur is driven by general ability and schooling.

Next, we analyze the explanatory power of abilities, wealth, and education at age 20 on lifetime income. Despite the life-cycle uncertainty (the shocks on the productivity and consumption value of different careers), the initial conditions explain a sizable portion (53.2%) of the lifetime income variance (column 1).[45] When we exclude education in the initial conditions, the conditional variance of lifetime income declines from 53.2% to 45.9% (by 7.3 ppt), as shown in column (2). This result is in contrast to Lee and Seshadri (2019): they find that college choice only reflects selection, as the college choice margin can be explained almost entirely by the other variables. Our model distinguishes between elite and ordinary colleges and allows the two types of colleges to affect the accumulation of various kinds of human capital (general, unincorporated, and incorporated) differently. Different career paths demand alternative combinations of human capital and deliver very diverse income processes. Therefore, it is vital to distinguish between elite versus ordinary colleges and between different career paths.

Like career choices, we find that leaving out the initial wealth barely affects the conditional variance of lifetime income (0.7 ppt decline, as shown in column (3)), while leaving out abilities has a significant impact. Removing the three abilities reduces the explanatory power by 32.4 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 reexamine the model's explanatory power by excluding the three abilities one by one. We find that general ability explains more of the lifetime income than the other two abilities.

Lastly, we reperform the above analysis by grouping elite and ordinary colleges and report the results in the bottom panel of Table 9. Comparing the upper and bottom panels reveals the importance of distinguishing elite and ordinary colleges. Column (1) shows that when we do not differentiate between elite and ordinary colleges, the initial conditions' capacity to explain the entrepreneurship decision drops from 44.4% to 41.8%. At the same time, that for other self-employment is not affected. Moreover, the fraction of variance in lifetime income explained by all initial conditions drops from 53.2% to 50.1%. Recall that when we differentiate the two types of colleges, excluding education reduces the conditional variances of entrepreneurship and lifetime income by 5.5 ppt and 7.3 ppt, respectively. When we combine the two types of colleges, excluding education only reduces the conditional variances of entrepreneurship and lifetime

[45] Lee and Seshadri (2019) can explain 74% of the lifetime income. Our model explains a smaller fraction because we do not model the precollege human capital investment by parents. Our model also allows for different productivity shocks on employees, unincorporated and incorporated business owners, which increases lifetime income uncertainty.

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

income by 2.9 ppt and 4.2 ppt, suggesting that the explanatory power of education for entrepreneurship and lifetime income drops 47% and 42%, respectively. 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 C9 shows that abilities and initial wealth are positively correlated. Education decision is also affected by abilities and wealth. The next section provides a simulation exercise to quantify elite colleges' effects on career choice and lifetime income.

6.2 *Simulation analysis*

To quantify the significance of elite college education on entrepreneurship decisions and lifetime income, we conduct two simulations in this section. First, we study the changes in elite college graduates' (ordinary college graduates') career choices and lifetime income if they attended ordinary college (elite college) instead. Second, we compare individuals' career choices and lifetime incomes with different combinations of abilities and initial wealth if assigned to elite colleges with those assigned to ordinary colleges.[47] The results on career choices are shown in Table 10, and the impacts on lifetime income are shown in Table 11.

6.2.1 *Effect on career choice* If elite college graduates attend ordinary colleges, their chance of becoming entrepreneurs drops significantly, falling by 6.5 ppt (48.5%), from 13.4% to 6.9%, as shown in the first column of Table 10. However, their likelihood of engaging in other forms of self-employment only declines slightly, by 0.1 ppt (0.8%), from 12.5% to 12.4%. Suppose ordinary college graduates attend elite colleges, their chance of becoming entrepreneurs increases by 2.8 ppt (19.6%), while their likelihood of being other self-employed does not change. Again, these results confirm that elite colleges have an enormous impact on entrepreneur decisions but not other self-employment decisions.

The above analysis mimics the average treatment effects of elite colleges on elite college graduates and ordinary college graduates. To address the potential heterogeneity in the "treatment effect" of elite college education, we conduct additional simulations. Specifically, we simulate individuals' career choices and income with given levels of abilities and initial wealth over the life cycle, assuming that all of them attended elite colleges or attended ordinary 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), the low (high) type is defined as one standard deviation below (above) the mean. For the initial wealth, the low type has $10,000 at age 20, while the high type has $30,000.

[47] To facilitate the comparison, we conduct the simulations conditional on the same set of simulated consumption and productivity shocks of each career choice, with and without an elite college degree.

Table 10. Simulation: effect of elite colleges on career choice.

	Entrepreneur (%)			Other Self-Employed (%)		
	Elite College	Ordinary College	Diff	Elite College	Ordinary College	Diff
Elite college graduates	13.4	6.9	6.5	12.5	12.4	0.1
Ordinary college graduates	9.8	7.0	2.8	12.7	12.7	0.0
(L, L, L, L)	0.0	0.0	0.0	0.5	0.0	0.5
(L, L, L, H)	0.0	0.0	0.0	0.5	1.4	−0.9
(H, L, L, L)	0.0	0.0	0.0	2.0	1.5	0.5
(H, L, L, H)	0.0	0.0	0.0	2.0	1.8	0.2
(L, H, L, L)	0.0	0.0	0.0	10.6	4.1	6.5
(L, H, L, H)	0.0	0.0	0.0	12.8	8.5	4.3
(L, L, H, L)	21.8	0.0	21.8	0.0	0.0	0.0
(L, L, H, H)	14.8	8.0	6.8	0.0	0.4	−0.4
(H, H, L, L)	0.0	0.0	0.0	16.8	14.8	2.0
(H, H, L, H)	0.0	0.0	0.0	18.3	16.8	1.5
(L, H, H, L)	7.1	0.0	7.1	7.9	5.8	2.1
(L, H, H, H)	8.2	6.9	1.3	8.2	6.4	1.8
(H, L, H, L)	31.1	11.8	19.3	0.9	1.1	−0.2
(H, L, H, H)	33.6	15.3	18.3	0.9	1.4	−0.5
(H, H, H, L)	22.6	8.3	14.3	15.9	14.6	1.3
(H, H, H, H)	25.1	10.6	14.5	17.4	14.9	2.5

Note: We simulate the career choice and earnings over the life cycle when individuals attend elite colleges and when they attend ordinary colleges. The first two rows present the results of elite college graduates and ordinary college graduates, respectively. The following rows present the results of individuals with a fixed level of initial abilities and wealth. The four elements in the parentheses refer to general 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 ordinary colleges, and their difference. The last three columns present the probability of being other self-employed if the individual attended elite college, that if he attended ordinary college, and their difference.

We find that individuals with low incorporated ability have little chance of becoming an entrepreneur. 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 ordinary colleges reduces the probability of becoming an entrepreneur by 21.8 ppt. The effect drops to 6.8 ppt when the same individuals have high initial wealth (denoted by (L, L, H, H). For individuals with high unincorporated and incorporated abilities but low general ability (denoted by (L, H, H, L) and (L, H, H, H)), the effects of elite college on entrepreneurship are also much more extensive for the poor than the rich (7.1 ppt vs. 1.3 ppt). Elite colleges (1) enhance entrepreneurial human capital and (2) improve employee salaries so that potential entrepreneurs accumulate wealth faster to open a business. The differential effects of elite colleges between the poor and rich suggest that (2) serves as an essential mechanism in affecting the entrepreneurship decision, consistent with the reduced form findings in Table 3.

Furthermore, for individuals with high general and incorporated abilities (denoted by $(H, \cdot, H, \cdot)$), elite college significantly improves the probability of becoming an en-

Table 11. Simulation: effect of elite colleges on lifetime income.

	Baseline Model	Forced to be Employees	Difference
Elite college graduates	21.45	16.88	4.57
Ordinary college graduates	14.50	12.22	2.28
(L, L, L, L)	15.04	14.65	0.39
(L, L, L, H)	14.16	13.83	0.33
(H, L, L, L)	16.92	16.52	0.40
(H, L, L, H)	14.28	13.93	0.35
(L, H, L, L)	19.53	18.74	0.79
(L, H, L, H)	11.05	10.26	0.79
(L, L, H, L)	25.28	19.96	5.32
(L, L, H, H)	12.00	9.13	2.87
(H, H, L, L)	16.22	15.26	0.96
(H, H, L, H)	18.05	17.71	0.34
(L, H, H, L)	23.34	20.68	2.66
(L, H, H, H)	12.60	10.24	2.36
(H, L, H, L)	24.17	18.89	5.28
(H, L, H, H)	29.91	23.35	6.56
(H, H, H, L)	23.40	18.79	4.61
(H, H, H, H)	26.37	22.66	3.71

Note: The first column presents the elite college premium (percentage change in the lifetime income if the individual's education changed from ordinary to elite colleges), allowing for free career choice. The second column shows the elite college premium if we force individuals to become employees. The third column presents the difference in the elite college premium between the first two columns. The first two rows present the results of elite college graduates and ordinary college graduates, respectively. The following rows present the results of individuals with a fixed level of initial abilities and wealth. For details, please refer to the footnote of Table 10.

trepreneur (by 14–19 ppt), regardless of initial wealth and unincorporated ability. In contrast, the effect of elite college on other self-employed is almost zero. Elite college barely affects the probability of engaging in unincorporated businesses, except for students with low general ability, high unincorporated ability, and low initial wealth ((L, H, L, L) and (L, H, H, L)).

In sum, graduating from an elite college increases the chance of becoming an entrepreneur but not an unincorporated business owner. Such effects are concentrated on individuals with the high incorporated ability and low financial capacity.

6.2.2 *Effect on lifetime utility* Next, we analyze the effect of elite colleges on lifetime income. While consumption values partly drive people's education choices in our model, our elite college premium is income-based. In particular, 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 attending an ordinary college. The calculation includes tuition expenditure but not the consumption value of colleges.

The first row of Table 11 shows that moving elite college graduates to ordinary colleges leads to a substantial decline in their lifetime income, which is reduced by 21%. It translates to an elite college premium of \$147,290 (in 2011 dollars, net of tuition). Although elite colleges charge much higher tuition fees (\$81,140 more over 4 years) than ordinary colleges, they provide higher returns in terms of the general, incorporated, and unincorporated human capital. Therefore, the net return of going to an elite college is positive. When we move ordinary college graduates to elite colleges, we observe an increase in lifetime income by 12%, as shown in the second row of Table 11.[48]

Next, we analyze how elite college premium varies by abilities and initial wealth, as shown in the third to last row of Table 11. Overall, elite college significantly improves the lifetime income for almost all types of individuals. The improvement is more extensive for individuals with high employee abilities or high incorporated abilities. The effect of elite college on lifetime income is similar across individuals from high- and low-income families, consistent with the reduced form findings in Table 3.

We further analyze how elite college premiums would change if the self-employment possibility vanishes, that is, we force everyone to be employees in the simulation. For elite college graduates, the estimated elite college premium declines from 21% to 17%, as presented in the first row of Table 11, suggesting that ignoring the self-employment option will underestimate the elite college premium. Moreover, this downward bias is tremendous for individuals with high incorporated abilities (potential entrepreneurs), as elite colleges bring more massive human capital gain for entrepreneurs than employees.

In sum, attending an elite college increases the chance of becoming an entrepreneur and improves lifetime income but does not affect an unincorporated business owner's likelihood. Such effects are concentrated on individuals with the high incorporated ability and low financial capacity. Modeling self-employment decision avoids underestimation of elite college premium.

7. Counterfactual analysis

Entrepreneurship is believed to drive economic growth since Schumpeter (1934). Entrepreneurs are subsidized in many ways in different countries and the effects are mixed (Lerner (2009), Lerner and Schoar (2010)). This section considers two types of subsidies: indirect subsidies to elite or ordinary college students and direct subsidies to incorporated or unincorporated businesses.

7.1 *Subsidies to elite or ordinary college students*

We first analyze how an education subsidy would affect entrepreneurship and other aggregate variables. We separate the cases of subsidies to elite versus ordinary college students. We consider a subsidy rate from 0 to 1, with the subsidy covering all tuition when the rate reaches 1. Labor income tax finances the subsidy and keeps the government budget balanced. While the previous section's simulation exercises take prices as given, we study the individual and aggregate outcomes in the new stationary equilibrium with new prices.[49] We keep the admission rate of elite colleges unchanged in this counterfactual, and we assume that elite colleges do not face capacity constraints.

[48] Some of them may have elite colleges as their first choice but get rejected by elite colleges and have to go to ordinary colleges.

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

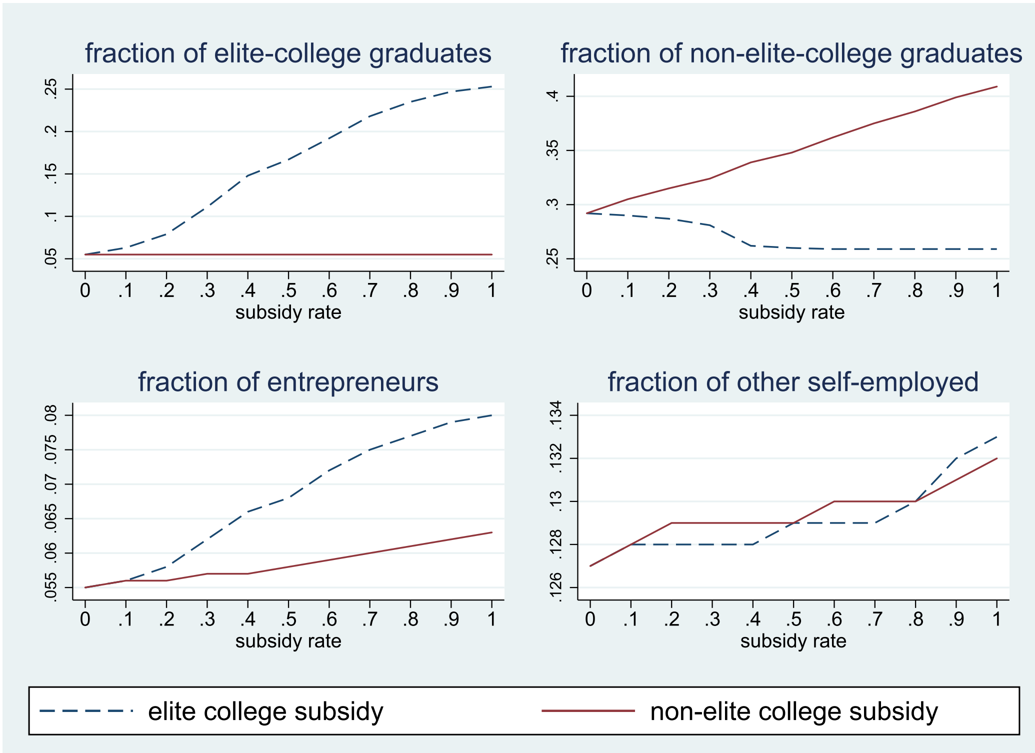

Figure 1. Counterfactual: Subsidy to elite/ordinary college students.

Figure 1 shows the impact on the fractions of ordinary college graduates, elite college graduates, entrepreneurship, and other self-employment for the two experiments at different tuition subsidy rates. For instance, when the elite college subsidy is 50%, the annual effective elite college tuition is $16,523, which is slightly higher than that of nonelite colleges ($12,761). The fraction of elite college graduates increases from 5.5% to 16.7% (by 11.2 ppt), and the fraction of ordinary college graduates reduces from 29.2% to 26.0% (by 3.2 ppt). Some ordinary college students would switch to elite colleges for higher gains to general, unincorporated, and incorporated human capital. Others still prefer ordinary colleges due to the tuition difference and preference shocks.

The same subsidy rate for ordinary college students increases the fraction of ordinary college graduates by 5.6 ppt and does not affect the fraction of elite college graduates. Nonelite college subsidies cannot attract elite-college students to substitute away from elite colleges. Notice that elite-college students mainly include those with high general ability and those who come from affluent families. The former receive generous financial aid from elite colleges and pay low net tuition; the latter care more about the elite-college human capital gains than the expensive tuition. Nonelite college is suboptimal for these two groups even if nonelite colleges are 100% subsidized. Ordinary college subsidies mostly encourage high school graduates to switch to ordinary colleges.

The lower left and right figures of Figure 1 present the effects of subsidies on career choices. Consistent with the previous section's findings, elite college subsidies have a

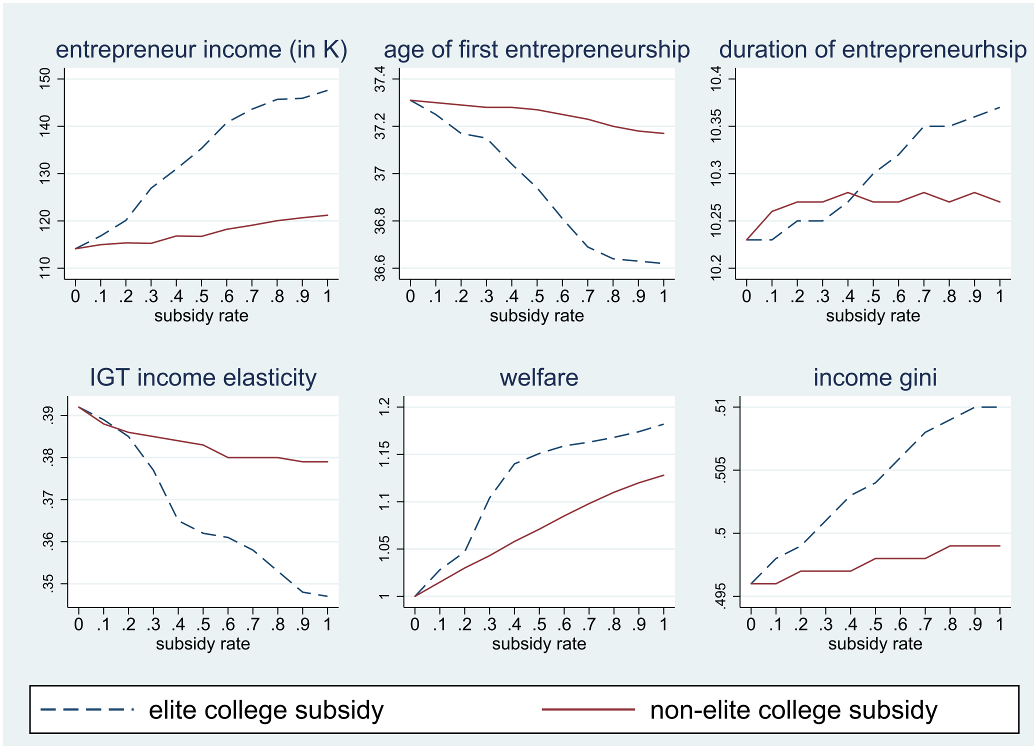

Figure 2. Counterfactual: Subsidy to elite/ordinary college students (cont'd).

more considerable impact on the number of entrepreneurs and other self-employed individuals than ordinary college subsidies. Also, elite college subsidies on entrepreneurship are more pronounced than on other forms of self-employment. A 50% subsidy to elite college students increases the fraction of entrepreneurs from 5.5% to 6.8% (by 1.3 ppt) and the fraction of other self-employed individuals from 12.7% to 12.9% (by 0.2 ppt). The same subsidy rate for ordinary college students only increases the fraction of entrepreneurs by 0.3 ppt and the fraction of other self-employed individuals by 0.2 ppt.

The three figures at the top of Figure 2 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 ordinary college can acquire more human capital, which increases the chance that they enter and stay in business. Second, college subsidies encourage those with relatively low incorporated ability to become entrepreneurs. They become entrepreneurs at an older age because they need more time to accumulate physical capital, and their business is unpromising. Therefore, the net effect of college subsidies on the entry and exit of entrepreneurship is ambiguous. Our counterfactual analysis shows that elite and ordinary college subsidies encourage more people to become entrepreneurs and allow them to enter earlier and stay longer, suggesting that the first channel dominates the second.

Moreover, elite college subsidies are more efficient than ordinary college subsidies to improve entrepreneurial performance. A 50% subsidy to elite college students increases entrepreneur income by 18.6%, reduces the age of beginning entrepreneurship by 0.37 years, and increases the average duration of entrepreneurship by 0.07 years. However, the same subsidy rate to ordinary college students only increases entrepreneur income by 2.2%, reduces the age of starting entrepreneurship by 0.04 years, and increases the average duration of entrepreneurship by 0.04 years.

The bottom three figures in Figure 2 present the aggregate effects on society, including intergenerational income elasticity, welfare, and the income Gini coefficient.[50] 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 ordinary college students reduces the intergenerational income elasticity by 3.0 ppt and 0.9 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 links of intergenerational persistence (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.

Furthermore, both subsidy types improve social welfare, which is optimized at the 100% subsidy rate in both cases. This finding is consistent with Abbott, Gallipoli, Meghir, and Violante (2019), who also find that more generous financial aid is welfare improving. A 50% subsidy to elite college students improves social welfare by 15.1%, while a 50% subsidy to ordinary college students improves social welfare by 7.1%. Figure 2 demonstrates that elite college subsidies provide more considerable welfare gains than ordinary college subsidies at all levels of subsidies. The extensive welfare gains of elite college subsidies mainly come from the relaxation of the business owners' borrowing constraints. Individuals with high entrepreneur ability from disadvantaged families will bear a hefty student loan when elite-college tuition is high, hindering them from making further loans to finance their business. Hence, some may not enroll in elite colleges at all. Therefore, elite-college subsidies encourage would-be entrepreneurs from low-income families to enroll in elite colleges and start an incorporated business.[51]

Although elite-college subsidies may reduce such distortions from borrowing constraints 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 0.8 ppt, whereas a 50% subsidy to ordinary college students only increases the Gini coefficient by 0.1 ppt.

In sum, elite college subsidies are more efficient than their ordinary college counterpart in increasing the number of entrepreneurs, improving entrepreneurs' income, reducing the age of starting entrepreneurship, and extending entrepreneurship duration. Relative to ordinary college subsidies, elite college subsidies more significantly reduce intergenerational income persistence and improve social welfare. However, elite college subsidies magnify income inequality.

[50]Welfare is the summation of the expected value of the discounted sum of utility of each agent.

[51]Note that these would-be entrepreneurs primarily come from the top of the ability distribution. Hence, elite college subsidy could represent a transfer from the less-able to the more able.

One caveat of this counterfactual experiment is that we keep the admission rates of elite colleges unchanged. However, when elite college subsidies encourage more students to enroll in elite colleges, the number of admitted students may exceed the colleges' capacity constraints. Therefore, we perform an additional counterfactual experiment in which the number of students enrolled in elite colleges is kept unchanged while the subsidy on elite college tuition increases.[52]

Figure 3 presents the effects of elite college subsidies on education and career choices after changing its admission rate and comparing them with the impact of ordinary college subsidies. With a constant fraction of elite college graduates, the fraction of entrepreneurs increases with the subsidy, and the magnitude is larger than the ordinary college subsidy counterpart. Such rise in entrepreneurs is due to the composition change among elite college students. Appendix Table C10 shows that, with elite college subsidies increase, the average general ability and initial wealth of elite college graduates decline, while the average incorporated ability of elite college graduates increases.[53] It is because elite college subsidies reduce elite colleges' costs, attract more students with relatively lower general ability and wealth, and relax the borrowing constraints that prevent potential entrepreneurs from attending elite colleges, increasing the average incorporated ability of the applicants. [54] Therefore, the number and incorporated ability of elite college graduates can increase with a fixed number of elite college graduates.

Figure 4 further shows that the elite college subsidies are superior to the ordinary college counterpart in increasing entrepreneur income, reducing the age of first entrepreneurship, increasing the duration of entrepreneurship, and reducing intergenerational income elasticity. However, the difference between the two subsidies gets smaller under elite college capacity constraints. Moreover, elite college subsidies are not better than the ordinary college counterpart in terms of social welfare.[55] Both elite college subsidies and ordinary college subsidies moderately increase income inequality in a similar magnitude. Thus, we should use elite college subsidies with caution when there exists a capacity constraint.[56]

[52]Hence, we scale down the admission rates of elite colleges at all score levels proportionally to keep the number of elite college graduates constant. At the same time, we assume there is no capacity constraint for ordinary colleges.

[53]The average ability and initial wealth of elite college graduates have similar patterns when we do not adjust the admission rate.

[54]There is also a small increase in the average unincorporated ability of elite college graduates.

[55]At lower levels of subsidies, elite college subsidies with adjusted admission rates have similar welfare gains as ordinary college subsidies. At a higher level of subsidies, elite college subsidies' welfare gain gets flattened out and is exceeded by that of ordinary college subsidies.

[56]In Appendix Figures C3 to C6, we present the impact of providing elite college subsidies and ordinary college subsidies, taking wage rate and interest rate as fixed. In the partial equilibrium setup, the effects of subsidies on college enrollment and entrepreneurship dynamics are similar. The welfare effect gets slightly larger. Overall, we still find that elite college subsidies are better than ordinary college subsidies to encourage more entrepreneurs and improve their performance. Elite college subsidies provide a more considerable welfare gain than ordinary college subsidies if there is no capacity constraint of elite colleges; with capacity constraint (adjusted admission rate), elite college subsidies become less efficient.

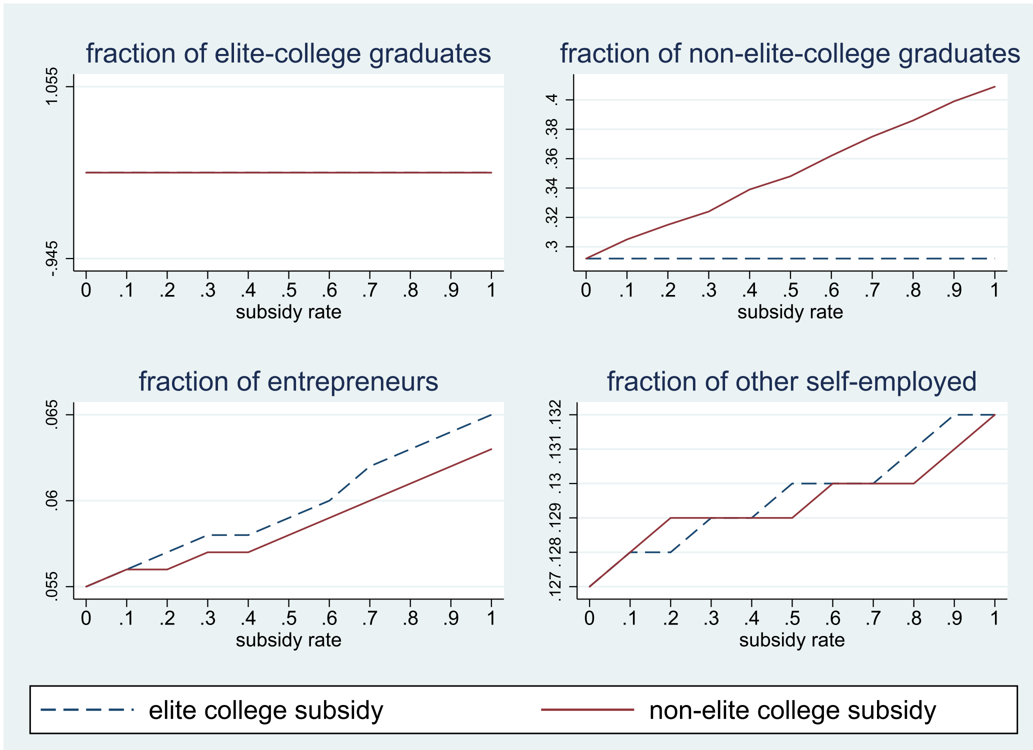

FIGURE 3. Counterfactual: Subsidy to elite/ordinary college students (adjusted for admission rate).

7.2 *Subsidies to incorporated or unincorporated businesses*

This section considers start-up subsidies for the self-employed. According to Caliendo (2016), many Western countries have some form of start-up subsidies. While formats and effects vary across nations, business subsidies typically involve a lump-sum subsidy given to the self-employed when the business is started. Therefore, we study the impact of a start-up subsidy as a lump-sum transfer.

In this model, since there is a fixed cost to start a business, the start-up subsidy is equivalent to reducing the entry costs. The subsidy ranges from 5000 to 50,000 dollars, which is 8.6% to 86% of the incorporated business's entry costs and 4.5% to 45% of entrepreneurs' annual income. We use a labor income tax to finance the subsidy and allow wage rate and interest rates to adjust to the new stationary equilibrium.[57]

As shown in Figure 5, a $50,000 incorporated business subsidy leads to a substantial increase in the fraction of entrepreneurs, from 5.5% to 8.1% (47% increase). However, incorporated business subsidies do not affect the fraction of elite college graduates, ordinary college graduates, or other self-employed. Although entrepreneur subsidies relax

[57]Appendix Figures C7 and C8 present the results when fixing the prices. The findings of partial equilibrium are similar to those of general equilibrium.

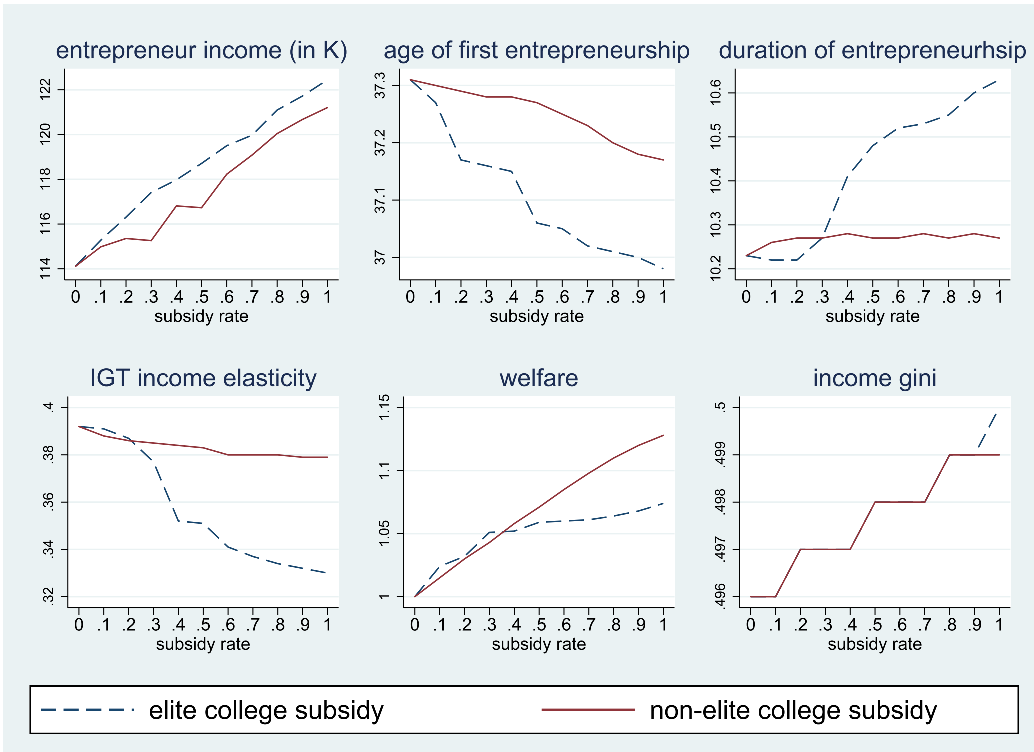

Figure 4. Counterfactual: Subsidy to elite/ordinary college students (cont'd, adjusted for admission rate).

the credit constraint for potential entrepreneurs who want to attend colleges, the entrepreneur subsidy may not be large enough to get them into colleges.[58]

Given that the subsidy reduces the entry barrier of an incorporated business, individuals with lower incorporated human capital can enter the business. Therefore, the age of first entrepreneurship declines with the average entrepreneur income (excluding subsidy) and the duration of entrepreneurship due to the selection effect, as shown in the upper panel of Figure 6. Thus, start-up subsidies contrast with elite college subsidies, which increase entrepreneur income and entrepreneurship duration.

We then compare incorporated business subsidies with unincorporated business subsidies, ranging from 5000 to 50,000 dollars, accounting for 62.5% to 625% of unincorporated business' entry costs. Not surprisingly, unincorporated business subsidies encourage more people to engage in other self-employment and have little impact on entrepreneurship, as shown in Figure 5 and the upper panel of Figure 6. A $50,000 unincorporated business subsidy increases the share of other self-employment from 12.7% to 18.8% (48%).

[58]The average age of starting an incorporated business is 37. Hence, a $50,000 entrepreneur subsidy at age 37 discounted to age 20 is only $24,970, which is relatively small compared to four-year college tuition ($132,000 for elite colleges and $51,000 for nonelite colleges).

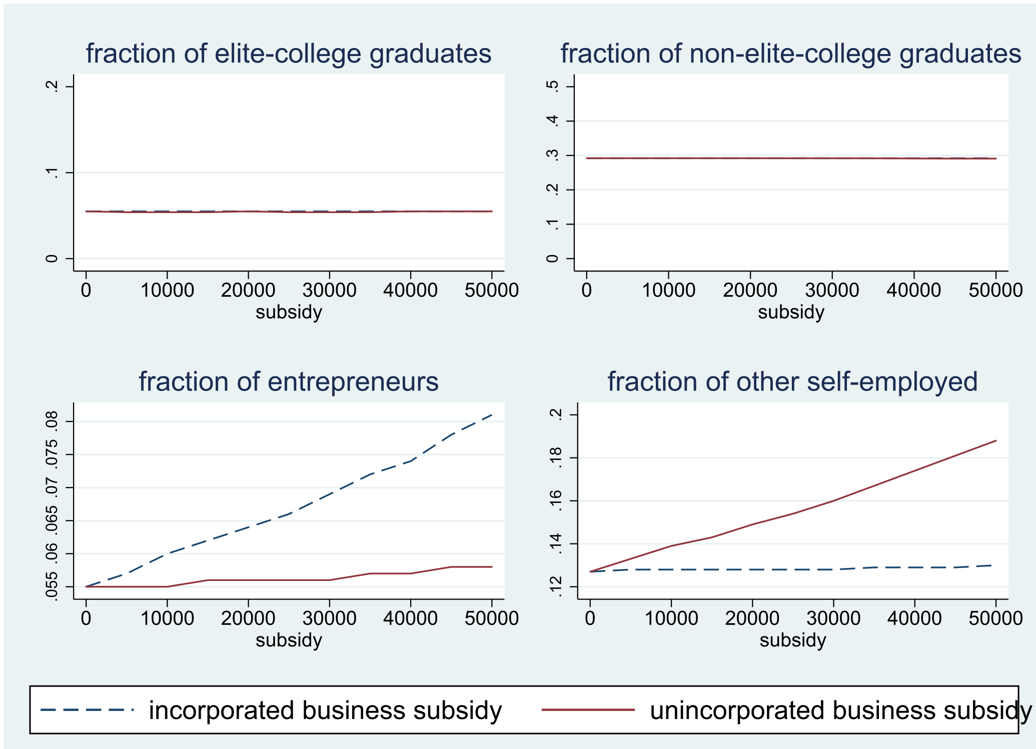

FIGURE 5. Counterfactual: Subsidy to incorporated/unincorporated businesses.

The bottom panel of Figure 6 suggests that both subsidies to incorporated and unincorporated businesses increase income inequality. Subsidies for unincorporated enterprises (but not incorporated businesses) reduce intergenerational income mobility. Moreover, subsidies to unincorporated businesses are more efficient in improving welfare compared to subsidies to incorporated counterparts. In sum, distinguishing the two types of self-employment provides the opportunity to consider policies targeting different forms of businesses and uncovers their differentiating welfare implications.

7.3 *Subsidies to students or businesses? A graphical approach*

The previous sections have shown the consequences of both education subsidies (both for the case of elite and ordinary colleges) and start-up subsidies (both for the case of incorporated and unincorporated businesses). This section asks which type of subsidy would a government prefer. A fiscally-constrained government needs to know whether (and how much) to invest in different forms of subsidies. To our knowledge, there is no consensus in the literature on how to compare different policy regimes in a unifying framework. Different authors adopt different approaches depending on the context (Chari and Kehoe (1999), Krusell, Quadrini, and Rios-Rull (1996)). We, therefore, follow a relatively intuitive approach from the literature, proposed by Hanushek, Leung, and Yilmaz (2003, 2014). The idea is to consider efficiency, equality, mobility as "social goods"

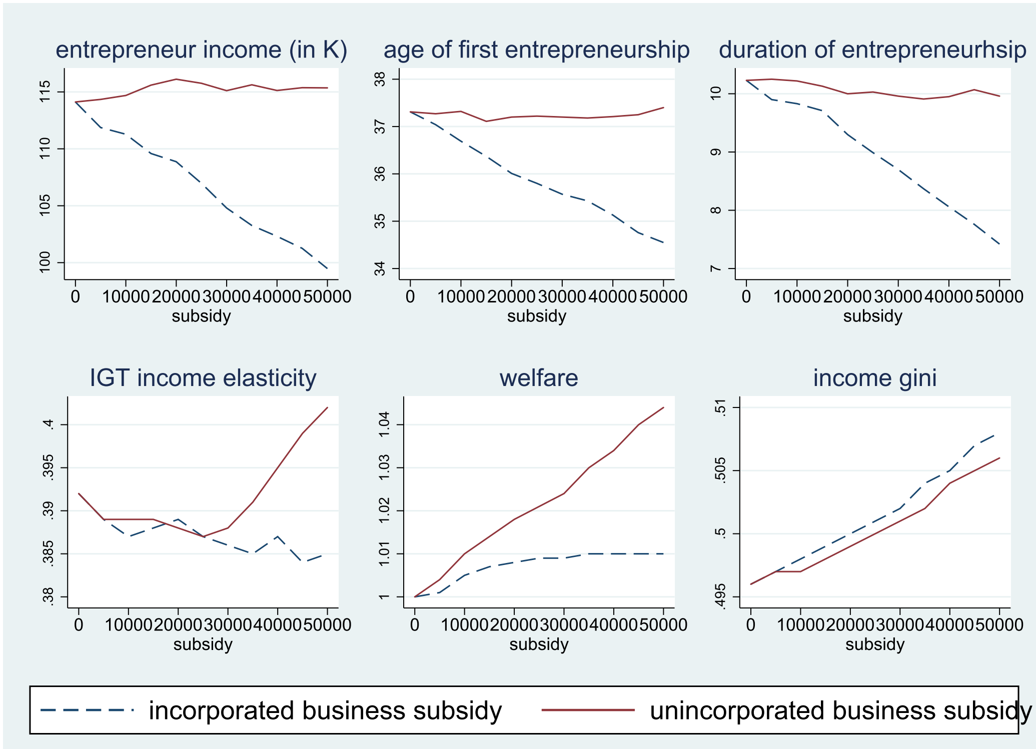

Figure 6. Counterfactual: Subsidy to incorporated/unincorporated businesses (cont'd).

and consider society to have a different "social goods production frontier" under each policy regime. We can then ask the following question: Which regime can attain the highest possible level of efficiency? Equality? Mobility? What is the trade-off among different social goods under each regime? Hanushek, Leung, and Yilmaz (2003, 2014) addressed these questions graphically.

In Figure 7, the horizontal axis is the welfare, which is a proxy for "efficiency." We normalize the level of welfare under zero-subsidy as unity. The vertical axis is (1-Gini), where Gini is the Gini coefficient. (1-Gini) increases with the level of income equality and is a proxy of "equality." For any given regime, we vary the subsidy rate, the tax rate, and wage rates so that the government balances her budget and the markets clear at any subsidy rate. Hence, we construct a production frontier for social goods for each regime. With this interpretation, the further away is the locus from the origin, the better is the regime. It means that for a given level of efficiency, that regime can generate a higher level of equality and vice versa. Some observations are in order. First, there is a trade-off for all regimes. It means that we must bear with more inequality for any given policy regime to increase efficiency. Second, the business start-up subsidy regimes, both incorporated and unincorporated businesses, are inferior to the education subsidy regimes. Third, although the elite college subsidy regime has a lower frontier than the ordinary college subsidy counterpart, it can generate a higher efficiency level when the subsidy rate is close to unity.

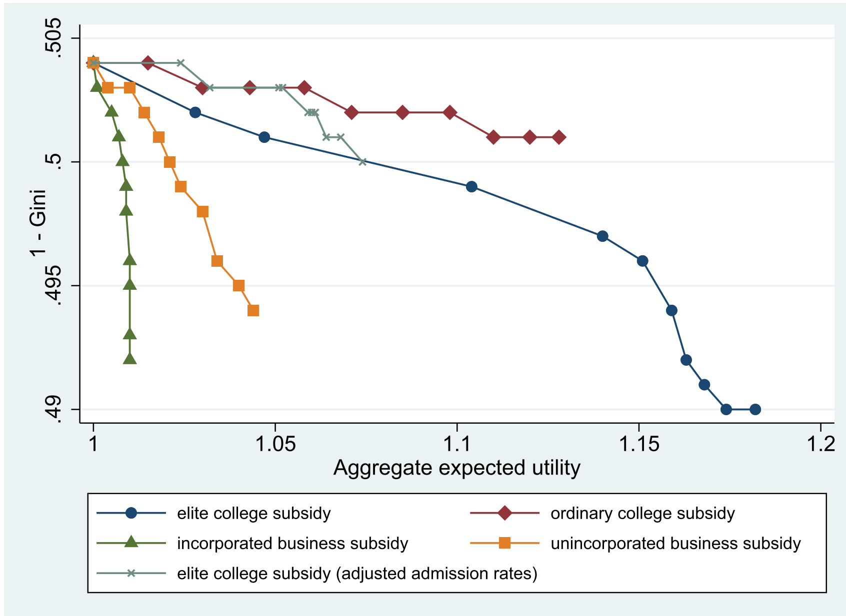

Figure 7. Counterfactual: Aggregate expected utility and inequality. *Notes*: The horizontal axis is the welfare, a measure of efficiency. The vertical axis is (1-Gini coefficient), a measure of equality. The further away is the locus from the origin, the better is the regime. It means that for a given level of efficiency, that regime can generate a higher level of equality and vice versa.

In the same spirit, we also plot Table 8. The horizontal axis is the welfare, a proxy for "efficiency." The vertical axis is now (1-intergenerational income elasticity), a proxy of "mobility." The idea is that a society with high mobility should have low intergenerational income elasticity. Some observations are in order. First, while we need to trade-off efficiency and mobility under the unincorporated business subsidy regime, we can increase efficiency and mobility simultaneously by providing college tuition subsidies. Second, for a ranger of efficiency, the ordinary and elite college subsidy regimes deliver a similar mobility level. However, whether we adjust the admission rates or not, the elite college subsidy regime gives a significantly higher mobility level after some threshold level of efficiency than the ordinary college counterpart.

These results in this section are consistent with the previous sections. Education subsidy regimes are "better" because they encourage more people to attend college and improve individuals' human capital. The college students receive human capital gains and have their lifetime income increase. On the other hand, a start-up subsidy does not relax the financial constraints for pre-college students. It hence has a limited effect on the aggregate and distribution of human capital in society. The elite college subsidy can do better than the ordinary college subsidy in some cases because it would enable people who have high abilities but limited financial resources to become entrepreneurs.

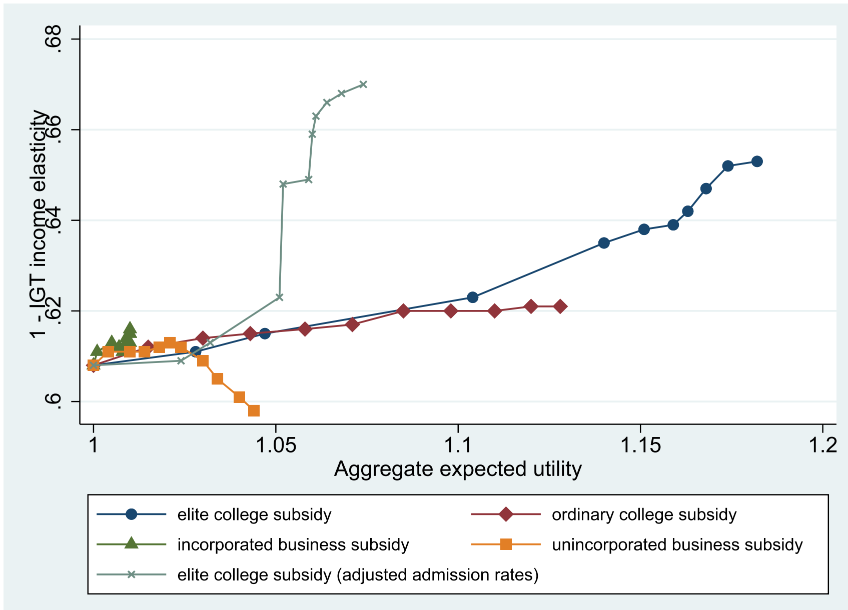

Figure 8. Counterfactual: Aggregate expected utility and intergenerational mobility. *Notes*: The horizontal axis is the welfare, a measure of efficiency. The vertical axis is (1-intergenerational income elasticity), a measure of mobility. The further away is the locus from the origin, the better is the regime. It means that for a given level of efficiency, that regime can generate a higher level of mobility and vice versa.

8. Conclusion

Central to the discussion surrounding elite colleges are two questions: Does elite college attendance matter? and if so, why? This paper addresses these questions by constructing and estimating an overlapping generations life-cycle model that captures the selection into different types of education and careers based on abilities and wealth inherited from parents. Our model allows for three different human capital types (general, unincorporated, incorporated) and distinguishes between elite and ordinary colleges, which could deliver distinct human capital accumulation packages. Our model also allows for different career paths (employee, entrepreneur, and other self-employed) that require different types of human capital. To estimate such a model, we use the PSID panel data with restricted accessed school information.

We find that elite colleges contribute more than ordinary colleges to accumulate different kinds of human capital, particularly entrepreneurs' human capital. Consequently, elite college attendance increases the likelihood of becoming entrepreneurs. We estimate that the (average) elite college premium is positive and significant, which means that elite college attendance generates positive income gains. Our decomposition analysis shows that education has sizable power to explain self-employment decisions, predominantly the decision to pursue entrepreneurship. Our simulation exercise further shows that moving elite college graduates to ordinary colleges would significantly reduce their chance of becoming entrepreneurs but would have little impact on their opportunity to engage in unincorporated business ownership. All of these results confirm that while elite college enhances different kinds of human capital, the elite college premium is tied tightly to entrepreneurship.

Our counterfactual analysis contrast subsidies to students in elite college with that in ordinary college and find that the former has many merits. Suppose the elite colleges have no capacity constraint. In that case, elite college subsidies are more efficient than ordinary colleges 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 more considerable increase in social welfare. The only drawback is that elite college subsidies increase income inequality. If the elite colleges are tightly constrained in capacity, elite college subsidies can still change elite college students' composition and produce more entrepreneurs than ordinary colleges. We also investigate start-up subsidies for both entrepreneurs and unincorporated business owners. We show that education subsidy regimes are superior to business start-up regimes to generate efficiency, equality, and intergenerational mobility. Overall, our paper suggests that elite colleges are essential engines for producing more successful entrepreneurs but that high tuition fees and borrowing constraints prevent some would-be entrepreneurs from attending elite colleges.

We ignore potentially relevant elements for tractability. For instance, Dyrda and Pugsley (2018) studied 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) explored a model with different career paths with errors in individuals' performance estimates. He suggests that overconfidence is more prevalent in occupations with noisier estimates of ability, such as entrepreneurship. Dillon and Stanton (2017) and Hincapié (2020) also considered the initial uncertainty in entrepreneur earnings and continuous learning about the entrepreneurial earnings process. We abstract from the signal extraction considerations to keep the model simple as we attempt to integrate insights from the human capital and entrepreneurship literature. We also abstract from the reality that many students do not finish their college education (Hanushek, Leung, and Yilmaz (2003)). Despite the rich modeling on the student-side sorting, we take a simple approach to model the institutional-side sorting, and our model takes the supply side of colleges as given.[59] Given that we do not have data on applications or admissions, it is not easy to distinguish between the selection on the student side and the institution side. Future work should explore how these issues would affect the parameter estimation and corresponding policy implications.

[59] There is a debate on whether elite colleges face a capacity constraint in the literature. For instance, Che and Koh (2016) reported that "1415 freshmen accepted Yale's invitation to join its incoming class in 1995–96, although the university had aimed for a class of 1335. In the same year, Princeton also reported 1100 entering students, the largest number in its history. Princeton had to set up mobile homes in fields and build new dorms to accommodate the students unincorporated ability of elite college graduates" (p. 1296). Fu (2014) argued that "Expanding college capacities has very limited effects on college attendance..." (p. 261).

Another limitation is our negligence of the trends in college attendance rates and the college wage premium. This is rooted in the overlapping generations model, which assumes a steady-state (Abbott et al. (2019) and Lee and Seshadri (2019)). While the distributions of abilities can be stable over time, elite colleges' costs and benefits may change. The distribution of initial wealth may also vary across generations. Therefore, we can treat the current estimates as an average on the cohort born in the 1950s to 1980s.[60] Future work may collect more data for the more recent cohort and examine whether the policy advice may need to be refined.

References

Abbott, B., G. Gallipoli, C. Meghir, and G. L. Violante (2019), "Education policy and intergenerational transfers in equilibrium." *Journal of Political Economy*, 127 (6), 2569–2624. [1384, 1393]

Astebro, T., H. Herz, R. Nanda, and R. A. Weber (2014), "Seeking the roots of entrepreneurship: Insights from behavioral economics." *Journal of Economic Perspectives*, 28 (3), 49–70. [1356]

Benz, M. and B. S. Frey (2008), "The value of doing what you like: Evidence from the self-employed in 23 countries." *Journal of Economic Behavior & Organization*, 68 (3-4), 445–455. [1356]

Black, D. A. and J. A. Smith (2004), "How robust is the evidence on the effects of college quality? Evidence from matching." *Journal of Econometrics*, 121 (1-2), 99–124. [1348]

Black, D. A. and J. A. Smith (2006), "Estimating the returns to college quality with multiple proxies for quality." *Journal of Labor Economics*, 24 (3), 701–728. [1348, 1359, 1364]

Cagetti, M. and M. De Nardi (2006), "Entrepreneurship, frictions, and wealth." *Journal of Political Economy*, 114 (5), 835–870. [1349, 1355, 1357, 1364]

Cagetti, M. and M. De Nardi (2009), "Estate taxation, entrepreneurship, and wealth." *American Economic Review*, 99 (1), 85–111. [1349, 1355]

Caliendo, M. (2016), "Start-up subsidies for the unemployed: Opportunities and limitations." *IZA World of Labor* (March), 1–11. [1386]

Cameron, S. V. and J. J. Heckman (2001), "The dynamics of educational attainment for black, Hispanic, and white males." *Journal of Political Economy*, 109 (3), 455–499. [1355]

Cameron, S. V. and C. Taber (2004), "Estimation of educational borrowing constraints using returns to schooling." *Journal of Political Economy*, 112 (1), 132–182. [1355]

Carneiro, P. and J. J. Heckman (2002), "The evidence on credit constraints in post-secondary schooling." *Economic Journal*, 112 (482), 705–734. [1355]

[60] Given that the tuition, financial aids, and admission rates in the baseline model are calibrated for the 1980s cohorts, the policy counterfactual regarding college subsidies is relative to a benchmark that approximates the state of the world for the 1980s cohorts.

Carrington, W. J., K. McCue, and B. Pierce (1996), "The role of employer-employee interactions in labor market cycles: Evidence from the self-employed." *Journal of Labor Economics*, 14 (4), 571–602. [1349]

Chari, V. and P. J. Kehoe (1999), "Optimal fiscal and monetary policy." In *Handbook of Macroeconomics*, Vol. 1 (J. B. Taylor and M. Woodford, eds.), 1671–1745, Elsevier. [1388]

Che, Y.-K. and Y. Koh (2016), "Decentralized college admissions." *Journal of Political Economy*, 124 (5), 1295–1338. [1392]

Chetty, R., J. Friedman, E. Saez, N. Turner, and D. Yagan (2020), "The determinants of income segregation and intergenerational mobility: Using test scores to measure undermatching." NBER Working Paper (w26748). [1348, 1373, 1384]

Dale, S. B. and A. B. Krueger (2002), "Estimating the payoff to attending a more selective college: An application of selection on observables and unobservables." *Quarterly Journal of Economics*, 117 (4), 1491–1527. [1348, 1349]

Dale, S. B. and A. B. Krueger (2014), "Estimating the effects of college characteristics over the career using administrative earnings data." *Journal of Human Resources*, 49 (2), 323–358. [1348, 1349]

Dillon, E. W. and C. T. Stanton (2017), "Self-employment dynamics and the returns to entrepreneurship." NBER Working Paper No. 23168. [1392]

Dyrda, S. and B. Pugsley (2018), "Taxes, private equity and evolution of income inequality in the us." Working paper. [1392]

Evans, D. S. and B. Jovanovic (1989), "An estimated model of entrepreneurial choice under liquidity constraints." *Journal of Political Economy*, 97 (4), 808–827. [1355]

Fu, C. (2014), "Equilibrium tuition, applications, admissions, and enrollment in the college market." *Journal of Political Economy*, 122 (2), 225–281. [1354, 1364, 1365, 1392]

Gayle, G., L. Golan, and M. Soytas (2018), "Estimation of dynastic life?cycle discrete choice models." *Quantitative Economics*, 9 (3), 1195–1241. [1352]

Ge, S., E. Isaac, and A. Miller (2018), *Elite Schools and Opting-in: Effects of College Selectivity on Career and Family Outcomes*. Technical report, National Bureau of Economic Research. [1348]

Gong, Y., L. Lochner, R. Stinebrickner, and T. Stinebrickner (2018), "The consumption value of college." Working paper. [1356]

Grönqvist, E., B. Öckert, and J. Vlachos (2017), "The intergenerational transmission of cognitive and noncognitive abilities." *Journal of Human Resources*, 52 (4), 887–918. [1372]

Guo, N., C. K Leung (2021), "Supplement to 'do elite colleges matter? The impact on entrepreneurship decisions and career dynamics'." *Quantitative Economics Supplemental Material*, 12, https://doi.org/10.3982/QE1587. [1351]

Guvenen, F. (2007), "Learning your earning: Are labor income shocks really very persistent?" *American Economic Review*, 97 (3), 687–712. [1355]

Guvenen, F. (2009), "An empirical investigation of labor income processes." *Review of Economic dynamics*, 12 (1), 58–79. [1355]

Haider, S. J. and K. McGarry (2018), "Parental investments in college and later cash transfers." *Demography*, 55 (5), 1705–1725. [1352]

Haider, S. J. and G. Solon (2006), "Life-cycle variation in the association between current and lifetime earnings." *American Economic Review*, 96 (4), 1308–1320. [1373]

Hall, R. E. and S. E. Woodward (2010), "The burden of the nondiversifiable risk of entrepreneurship." *American Economic Review*, 100 (3), 1163–1194. [1350]

Hamilton, B. H. (2000), "Does entrepreneurship pay? An empirical analysis of the returns to self-employment." *Journal of Political Economy*, 108 (3), 604–631. [1362]

Hanushek, E., C. K. Y. Leung, and K. Yilmaz (2003), "Redistribution through education and other transfer mechanisms." *Journal of Monetary Economics*, 50 (8), 1719–1750. [1388, 1389, 1392]

Hanushek, E., C. K. Y. Leung, and K. Yilmaz (2014), "Borrowing constraints, college aid, and intergenerational mobility." *Journal of Human Capital*, 8 (1), 1–41. [1388, 1389]

Hartog, J., M. Van Praag, and J. Van Der Sluis (2010), "If you are so smart, why aren't you an entrepreneur? Returns to cognitive and social ability: Entrepreneurs versus employees." *Journal of Economics & Management Strategy*, 19 (4), 947–989. [1353]

Heckman, J. J. and S. Mosso (2014), "The economics of human development and social mobility." *Annual Review of Economics*, 6 (1), 689–733. [1355]

Hincapié, A. (2020), "Entrepreneurship over the life cycle: Where are the young entrepreneurs?" *International Economic Review*, 61 (2), 617–681. [1392]

Hoxby, C. M. (2009), "The changing selectivity of American colleges." *Journal of Economic Perspectives*, 23 (4), 95–118. [1348]

Hurd, M., J. Smith, and J. Zissimopoulos (2011), "Intervivos giving over the lifecycle." Working paper. [1352]

Jacob, B., B. McCall, and K. Stange (2018), "College as country club: Do colleges cater to students' preferences for consumption?" *Journal of Labor Economics*, 36 (2), 309–348. [1356]

Juhn, C., K. M. Murphy, and B. Pierce (1993), "Wage inequality and the rise in returns to skill." *Journal of Political Economy*, 101 (3), 410–442. [1349]

Karahan, F., S. Ozkan, and J. Song (2019), *Anatomy of Lifetime Earnings Inequality: Heterogeneity in Job Ladder Risk vs. Human Capital.* FRB of New York Staff Report (908). [1369]

Kartashova, K. (2014), "Private equity premium puzzle revisited." *American Economic Review*, 104 (10), 3297–3334. [1350]

Keane, M. P. and K. I. Wolpin (1997), "The career decisions of young men." *Journal of Political Economy*, 105 (3), 473–522. [1348, 1365]

Kerr, S. P., W. R. Kerr, T. Xu et al. (2018), "Personality traits of entrepreneurs: A review of recent literature." *Foundations and Trends® in Entrepreneurship*, 14 (3), 279–356. [1353]

Kiyotaki, N. and J. Moore (1997), "Credit cycles." *Journal of Political Economy*, 105 (2), 211–248. [1355]

Kochhar, R., K. Parker, and M. Rohal (2015), *Three-in-ten us Jobs are Held by the Self-Employed and the Workers They Hire: Hiring More Prevalent Among Self-Employed Asians, Whites and Men*. Pew Research Center, Washington, DC. [1354]

Krusell, P., V. Quadrini, and J.-V. Rios-Rull (1996), "Are consumption taxes really better than income taxes?" *Journal of Monetary Economics*, 37 (3), 475–503. [1388]

Lazear, E. P. (2004), "Balanced skills and entrepreneurship." *American Economic Review*, 94 (2), 208–211. [1374]

Lazear, E. P. (2005) *Entrepreneurship. Journal of Labor Economics*, 23 (4), 649–680. [1374]

Lazear, E. P. (2016), "Overconfidence and occupational choice." NBER Working Paper No. 21921. [1392]

Lee, S. Y. and A. Seshadri (2019), "On the intergenerational transmission of economic status." *Journal of Political Economy*, 127 (2), 855–921. [1352, 1375, 1377, 1378, 1393]

Lerner, J. (2009), *Boulevard of Broken Dreams: Why Public Efforts to Boost Entrepreneurship and Venture Capital Have Failed–and What to Do About It*. Princeton University Press. [1381]

Lerner, J. and A. Schoar (2010), *International Differences in Entrepreneurship*. Technical report, National Bureau of Economic Research. [1381]

Levine, R. and Y. Rubinstein (2017), "Smart and illicit: Who becomes an entrepreneur and do they earn more?" *Quarterly Journal of Economics*, 132 (2), 963–1018. [1349, 1352, 1362, 1371, 1375]

Low, H., C. Meghir, and L. Pistaferri (2010), "Wage risk and employment risk over the life cycle." *American Economic Review*, 100 (4), 1432–1467. [1349]

McLaughlin, K. and M. DeGeurin (2020), "Here's everyone who has been sentenced in the college admissions scandal so far." Insider, Feb. 8, 2020. [1348]

Moskowitz, T. J. and A. Vissing-Jørgensen (2002), "The returns to entrepreneurial investment: A private equity premium puzzle?" *American Economic Review*, 92 (4), 745–778. [1362]

Robb, A. M. and D. T. Robinson (2014), "The capital structure decisions of new firms." *Review of Financial Studies*, 27 (1), 153–179. [1364]

Schmidt, F. L. and J. E. Hunter (1998), "The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 85 years of research findings." *Psychological Bulletin*, 124 (2), 262. [1353]

Schmidt, F. L. and J. E. Hunter (2000), "Select on intelligence." *Handbook of Principles of Organizational Behavior*, 3–14. [1353]

Schmidt, F. L. and J. E. Hunter (2004), "General mental ability in the world of work: Occupational attainment and job performance." *Journal of Personality and Social Psychology*, 86 (1), 162. [1353]

Schoon, I. and K. Duckworth (2012), "Who becomes an entrepreneur? Early life experiences as predictors of entrepreneurship." *Developmental Psychology*, 48 (6), 1719. [1353]

Schumpeter, J. (1934), *The Theory of Economic Development: An Inquiry Into Profits, Capital, Credit, Interest, and the Business Cycle*. Transaction Publishers, New York, NY. [1381]

Toft-Kehler, R., K. Wennberg, and P. H. Kim (2014), "Practice makes perfect: Entrepreneurial-experience curves and venture performance." *Journal of Business Venturing*, 29 (4), 453–470. [1353]

Yamaguchi, S. (2010), "Job search, bargaining, and wage dynamics." *Journal of Labor Economics*, 28 (3), 595–631. [1349]

Zimmerman, S. D. (2019), "Elite colleges and upward mobility to top jobs and top incomes." *American Economic Review*, 109 (1), 1–47. [1348]

Co-editor Peter Arcidiacono handled this manuscript.

Manuscript received 30 March, 2020; final version accepted 30 March, 2021; available online 9 April, 2021.