SELECTION INTO ENTREPRENEURSHIP AND SELF-EMPLOYMENT

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Abstract: We study the effects of ability and liquidity constraints on entrepreneurship. We develop a three sector Roy model that differentiates between entrepreneurs and other self-employed to address puzzling gaps that have emerged between theory and evidence on entry into entrepreneurship. The model predicts—and the data confirm—that entrepreneurs are positively selected on highly-remunerated cognitive and non-cognitive human capital skills, but other self-employed are negatively selected on those same abilities; entrepreneurs are positively selected on collateral, but other self-employed are not; and entrepreneurship is procyclical, but self-employment is countercyclical.

Keywords: Entrepreneurship; Human capital; Occupational choice; Corporate finance; Business cycles

JEL Classifications: L26; J24; G32; E32

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I. INTRODUCTION

Entrepreneurship plays a central role in theories of economic growth and business cycles. For example, Smith (1776), Schumpeter (1911), and Aghion and Howitt (1992) emphasize that entrepreneurs facilitate economic growth by bring new goods, services, and technologies to the economy. Lucas (1978), Baumol (1990), Murphy et al (1991), and Gennaioli et al (2013) stress that the allocation of entrepreneurial talent influences the productivity of firms and the growth of economies. On business cycles, Veblen (1904), Fisher (1933), Keynes (1936), Shleifer (1986), Bernanke and Gertler (1989), and Caballero and Hammour (1994) explain that the response of entrepreneurs to aggregate shocks shapes how those shocks propagate through the economy. Unsurprisingly, therefore, extensive research explores selection into entrepreneurship.

Research, however, highlights three puzzling gaps between theory and evidence regarding the human capital, earnings, and liquidity constraints of entrepreneurs. Influential theories emphasize that (1) entrepreneurs have unique human capital—including creativity, analytical skills, risk taking, self-confidence, education, and managerial acumen (Schumpeter 1911, Lucas 1978, Kihlstrom and Laffont 1979, Evans and Jovanovic 1979, Baumol 1990, Murphy et al 1991, and Gennaioli et al 2013); (2) entrepreneurs are highly remunerated for these scarce skills and for the additional risks associated with entrepreneurship (Lucas 1978 and Kihlstrom and Laffont 1979); and (3) liquidity constraints limit entry into entrepreneurship (Knight 1921, Bernanke and Gertler 1989, Evans and Jovanovic 1989, Kiyotaki and Moore 1997, and Cagetti and De Nardi 2006). Yet, empirical research finds that (1) the typical self-employed person does not have better skills or education than her salaried counterpart (Fairlie 2002); (2) the typical self-employed person does not earn more than her salaried counterpart (Evans and Leighton 1989, Hamilton 2000, and Moskowitz and Vissing-Jorgensen 2002); and (3) liquidity constraints restrict only a small proportion of wealthy individuals from becoming self-employed (Hurst and Lusardi 2004).

Researchers have addressed each of these puzzles independently. On the human capital puzzle, several researchers argue that although there is no evidence of positive selection into self-employment on cognitive skills, there is selection on noncognitive traits, such as risk aversion,

break-the-rules mentality, and preferences for self-employment (Fairlie 1999, 2002, Fairlie and Robb 2007a,b, Fairlie and Woodruff 2010, and Nanda and Sørensen 2010). On the earnings puzzle, some argue that "overly confident" business owners (Bernardo and Welch 2001, De Meza and Southey 1996, and Dawson et al. 2014), the non-pecuniary benefits of self-employment (Hurst and Pugsley 2011, 2015), attribution bias (Manso 2016), and underreported income (Hurst, Li, and Pugsley 2014) help explain why the typical self-employed and salaried person earn about the same. On liquidity constraints—and without necessarily rejecting the Hurst and Lusardi (2004) finding that liquidity constraints bind for few individuals, considerable research shows that entrepreneurial wealth in general and housing wealth in particular shape selection into self-employment.[1] Levine and Rubinstein (2017) empirically account for both the human capital and earnings puzzles by using the incorporated self-employed, rather than the aggregate group of self-employed, to proxy for entrepreneurs. Specifically, they document that entrepreneurs possess a unique mixture of cognitive and non-cognitive human capital traits and earn more than the typical salaried worker, while other self-employed have very different traits and earn less than their salaried counterparts.

What researchers have not yet provided, however, is (1) a theory of entrepreneurship and self-employment that explains the human capital, earnings, and liquidity puzzles in an economy where entrepreneurship demands liquidity and distinct abilities, while other self-employment requires little or no liquidity and demands different abilities and (2) an empirical evaluation of the importance of "liquidity" and "ability" on selection into entrepreneurship and other forms of self-employment and the differential earnings associated with those choices.

In this paper, we offer a unified treatment of entrepreneurship and self-employment that addresses these gaps. We first develop a theoretical model of how human capital, preferences, and liquidity constraints shape selection into entrepreneurship, other self-employment, and salaried

[1] On wealth and self-employment, see Evans and Jovanovic (1989), Evans and Leighton (1989), Holtz-Eakin, Joulfaian, and Rosen (1994a), Blanchflower and Oswald 1998, and (Fairlie 1999). On housing wealth and self-employment, see Black, De Meza, and Jeffreys (1996), Fairlie and Krashinsky (2012), Adelino, Schoar, and Severino (2015), Corradin and Popov (2015), and Schmalz, Sraer, and Thesmar (2017), though Kerr, Kerr, and Nanda (2015) offer contrasting evidence. Research also shows that housing prices influence corporate investments (Gan 2007a and Chaney, Sraer, and Thesmar 2012) and bank lending (Gan 2007b). On collateral and investment, see Fazzari, et al. 1988, Hoshi, Kashyap, and Scharfstein (1991), Hubbard and Kashyap (1992), and Gertler and Gilchrist (1994).

employment. We then, use our framework to analyze empirically the roles of cognitive and noncognitive traits, labor market skills, and credit constraints in shaping selection into the different employment types. Our theoretical and empirical analyses offer a resolution to the human capital, earnings, and liquidity "puzzles." Furthermore, we use our framework to address a different and enduring debate about the cyclicality of entrepreneurship, where we allow for pro- and counter-cyclical forces to differentially influence entry into entrepreneurship and other self-employment.

A key starting point in building our model is the growing body of evidence that self-employment is a problematic proxy for entrepreneurship because it fails to distinguish between entrepreneurs and other self-employed individuals. Evans and Leighton (1989), Schoar (2010), Hurst and Pugsley (2011), La Porta and Shleifer (2014), Levine and Rubinstein (2017), and others indicate that some of the self-employed undertake highly-productive ventures that create jobs and introduce new goods and services to the market, i.e., "entrepreneurs." Most of the self-employed, however, are one-person, low-productivity "other self-employed" individuals, who were often unsuccessful salaried workers, perform routine, manuals tasks, and have few ambitions to grow their businesses. Thus, bundling together these two different types of self-employment might yield misleading perspectives on and inferences about entrepreneurship.

We first develop a three-sector Roy model that distinguishes between entrepreneurs, salaried employees, and other self-employed. Our model differs from Evans and Jovanovic's (1979) (henceforth EJ) canonical model of entrepreneurship in two key respects. While EJ aggregate business owners into one category, we distinguish between (i) entrepreneurship—which demands entrepreneurial ability, physical capital, and liquidity—and (ii) other self-employment—which demands none (or little) of these inputs and is driven primarily by the non-pecuniary benefits of self-employment, such as being one's own boss, with "… little desire to grow big or to innovate in any observable way" (Hurst and Pugsley 2011, p. 73). Our model also incorporates key insights from Hurst and Pugsley (2015). Rather than focusing on entrepreneurial ability and liquidity constraints as in EJ, they use heterogeneous preferences with respect to the non-pecuniary benefits of self-employment to generate selection into either salaried jobs or business ownership. Besides

also including preferences for different employment types in our model, we include differences in entrepreneurial ability and liquidity constraints and explore sorting into entrepreneurship, other self-employment and salaried jobs.

The model yields unique predictions with respect to human capital, earnings, and liquidity constraints. First, entrepreneurs are *positively* selected on entrepreneurial ability and salaried wages when entrepreneurial ability is also useful in salaried employment, but the other self-employed are *negatively* selected on both. Thus, the model highlights the conceptual problems with aggregating (i) high-ability entrepreneurs, who earn high-wages when they work as salaried employees, with (ii) low-ability other self-employed, who earn low-wages when they work as salaried employees. The model's second prediction is that entrepreneurs are positively selected on collateral and access to capital, but the other self-employed are not. Thus, combining these two types of self-employment may yield an aggregate group in which only a small proportion is liquidity constrained and only a few enter and exit self-employment in response to liquidity shocks.

Our framework also provides distinctive predictions about the cyclicality of entrepreneurship and other self-employment. Several business cycle theories stress that the procyclicality of entrepreneurship amplifies aggregate shocks (e.g., Shleifer 1986, Bernanke and Gertler 1989, Kiyotaki and Moore 1997, Francois and Lloyd-Ellis 2003, and Barlevy 2007). Other models highlight countercyclical forces, emphasizing that the opportunity costs of investment are lower in recessions (Caballero and Hammour 1994) and weak demand for labor in recessions pushes workers temporarily into self-employment (e.g., Kihlstrom and Laffont 1979, and Banerjee and Newman 1993). Empirical assessments that use the aggregate group of self-employed to proxy for entrepreneurship have not resolved this debate (Evans and Leighton 1989, Parker 2009, Koellinger and Thurik 2012, and Yu, Orazem, and Jolly 2014).

Our model highlights the conceptual problems with using the aggregate group of self-employed to analyze the cyclicality of entrepreneurship. Following the literature, recessions involve both a drop in the demand for salaried workers (reducing the opportunity costs of self-employment) and a tightening of liquidity conditions (increasing the cost of capital). In the model, the drop in

demand for salaried workers increases the flow of people into both types of self-employment, i.e., this labor demand effect is countercyclical for both entrepreneurs and other self-employed. The tightening of liquidity conditions, however, impedes people from entering entrepreneurship (liquidity constraint effect) but has a negligible effect on entry into other self-employment, which demands no (or little) capital. As a result, the model predicts that other self-employment is countercyclical, but entrepreneurship will be procyclical if the liquidity constraint effect is strong enough. Thus, examining the aggregate group of self-employed can hide the distinct cyclical patterns of entrepreneurship and other self-employment.

In turning to the data, we use the incorporated as a proxy for "entrepreneurs" and the unincorporated as a proxy for the model's "other self-employed." Conceptually, the corporation's defining legal characteristics—limited liability and a separate legal identity—are most useful for undertaking large, risky investments that require external financing. Thus, when people establish smaller businesses that do not require much external finance, they choose the simpler unincorporated legal form; and, when they start larger, risky—more "entrepreneurial"—ventures, they incorporate. Empirically, Levine and Rubinstein (2017) show that the incorporated and their businesses engage in activities that demand strong nonroutine analytical skills, such as creativity, complex problem-solving, and persuading, motivating, and managing others. In contrast, the unincorporated and their businesses perform activities that demand strong manual skills. To the extent that stronger cognitive skills are more closely aligned with core conceptions of entrepreneurship than strong eye-hand coordination, these results advertise the value of using incorporation, rather than the aggregate group of self-employed, as a proxy for entrepreneurship. Furthermore, Levine and Rubinstein (2017) provide evidence that the choice of the business's legal form reflects the ex ante nature of the underlying endeavor—not selection on the ex post success of the business. That is, very few people start an unincorporated business and then incorporate if the endeavor is successful. Although using the incorporated and unincorporated as proxies for entrepreneurs and other self-employed respectively is admittedly crude, these findings highlight the advantages of using this demarcation rather simply using the aggregate group of self-employed.

Using the National Longitudinal Survey of Youths 1979, we document that the incorporated and unincorporated are notably different with respect to human capital, early career wages, and starting capital. As teenagers, incorporated business owners had stronger analytical skills, greater self-esteem, and a stronger sense of controlling their futures than those who ultimately became unincorporated self-employed. Furthermore, as young salaried workers in their 20s, incorporated business owners tended to earn more than those who ultimately became unincorporated self-employed or remained salaried employees. There are also notable differences in starting capital. The typical incorporated business starts with almost ten-times as much capital as the typical unincorporated business, and 21% of the unincorporated need no capital to start their businesses.

We begin by evaluating the model's predictions concerning the differential selection of individuals into incorporated and unincorporated self-employment on entrepreneurial traits, early career salaried wages, and collateral. We first discover that entrepreneurs—as proxied by the incorporated self-employed—are positively selected on a mixture of cognitive and non-cognitive traits and early career salaried wages, while the unincorporated are negatively selected on these same features Second, we find that entrepreneurs are positively selected on collateral—as measured by home wealth, while the unincorporated are not. Besides being consistent with the model's predictions, these results offer a resolution of the human capital, earnings, and liquidity puzzles: When researchers combine entrepreneurs with the other self-employed, they aggregate away the unique human capital traits and high earnings of entrepreneurs and obfuscate the connection between entrepreneurship and liquidity constraints.

Next, we exploit natural variation in home equity values across regions and time and the cross-sectional variation in home ownership to identify the impact of collateral, and hence liquidity constraints, on entry into entrepreneurship and other self-employment. Thus, we follow a long literature stressing that an individual's housing wealth shapes credit constraints and the ability to start and grow a business (e.g., Chaney, Sraer, and Thesmar 2012, Adelino, Schoar, and Severino 2015, Corradin and Popov 2015, Schmalz, Sraer, and Thesmar 2017). We discover economically large and statistically significant effects of collateral on entry into entrepreneurship, but no effect on

entry into other self-employment. Therefore, aggregating entrepreneurs and other self-employed into one business category dilutes the estimated impact of liquidity constraints on entrepreneurship. This helps explain the liquidity puzzle.

We then turn to the cyclicality of entrepreneurship and other forms of self-employment. We use cross-year variation in state unemployment rates to assess the cyclicality of entrepreneurship and the other self-employed. Consistent with our model's predictions, incorporated self-employment is procyclical, unincorporated self-employment is countercyclical, and aggregate self-employment is countercyclical. During periods of high unemployment, entrepreneurship falls, but there is a sharp increase in unincorporated self-employment that reverses when the economy recovers. This suggests that some people use unincorporated self-employment as a temporary cushion against adverse labor market shocks (e.g., Farber 1999). Since cyclical fluctuations in unincorporated self-employment are larger than those in incorporated self-employment, our findings (a) confirm and account for past findings that aggregate self-employment is countercyclical and (b) uncover the procyclicality of entrepreneurship.

Finally, we extend the model and the empirical analyses to consider risk aversion—and hence the interaction between cognitive and noncognitive traits. The model with risk aversion predicts that entrepreneurial success reflects both entrepreneurial ability—the ability to use capital effectively—and risk tolerance—the capacity to effectuate those abilities in risky entrepreneurial endeavors. Thus *effective* entrepreneurial capacity is a mixture of entrepreneurial ability, which we associate with cognitive skills, and risk tolerance, which we categorize as a noncognitive skill. Selection into entrepreneurship, therefore, is determined by the joint distribution of entrepreneurial ability and risk tolerance. Accordingly, some people with exceptional entrepreneurial abilities might choose to work as salaried employees if they are sufficiently risk averse (or lack other features associated with entrepreneurship). Consistent with this prediction, we find that among smart, able people—whether measured by cognitive test scores or early career wages—it is those who are more likely to engage in risky behaviors, as measured by their tendency to engage in illicit activities as teenagers, who disproportionately select into entrepreneurship. Our findings relate to research by

Cunha, Heckman, and Schennach (2010), Heckman (2000), Heckman and Rubinstein (2001), and Heckman, Stixrud, and Urzua (2006), who emphasize that noncognitive skills influence the accumulation and effectuation of cognitive abilities.

The remainder of the paper is organized as follows. Section II documents the human capital and liquidity puzzles. Section III presents the theoretical model. Section IV develops the statistical model, so that we can move from the theory to estimable equations. Section V provides the empirical evaluation of the model's predictions and Section VI concludes.

II. THE HUMAN CAPITAL AND LIQUIDITY PUZZLES

In this section, we document puzzles concerning the human capital and liquidity constraints of entrepreneurs. We first show that salaried employees and the self-employed have similar human capital traits despite an abundance of theoretical models emphasizing the distinct features of entrepreneurs. Second, we show that most businesses start with less than $3,500 of capital. This is consistent with the findings in Hurst and Lusardi (2004), who stress that liquidity constraints bind for very few. To illustrate these puzzles—and foreshadow our strategy for resolving them, we use data from the NLSY79. We do not document the earnings puzzle here since many researchers show that the median self-employed and salaried worker earn about the same per hour (Hamilton 2000).

II.A. Data[2]

The NLSY79 is a representative survey of 12,686 individuals who were 15-22 years old when they were first surveyed in 1979. Individuals were surveyed annually through 1994 and biennially since then. Thus, we use year *t-2* when referring to a lagged value. We examine individuals who are 30 years of age or older for whom the NLSY79 has information on assets, standard demographic information, and the human capital traits described below.

[2] Appendix Table I provides detailed variable definitions and sources.

The NLSY79 reports information on human capital. This includes basic demographic information, such as age, gender, race, and state of residence, and educational attainment, including the number of years of education and whether the person graduated from college.

The NLSY79 also contains measures of cognitive ability, illicit activities, and personality traits. From the 1980 survey, AFQT (Armed Forces Qualifications Test) measures the aptitude and trainability of each individual and is often used as an indicator of cognitive skills. The AFQT indicates the individual's percentile within the entire sample and has a median of 50. Furthermore, we construct the index *Illicit* that measures the aggressive, risk-taking, disruptive, "break-the-rules" behaviors of individuals before they reach prime working-age. *Illicit* is based on 20 survey questions from the 1980 NLSY79 that cover actions associated with damaging property, fighting, shoplifting, robbery, assault, drug use and dealing, etc., and whether the individual was stopped by the police, charged with an illegal activity, or convicted of non-minor traffic violations. We construct this index to have a mean of zero and standard deviation of one. In addition, we construct *Smart & Illicit*, which equals one for an individual if (a) *AFQT* is 50 or above and (b) *Illicit* is zero or above. Otherwise, *Smart & Illicit* equals zero. With respect to personality traits, the *Self-Esteem* index measures the degree of approval or disapproval of one's self and is based on ten questions in the 1980 survey. *Locus of Control* is from the 1979 survey and measures the degree to which individuals believe they have internal control of their lives through self-determination relative to the degree that external factors, such as chance, fate, and luck, shape their lives. Smaller values indicate a greater sense of self-determination. Both *Rosenberg Self-esteem* and *Locus of control* are standardized across all individuals in the survey, so that each has a mean of zero and standard deviation of one.

The NLSY79 also contains information on wealth, earnings, and the funds used to start businesses. We compute *Wealth* as the value of all assets minus all liabilities and *Home Wealth* as the market value of the individual's home minus any mortgages on it. To compute real earnings, the NLSY79 provides nominal earnings, and we use the Consumer Price Index to convert these values into 2010 dollars. Furthermore, we construct *Wages (25-29),* which equals an individual's average real log hourly earnings as a salaried employee during the ages of 25 through 29 if the person is 31 years of age or older during the survey year and equals the individual's average real log hourly

earnings as a salaried employee in *t-2* if the person is between the ages of 27 and 30. When people are less than 27 year old, we set *Wages (25-29)* equal to missing. *Wages (25-29)* is available for almost all individuals, since people typically start their working lives as salaried workers. Starting with the 2010 survey, the NLSY79 began asking businesses about the amount of capital used to start the business (*Starting Capital*) and the number of employees (*Employees*).

With respect to employment types, the NLSY79 classifies all workers in each year as either salaried or self-employed, and among the self-employed, indicates whether individuals are incorporated or unincorporated. Specifically, individuals are asked about the employment class for their main job: "Were you employed by a government, by a private company, a nonprofit organization, or were you self-employed (or working in a family business)?" Those responding that they are self-employed are further asked, "Is this business incorporated?" While incorporation offers the benefits of limited liability and a separate legal identity, there are direct costs of incorporation, such as annual fees and the preparation of more elaborate financial statements, and indirect costs associated with the separation of ownership and control.

We use the incorporated as a proxy for entrepreneurs and the unincorporated as a proxy for the other self-employed in our model. Levine and Rubinstein (2017) show that the incorporated and their businesses engage in activities that demand a relatively high degree of creativity, complex problem-solving, and communication skills, including the ability to persuade, motivate, and manage others. In contrast, the unincorporated perform activities that require relatively low levels of these analytical skills but instead require strong manual skills. Under the assumption that stronger cognitive skills are more closely aligned with core conceptions of entrepreneurship than manual dexterity, these observations motivate our use of incorporation as a better proxy for entrepreneurship than aggregate self-employment.

II.B. Patterns: Human capital

Table I provides summary statistics on individuals and their businesses. Focusing on those who work full-time, full year, the table differentiates individuals by whether they are salaried employees (Employed) or self-employed. For the self-employed, the table provides summary statistics on all self-employed (Total) and also by the legal form of the business (Unincorporated or

Incorporated). The data are from the business ownership part of the 2010 and 2012 NLSY79 surveys.[3] For the business ownership part of the surveys, the observation is at the person-business level. Specifically, individuals are classified as business owners based on the 2010-2012 waves. Individuals who are not business owners enter the sample only once. Individuals who are business owners have an entry per business reported. If a person reports one business – she enters once. If a person reports two businesses, she enters twice. Accordingly, data on starting capital and the legal form of the business are per business start.

Table I shows that the human capital traits of employees and the self-employed are similar. On average, employees and the self-employed in 2010 and 2012 have virtually the same (a) number of years of education (13.8 v. 13.7), (b) proportion of college graduates (29% v. 28%), (c) salaried earnings when they were 25-29 years old (2.35 for employees and 2.39 for the self-employed). We also compare measures of the cognitive abilities and personality traits of individuals before they entered the prime age workforce. We find that the differences between employees and the self-employed are small, though the self-employed have slightly higher AFQT scores and self-esteem values, and slightly lower values of the Locus of control indicator. For example, there is only a 2.2 percentile point difference in average AFQT scores between employees (49.2) and the self-employed (51.4). Thus, although influential models of entrepreneurship emphasize the unique human capital of entrepreneurs, the self-employed and salaried employees have remarkably similar attributes.

Table I also hints at an explanation of this human capital puzzle: There are two distinct types of self-employed, those who tend to engage in entrepreneurial activities (Incorporated) and those who do not (Unincorporated). These two types of self-employed have very distinct human capital characteristics. The incorporated have, on average, more years of education, a much greater likelihood of graduating from college, and earn much more per hour than both the unincorporated

[3] There are some differences between the responses that individuals give regarding employment type in the business ownership and employment parts of the NLSY79. In Table 1, we classify an individual as incorporated or unincorporated only if the individual provides consistent responses in both parts of the survey. The results, however, are very similar if we classify employment type based either the business ownership or employment part.

and salaried employees. In contrast, the unincorporated have lower levels of each of these human capital indicators than salaried employees and incorporated business owners. There are also large differences in *AFQT*, *Self-esteem*, and *Locus of control*. For example, the incorporated have AFQT scores that are, on average, 11.5 percentile points greater than the unincorporated and 10.6 percentile point greater than salaried workers, while the unincorporated have the lowest AFQT scores across employment types. Thus, while salaried employees have similar human capital to the aggregate group of self-employed, entrepreneurs tend to have much greater human capital than salaried workers, while other self-employed have much less. Aggregation may account for the human capital puzzle.

II.C. Patterns: Starting capital

Table I also documents that the median self-employed individual (a) starts the business with less than $3,500 and (b) has no employees. This is consistent with the findings of Evans and Leighton (1989), Hurst and Lusardi (2004), Hurst and Pugsley (2011), and Levine and Rubinstein (2017): most businesses are one-person, retail operations that provide routine, manual services, such as landscaping, house cleaning, handyman services, etc. Indeed 17% of the self-employed indicate that no capital was needed to start their businesses. These observations on starting capital further motivate the question raised by the findings in Hurst and Lusardi (2004): Do liquidity constraints represent a high entry barrier for many potential entrepreneurs?

The notable differences between entrepreneurs and other self-employed may also account for this liquidity puzzle. Table I indicates that the median starting capital for an unincorporated business is about $2,000, but it is almost $20,000 for incorporated businesses. While 21% of individuals report needing no capital to start an unincorporated business, only 5% of incorporated business owners respond similarly. Also note, that the average incorporated business has more than ten-times the number of employees as an average unincorporated business. There are also pronounced differences in wealth. The total wealth of the unincorporated self-employed is, on average, about $70,000, of which $19,500 is home wealth. In contrast, the overall wealth of

incorporated business owners is almost $160,000, of which $32,000 is home wealth. These differences in collateral and starting capital suggest that aggregating the incorporated and unincorporated self-employed might yield misleading information on the degree to which liquidity constraints limit entry into entrepreneurship.

Table I documents that contrary to influential theories, salaried employees and self-employed individuals have similar human capital characteristics and most businesses start with little or no capital. The data also suggest a strategy for resolving these puzzles: There are material differences between incorporated and unincorporated self-employed and their businesses. Thus, we now develop a three-sector Roy model to explore the selection of individuals on human capital and liquidity into entrepreneurship and other forms of self-employment. Below, we empirically evaluate the predictions emerging from the model.

III. A MODEL OF SELECTION INTO ENTREPRENEURSHIP AND SELF-EMPLOYMENT

III.A. Framework

Each individual chooses one of three employment types: Salaried employment (*S*), entrepreneurship (*E*), and other self-employment (*U*). Individual *i* then receives income I_{Ji} from working in employment type *J*, where *J* is *S*, *E*, or *U*. Individuals sort into employment types to maximize utility, where the utility of individual *i* in employment type *J* is a function of income and non-pecuniary benefits (δ_{Ji}):

$$V_{Ji} = I_{Ji} * e^{\delta_{Ji}}. \quad (1)$$

The non-pecuniary benefits of self-employment could, for example, reflect preferences to be one's "own boss," as emphasized by Hurst and Pugsley (2011, 2015). Non-pecuniary benefits are defined relative to salaried employment, so that $\delta_{Si} = 0$. We first derive the model with risk neutral individuals, as in Evans and Jovanovic (1979), henceforth EJ, and then extend the model to allow for risk aversion.

Individuals are endowed with human capital, consisting of (1) entrepreneurial ability (θ_i) and (2) other employment specific skills (ε_{Ji}) that are uncorrelated with entrepreneurial ability. Without loss of generality, we assume that $\theta_i > 0$, $\varepsilon_{Ei} = 0$, and $E(\varepsilon_{Ji}) > 0$, for *J*=*S* or *U*.

Human capital skills are not equally productive across employment types. Specifically, the effective human capital of individual *i* in employment type *J* (H_{Ji}) is

$$H_{Ji} = \theta_i^{\rho_J} * e^{\varepsilon_{Ji}}, \tag{2}$$

where the effective human capital of entrepreneurial ability in employment type *J* is represented by ρ_J, so that it is natural to set $\rho_E = 1$. While EJ assume that $\rho_S = 0$, we relax this assumption and allow abilities that are useful for entrepreneurship to also be productive in salaried employment. Thus, we assume that $0 \leq \rho_U < \rho_S \leq 1$. That is, we assume that entrepreneurial ability is productive in entrepreneurship and potentially in salaried work, but is not as productive in other self-employment. Without further loss of generality, we set $\rho_U = 0$.[4] For salaried work, the effective human capital of individual *i* in salaried employment is increasing in (a) the person's job-specific skills in salaried work (ε_{Si}), (b) the persons entrepreneurial ability (θ_i), and (c) the degree to which entrepreneurial ability is productive in salaried employment (ρ_S).

An individual choosing employment type *U* or *S* earns

$$I_{Ji} = H_{Ji}, \tag{3}$$

which expressed as log earnings is

$$LnI_{Ji} = \rho_J ln\theta_i + \varepsilon_{Ji}. \tag{4}$$

Individuals engaged in entrepreneurship combine entrepreneurial ability and physical capital (*K*) to produce output (*Y*) using a similar production function as in EJ:

$$Y_i = H_{Ei} K_i^{\alpha} \nu_i = \theta_i K_i^{\alpha} \nu_i, \tag{5}$$

[4] The assumption that $\rho_U < \rho_S \leq \rho_E$ is consistent with the findings in Levine and Rubinstein (2017) and those reported below. Given this assumption, setting $\rho_U = 0$ is a simplifying normalization that does not affect the analyses. If $\rho_S = 0$, there is no unique θ_i at which individuals are indifferent between *U* and *S*.

where $0 < \alpha < 1$, and ν_i is a lognormal disturbance that reflects an independent and identically distributed productivity shock, where $E[\nu_i] = 1$. As in Lucas (1978), Jovanovic (1982), EJ, and many others, entrepreneurs with more entrepreneurial ability have, ceteris paribus, larger average and marginal products of capital at each level of capital.

Net returns from entrepreneurship, i.e., entrepreneurial earnings (I_{Ei}), equal

$$I_{Ei} = \theta_i K_i^{\alpha} \nu_i - r_i K_i, \tag{6}$$

where the price of output is one and the gross cost of capital (r_i)—one plus the interest rate—is greater than one. For now, we simply take r_i as given. Below, we assume individuals are endowed with exogenously given assets and when these assets are used as collateral to finance *K*, they reduce the cost of capital that equates individual *i*'s demand for capital and the supply of credit made available to individual *i*. This is a bit different from EJ, who assume that exogenously given collateral determines how much an individual can borrow. In our model, collateral influences the cost of capital and endogenously influences the optimal capital stock and hence borrowing.[5]

The K_i that maximizes expected entrepreneurial earnings (K_i^*), given θ_i and r_i, is

$$K_i^* = (\theta_i \alpha / r_i)^{1/(1-\alpha)}, \tag{7}$$

and the log of expected entrepreneurial earnings at this maximum is therefore:

$$ln I_{Ei}^* = \rho_E' ln\theta_i + \alpha \rho_E' \ln\left(\frac{\alpha}{r_i}\right) + \ln(1-\alpha), \tag{8}$$

$$\text{where } \rho_E' = \left(\frac{1}{1-\alpha}\right). \tag{9}$$

Notice three features about entrepreneurial earnings. First, entrepreneurial earnings (and the optimal capital stock) are increasing in entrepreneurial ability (θ_i) and decreasing in the cost of capital (r_i). Second, the elasticity of entrepreneurial earnings with respect to entrepreneurial ability is greater than one, i.e., $\rho_E' > 1$. This reflects the endogeneity of capital to entrepreneurial ability: Higher θ_i not only increases the returns to entrepreneurship at each level of capital, it increases the

[5] All of the results hold when using the EJ formulation of credit constraints.

returns to increasing the capital stock. Third, by comparing equations (4) and (8), note that the returns to entrepreneurial ability in entrepreneurship are larger than the returns to entrepreneurial ability in salaried employment even when $\rho_S = 1$. This arises because of the complementarity between entrepreneurial ability and physical capital.

III.B. Selection into employment types

Individuals select into employment types *U*, *S*, or *E* by comparing expected utility levels:

$$lnV_{Ui} = \varepsilon_{Ui} + \delta_{Ui}, \tag{10.1}$$

$$lnV_{Si} = \rho_S ln\theta_i + \varepsilon_{Si}, \tag{10.2}$$

$$lnV_{Ei} = \rho'_E ln\theta_i + \alpha\rho'_E \ln\left(\frac{\alpha}{r_i}\right) + \ln(1-\alpha) + \delta_{Ei}. \tag{10.3}$$

In comparing the logs of expected utilities across employment types, note the following results on human capital. First, utility in entrepreneurship rises faster in θ_i than utility rises in either salaried work or other self-employment. This holds even when entrepreneurial abilities are equally productive in salaried work—that is, when $\rho_S = 1$—because of the complementarity between entrepreneurial ability and physical capital within entrepreneurial endeavors. Second, the log of utility in salaried employment (lnV_{Si}) reflects both human capital that is specific to salaried employment (ε_{Si}) and entrepreneurial human capital that is valuable in salaried work ($\rho_S ln\theta_i$). One implication of these first two results is that, ceteris paribus, increases in ε_{Si} boost the relative utility of salaried employment, but increases in $ln\theta_i$ boost the relative utility of entrepreneurship because $\rho'_E > 1 \geq \rho_S$. Third, liquidity constraints, in the form of higher capital costs (r_i), reduce the utility from entrepreneurship and therefore have larger adverse effects on able entrepreneurs. The overall effect of liquidity constraints on the log of expected utility in entrepreneurship reflects the direct cost of capital and its indirect effect on the optimal level of capital and hence gross earnings. Fourth, other human capital endowments (ε_{Ji}) and preferences (δ_{Ji}) directly shape the relative utility of different employment types.

We now derive the cutoff levels of entrepreneurial ability that lead individuals to select into self-employment, salaried employment, or entrepreneurship. We derive these cutoff levels of $ln\theta_i$ as functions of the cost of capital (r_i), non-entrepreneurial human capital skills (ε_{Ui} and ε_{Si}), preferences (δ_{Ji}), and the degree to which entrepreneurial ability is remunerated in salaried employment (ρ_S) and entrepreneurship (ρ'_E).

First, define $ln\theta_{Si}$ as the level of entrepreneurial ability ($ln\theta_i$), such that the individual is indifferent between other self-employment and salaried work. Below $ln\theta_{Si}$, the individual prefers other self-employment to salaried work; and above $ln\theta_{Si}$, the individual prefers salaried work to other self-employment. Setting lnV_{Ui}= lnV_{Si}, and solving for $ln\theta_{Si}$ yields:

$$ln\theta_{Si} = \frac{\delta_{Ui}+(\varepsilon_{Ui}-\varepsilon_{Si})}{\rho_S}. \tag{11.1}$$

Individuals with stronger preferences for other self-employment, δ_{Ui}, (e.g., people who like being their own bosses) will have higher $ln\theta_{Si}$ cutoff values than otherwise similar individuals. Furthermore, in economies where entrepreneurial ability is more highly remunerated in salaried employment (higher ρ_S), $ln\theta_{Si}$ will be correspondingly lower, because it takes less entrepreneurial ability to generate the earnings level in salaried employment that makes the individual indifferent between salaried work and other self-employment. Finally, note that if there are insufficient pecuniary (ε_{Ui}) and nonpecuniary (δ_{Ui}) returns to other self-employment (*U)* (or skills as a salaried worker are sufficiently high (ε_{Si})), then $ln\theta_{Si} \leq 0$ and individuals will not sort into *U*.

Next, define $ln\theta_{Ei}$ as the level of entrepreneurial ability ($ln\theta_i$), such that the individual is indifferent between salaried work and entrepreneurship. If $ln\theta_i < ln\theta_{Ei}$, the individual prefers salaried work to entrepreneurship; and when $ln\theta_i > ln\theta_{Ei}$, the individual prefers entrepreneurship to salaried work. Setting lnV_{Ei}= lnV_{Si}, and solving for $ln\theta_{Ei}$ yields:

$$ln\theta_{Ei} = -\frac{\alpha\rho'_E \ln(\alpha/r_i)+\ln(1-\alpha)+(\delta_{Ei}-\varepsilon_{Si})}{\rho'_E-\rho_S}. \tag{11.2}$$

Equation (11.2) indicates that individuals facing a higher cost of capital are less likely to become entrepreneurs, implying that individuals with higher r_i require more entrepreneurial ability to enter

entrepreneurship than similar individuals with lower capital costs. Equation (11.2) also indicates that individuals with greater salaried-specific human capital (larger ε_{Si}) or those receiving less utility from entrepreneurship (smaller δ_{Ei}) will require greater entrepreneurial skills to prefer entrepreneurship over salaried employment.

There are two scenarios. The first is when $ln\theta_{Ei} > ln\theta_{Si}$. This is the *benchmark* case, where all employment types are relevant, meaning there are levels of entrepreneurial ability such that each employment type is optimal. The second scenario is when $ln\theta_{Ei} < ln\theta_{Si}$. In this *non-benchmark* case, some employment types are never optimal regardless of entrepreneurial ability.

Consider the benchmark case where the cost of capital (r_i), non-entrepreneurial human capital skills (ε_{Ji}), preferences (δ_{Ji}), and the production function parameter (α) are such that individuals might select into each of the three employment types—self-employment, salaried work, and entrepreneurship—for different values of entrepreneurial ability $ln\theta_{Ei}$. That is, the benchmark involves values of r_i, ε_{Ji}, δ_{Ji}, and α, such that $ln\theta_{Ei} > ln\theta_{Si}$, as discussed above.

For the benchmark case, Figure I illustrates the relationship between the log of the expected utility in each employment type and $ln\theta$. The horizontal line represents the log of expected utility of other self-employment (lnV_{Ui}) and equals $\varepsilon_{Ui} + \delta_{Ui}$. The upward sloping line with squares is the log of expected utility of salaried employment (lnV_{Si}), where the slope is ρ_S. lnV_{Si} intersects lnV_{Ui} at the first cutoff level of entrepreneurial ability: $ln\theta_{Si}$. The upward sloping line with circles is the log of the expected utility of entrepreneurship (lnV_{Ei}), where the slope is ρ'_E, and where lnV_{Ei} intersects lnV_{Si} at the second cutoff level: $ln\theta_{Ei}$. Except where explicitly noted, we focus on this benchmark case.

Figures I and II illustrate key features of the model under these benchmark conditions. Figure I shows how human capital shapes selection into different employment types. On human capital, entrepreneurs are positively selected on entrepreneurial ability, but the other self-employed are negatively selected on $ln\theta_i$. On liquidity constraints, Figure II indicates that r_i shapes entry into entrepreneurship, but not into self-employment. In particular, increases in r_i shift downward the intercept of the line for the log utility of entrepreneurship, constraining entry into entrepreneurship.

Changes in r_i, however, do not alter the intercepts or slopes of the other lines and therefore liquidity constraints do not affect entry into other self-employment.

Figure I shows that entrepreneurs expect to earn more than salaried workers when the non-pecuniary benefits from entrepreneurship are low (for example $\delta_{Ui} \leq 0$), but this is not the case for the other self-employed, especially given the non-pecuniary benefits from self-employment documented by Hurst and Pugsley (2011). Finally, note that the model illustrates the problems with aggregating the entrepreneurs (*E*) and the other self-employed (*U*). The typical self-employed individual in this aggregate group is not selected on entrepreneurial traits; does not earn more than the typical salaried worker; and does not face binding liquidity constraints, since entrepreneurs are a small proportion the aggregate group of self-employed individuals.

III.C. Testable implications and discussion

The model yields testable implications with respect to the impact of human capital, liquidity, and the business cycle on entrepreneurship and other self-employment. In this subsection, we highlight three testable implications for the benchmark case, i.e., for the non-degenerative cases, in which individuals can feasibly sort into each of the three employment types depending on their entrepreneurial ability.

The first two novel testable implications relate to selection on entrepreneurial ability and salaried wages. First, there is negative selection on entrepreneurial ability into other self-employment; but positive selection into entrepreneurship. Second, there is negative selection on salaried wages into other self-employment; yet, there is potentially positive selection on salaried wages into entrepreneurship when entrepreneurial ability is highly productive in salaried work (e.g., if $\rho_S = 1$).

Figure I illustrates both of these implications. Individuals with entrepreneurial abilities above $ln\theta_{Ei}$ have better salaried job opportunities and even better entrepreneurial opportunities than otherwise similar people with lower entrepreneurial abilities. The opposite is true of people who sort into other self-employment, i.e., the U-employment type. Ceteris paribus, it is people with

lower entrepreneurial abilities and hence people with comparatively low-paying salaried options, who choose other self-employment. As for selection into entrepreneurship on salaried wages, this depends on the importance of entrepreneurial abilities in paid-employment. For example, in an economy where only one skill determines people's productivity in both salaried employment and entrepreneurship, people with the best salaried job opportunities become entrepreneurs. As illustrated in Figure II, for $\rho_S = 1$ and $\varepsilon_s = 0$, all other things equal, the most productive salaried workers become entrepreneurs. The positive selection into entrepreneurship reflects the complementarity between ability and capital in entrepreneurship and the lack of perfect adjustment of capital to human-capital in paid employment.

Yet, when entrepreneurial abilities are not very useful in paid-employment (low ρ_S), then there can be negative selection on salaried wages. For example, when $\rho_S = 0$ and wage differences reflect only ε_s, as in the EJ model, then there is negative selection on wages into entrepreneurship. Thus, our model allows for positive and negative selection into entrepreneurship on salaried wages depending on the sources of variation in salaried earnings.

The third testable implication is that entrepreneurs are negatively selected on the cost of capital, but the other self-employed are not. As illustrated in Figure II, an increase in the cost of capital implies a parallel drop in the line representing the log utility of entrepreneurship (lnV_{Ei}). This implies a higher entrepreneurial ability threshold with respect to selection into entrepreneurship but has no effect on selection into other forms of self-employment.

A fourth testable implication involves the cyclicality of entrepreneurship and other self-employment. In the context of our model, we characterize the manifestation of aggregate fluctuations as changes in both the demand for salaried employees and the severity of liquidity constraints. For example, we characterize recessions as a simultaneous reduction in labor demand and a tightening of credit constraints.[6] This is illustrated in Figure III. The tightening of liquidity

[6] A tightening of credit constraints for individual *i* means an increase in the implicit interest rate that equates individual *i*'s demand for capital and the supply of credit made available to individual *i*. Besides higher explicit interest rates on loans, a tightening of credit constraints can manifest as greater credit rationing, in which implicit interest rates become infinite.

constraints involves a parallel fall in the log utility of entrepreneurship line (lnV_{Ei}). As shown, this tightening reduces selection into entrepreneurship but has no effect on entry into other self-employment, i.e., the liquidity effect exerts a procyclical influence on entrepreneurship, but not on other self-employment. With respect to labor demand, a reduction in the demand for salaried employees implies a parallel drop in the line depicting the log utility of salaried employment (lnV_{Si}). The labor demand effect is countercyclical for both types of self-employment. Thus, the model yields (a) an ambiguous prediction about the cyclicality of entrepreneurship but (b) an unambiguous prediction that other self-employment is countercyclical. It is worth noticing that aggregate self-employment might be countercyclical even if entrepreneurship is procyclical.

These implications of the model are unique. Other models of entrepreneurship do not distinguish between entrepreneurs and other self-employed individuals. Therefore, they do not derive predictions regarding the contrasting selection of individuals into entrepreneurship and other self-employment. Our model explains why aggregating these two groups and calling the combined group "entrepreneurs" can lead to mis-leading perspectives on entrepreneurship. In addition, our model's prediction that entrepreneurs might be positively selected on salaried wages is very different from EJ, where the less able salaried workers select into entrepreneurship.

III. D. Extension: Risk aversion

We now generalize the utility function to allow for risk-aversion. Consider the constant absolute risk aversion utility (CARA) function as in Holmstrom and Milgrom (1987, 1994):

$$V_{Ji} = -\exp\{-\tau_i I_{Ji} * e^{\delta_{Ji}}\}, \qquad (1')$$

where τ_i is the Arrow-Pratt index of absolute risk aversion that represents the degree of individual *i*'s risk aversion, as defined by $-V_i''/V_i'$. Equation (1') converges to the risk neutral utility function defined by equation (1) as $\tau_i \to 0$. Furthermore, we slightly modify the specification of the shock to productivity, so that

$$Y_i = \theta_i K_i^{\alpha}(1 + \nu_i'), \qquad (5')$$

where ν_i' is a zero mean, normally distributed shock to productivity. Assuming that the variance-to-mean ratio of output equals σ^2, so that the variance of aggregate output does not change if a firm is split into two or more firms, the expected utility in entrepreneurship is then given by[7]:

$$E\{V_{Ei}\} = -\exp\{-\tau_i[\theta_i K_i^{\alpha} - r_i K_i - \tau_i \theta_i K_i^{\alpha} (\sigma^2/2)]\},$$

where, for simplicity, we have set $\delta_{Ei} = 0$ (rather than $\delta_{Si} = 0$). Exploiting the observation that the certainty equivalent earnings from entrepreneurship is $I_{Ei}' = \theta_i K_i^{\alpha}(1 - \tau_i (\sigma^2/2)) - r_i K_i$, the optimal capital stock for entrepreneur *i* is:

$$K_i^* = (\theta_i \gamma_i \alpha / r_i)^{1/(1-\alpha)}, \qquad (7')$$

where $\gamma_i = (1 - \tau_i (\sigma^2/2))$, so that γ_i is increasing in risk tolerance and decreasing with risk.

The log of the certainty equivalent earnings from entrepreneurship, $ln\{I_{Ei}'\}$, evaluated at the optimal capital stock is then given by:

$$ln\{I_{Ei}'\} = \rho_E' \ln[\theta_i \gamma_i] + \alpha \rho_E' \, Ln\left(\frac{\alpha}{r_i}\right) + Ln(1-\alpha). \qquad (8')$$

Furthermore, since there is no income uncertainty associated with salaried employment or other self-employment, risk aversion does not alter the expected utilities from these employment types.

Allowing for risk aversion, therefore, yields the following insights. First, the core predictions from the benchmark, risk-neutral specification hold: (1) entrepreneurs are positively selected on entrepreneurial ability ($ln\theta_i$), but other self-employed are negatively selected on entrepreneurial ability, (2) entrepreneurs are positively selected on salaried wages when productivity in salaried employment is highly correlated with entrepreneurial abilities (i.e., when ρ_S is sufficiently large), but other self-employed are negatively selected on salaried wages, and (3) entrepreneurs are negatively selected on the cost of capital but other self-employed are not.

Second, risk aversion reduces the optimal capital stock—and hence the efficiency of entrepreneurial activity. In particular, the optimal capital stock reflects the interaction between ability (θ_i), and attitudes toward risk (τ_i), weighted by risk (σ^2). This interaction suggests that

[7] The variance of output is $\sigma_Y^2 = \sigma^2 \theta K^{\alpha}$.

"effective" entrepreneurial human capital is a mixture of narrowly defined entrepreneurial ability and personality traits that allow individuals to effectuate those skills. Self-selection into entrepreneurship depends on the joint distribution of entrepreneurial abilities (θ) and attitudes toward risk (τ). Thus, the most successful entrepreneurs might not be those with the most entrepreneurial ability, e.g., if risk tolerance (τ) and entrepreneurial ability (θ) are negatively correlated.[8] This is akin to the combination of "smart and illicit" traits emphasized by Levine and Rubinstein (2017), where illicit captures attitudes toward breaking from the norm, undertaking novel endeavors, and investing in risky ventures.[9]

IV. STATISTICAL MODEL

As discussed above, it is puzzling that existing theoretical models emphasize the crucial roles of both human capital and liquidity constraints in shaping selection into entrepreneurship, but existing empirical research finds that (1) the aggregate group of self-employed has very similar human capital traits and earnings to their salaried counterparts and (2) it takes little capital to start most U.S. businesses. Our model suggests that these findings might reflect the aggregation of entrepreneurs and other self-employed into one category when selection into these two employment types differs systematically on human capital traits, labor market skills, and liquidity constraints.

In this section, we take the theoretical model from section III and derive estimable equations that will allow us to identify statistically and quantify empirically the roles of human capital traits, salaried employment opportunities, and liquidity in shaping selection across employment types and entry into entrepreneurship. In moving from the model toward an estimable equation we need proxies for entrepreneurial traits, salaried employment opportunities, and liquidity constraints. First, with respect to entrepreneurial traits, we follow Levine and Rubinstein (2017) and use the

[8] Therefore, selection on entrepreneurial ability might vary across industries if σ^2 differs across industries.
[9] This view of effective entrepreneurial ability motivates additional research. For example, it might help explain the gender gap in entrepreneurship if women tend to be more risk averse than men as some research documents (e.g., Halevy 2007 and Borghan et al. 2009). Also, the model suggests that with less risk, selection into entrepreneurship will be determined more by pure entrepreneurial ability. This might explain cross industry (and cross country) differences in the human-capital qualities of entrepreneurs and the performance of their businesses.

interaction between cognitive and non-cognitive traits ("smart and illicit") measured early in life, which they show shape selection into entrepreneurship and success as an entrepreneur. This is consistent with our risk-aversion model that highlights the non-separability of entrepreneurial abilities and non-cognitive skills in shaping selection into entrepreneurship and performance as entrepreneurship conditional on selection into this employment type. Second, we exploit the observation that almost all individuals work as paid-employees before becoming business owners and use these early career wages to proxy for salaried employment opportunities later in life. Third, on liquidity constraints, we note that home equity is frequently used as collateral to obtain loans. Thus, we use home equity as a proxy for collateral and hence the cost of capital facing an individual.

Assuming that the cost of capital for individual *i* diminishes with the person's collateral (C_{it}) in the following form $\alpha/r_{it} = \exp(\kappa C_{it})$, where κ is a positive constant, and letting SIL_i represent the interaction between cognitive ability ("smart") and non-cognitive attitudes ("illicit") of individual *i*, then the probability that individual *i* prefers entrepreneurship or other self-employment to salaried work is:

$$P(V_{Jit} > V_{Sit}) = P(\beta_{JW} W_i + \beta_{JSIL} SIL_i + \beta_{JC} C_{it} + \beta_{JX} X_{it} > \eta_{Sit} - \eta_{Jit}), \quad (12)$$

where W_i represents person *i's* salaried employment opportunities. As discussed further below, we proxy for W_i using person *i*'s early career wages, i.e., wages between the ages of 25 and 29. C_{it} represents the collateral of person *i* at time *t*, which, as described below, which we proxy with the equity value of the person's home. X_{it} is a vector of observable characteristics, including demographics, schooling and early measures of cognitive and non-cognitive traits that might influence employment choices. The error term (η_{Jit}) combines person-specific shocks to productivity in employment type *J* in period *t* and taste, $\eta_{Jit} = \varepsilon_{Jit} + \delta_{Jit}$. Assuming that the error term follows an extreme value distribution, we can estimate the reduced form parameters in (12) using the following multinomial logit regression:

$$Ln(P_{Jit}/P_{Sit}) = \beta_{JW} W_i + \beta_{JSIL} SIL_i + \beta_{JC} C_{it} + \beta_{JX} X_{it}, \quad (13)$$

where the link function, $Ln(P_{Jit}/P_{Sit})$, is the log-odds ratio of the probability of person *i* being an entrepreneur (*J=E*) or other self-employed (*J=U*), rather than a salaried worker (P_{Sit}) at time *t*.

There are three main reduced form parameters of interest: selection on (i) "smart and illicit" (β_{JSIL}), (ii) salaried wages (β_{JW}) and (iii) collateral (β_{JC}). With respect to cognitive and non-cognitive traits, the model predicts that $\beta_{USIL} < 0$ and $\beta_{ESIL} > 0$. That is, the model predicts that smart and illicit traits are negatively associated with entry into other self-employment (the U-employment type) and positively associated with entry into entrepreneurship. With respect to wages, the model predicts that $\beta_{UW} < 0$: increases in wages increase the utility of salaried employment relative to other self-employment. The model, however, generates ambiguous predictions with respect to β_{EW}. To the extent that wages are higher because the individual has higher salaried-specific skills, then $\beta_{EW} < 0$: wages rise but entrepreneurial earnings do not. However, when productivity as a salaried worker is sufficiently positively associated with entrepreneurial ability (high ρ_S), then the model predicts positive selection into entrepreneurship on wages ($\beta_{EW} > 0$) (assuming that SIL_i is not a perfect measure of entrepreneurial ability). Appendix Table II provides empirical evidence that productivity as a salaried worker and entrepreneurial ability are highly correlated, suggesting that we should find positive selection on wages into entrepreneurship.[10] With respect to collateral, the model predicts $\beta_{UC} = 0$ and $\beta_{EC} > 0$. That is, collateral does not shape directly barriers to becoming a salaried worker or U-self-employment type, but collateral lowers the costs of becoming an entrepreneur.

[10] Appendix Table II presents regressions of log hourly earnings of individual *i* in year *t* on the average log hourly salaried wages of the individual between the ages of 25 and 29 (Wages (25-29)) while conditioning on Mincerian characteristics, measures of cognitive and non-cognitive traits (AFQT, Rosenberg self-esteem, Rotter Locus of Control), as well as race, gender, year, and state fixed effects. We run this regression by employment type in year *t*. We find that early career salary wages are positively related to later entrepreneurial earnings and future salaried earnings but not to earnings in unincorporated self-employment.

V. SELECTION INTO ENTREPRENEURSHIP AND OTHER SELF-EMPLOYENT

In this section, we empirically evaluate the effects of human-traits, early career wages, and collateral on selection into entrepreneurship, salaried employment, and other self-employment.

V.A. Section on wages and home wealth

We begin by examining differential selection into incorporated self-employment (entrepreneurship) and unincorporated self-employment (other self-employment) on cognitive and non-cognitive skills, early careers wages, and collateral. Based on equation (13), we estimate the multinomial logit regression:

$$Ln(P_{Jit}/P_{Sit}) = \beta_{JW}W_i + \beta_{JSI}SIL_i + \beta_{JC}C_{it} + \beta_{JX}\boldsymbol{X}_{it}, \quad (13')$$

where the link function is the log-odds ratio of being incorporated (*J=E*) or unincorporated (*J=U*) rather than a salaried worker and the other terms are defined above. In Table II, we provide the multinomial logit results on unincorporated and incorporated self-employment (columns 2-3), where we do not report results on other employment categories such as unpaid family and nonprofit businesses. In column 1, we provide the results from a logit regression in which the dependent variable is a binary indicator that equals one if the individual is self-employed (either incorporated or unincorporated) in year *t* and zero otherwise.

The key explanatory variables are as follows. For potential salaried wages (W_i), we use *Wages (25-29)*, which equals log hourly salaried earnings when the individual was 25-29 years. For SIL_i, we use *Smart & Illicit*, which equals one if an individual has both above the NLSY79 sample median of *AFQT* and *Illicit* and zero otherwise. For C_{it}, we use *Home Wealth(t-2)*, which equals the market value of the individual's home (if any) minus mortgages on the house divided by $100,000 two year before period *t*. For $\boldsymbol{X}$, we use the following controls that are not reported in the tables: Mincerian characteristics (a quartic expression for potential work experience and dummy variables for six education categories),[11] measures of cognitive and non-cognitive traits (*AFQT*, *Self-esteem*,

[11] The six educational attainment categories are: (i) high school dropouts: less than 12 years of schooling (ii) GED degree (iii) high school graduates: 12 years of schooling (iv) had some college education: 13-15 years of schooling (i)

Locus of Control), as well as gender-year, race-year, and state fixed effects. Since the data on home wealth begins in sample year 1985 and we restrict the sample to individuals with data on home wealth in *t-4*, the sample starts in 1989. The sample also excludes individuals who were self-employed in either *t-2* or *t-4*. The table provides heteroskedasticity robust standard errors clustered at the individual level.

As shown in column (1) of Table II for the aggregate group of self-employed, we find (1) a mild, yet statistically significant association between wealth and entry into self-employment, (2) negative selection on salaried wages into self-employment, and (3) no association between cognitive and non-cognitive traits and entry into self-employment. These findings are consistent with previous research, e.g., Evans and Jovanovic (1979) that examines aggregate self-employment. In contrast to previous studies, however, we find that that these patterns reflect differential selection into entrepreneurship (incorporated) and other self-employment (unincorporated) on wealth, salaried wages, and entrepreneurial traits. In particular, and as we will now describe in greater detail, Table II shows that there is positive selection into entrepreneurship on wealth, salaried wages, and entrepreneurial traits but negative selection into other self-employment on salaried wages and entrepreneurial traits and no relationship between other self-employment and wealth.

More specifically, and consistent with the model's predictions, the results reported in Table II indicate positive selection into incorporated self-employment on early career wages and negative selection into unincorporated self-employment on those wages. *Wages (25-29)* enters positively and significantly when examining selection into incorporated self-employment but negatively and significantly when assessing entry into unincorporated self-employment. The economic magnitudes are substantial. Using the estimates from the multinomial logit regressions, consider two people: a high early-career wage earner, where *Wage (25-29)* is 25% above the sample median and a low early-career wage earner, where *Wage (25-29)* is 25% below the sample median. The coefficient

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college education: 16 years of schooling (vi) advanced studies: 17+ years of schooling. Potential work experience (pwe) equals age minus years of schooling minus six (or zero if this computation is negative). The quartic includes pwe, pwe^2, pwe^3, and pwe^4.

estimates suggest that the odds of the high early-career wage earner switching from salaried work into incorporated business ownership next period are approximately 17% greater than the low early-career wage worker (1.17=exp(0.5*0.3139)). Similarly, the estimated coefficients indicate that the odds of the low early-career wage earner switching from salaried work into unincorporated self-employment next period are 20% greater than the high early-career wage worker (1.2=exp(0.5*0.3713)). Table II also highlights the pitfalls of using the aggregate group of self-employed business owners. As shown in column (1), there is negative selection into aggregate self-employment on early career wages, which masks the differential selection into entrepreneurship and other self-employment.

Also consistent with the model's predictions, we find positive selection into incorporated self-employment on collateral, but no link between collateral and entry into unincorporated self-employment. That is, *Home Wealth(t-2)* enters positively, significantly, and with an economically large coefficient when examining incorporated self-employment but enters with a small, insignificant coefficient when examining unincorporated self-employment. With respect to the economic size of the estimated coefficients, consider a high-collateral and low-collateral person, where the high-collateral person has $50,000 of additional home wealth in year *t-2* than the low-collateral person. The coefficient estimates suggest that the odds of the high-collateral person switching into incorporated business ownership next period from salaried employment this period) are 6.5% greater than the low-collateral person (1.065=exp(0.5*(0.1607-0.0344).

The findings on *Smart & Illicit* are also consistent with the model and the findings in Levine and Rubinstein (2017). Like *Wages (25-29)*, *Smart & Illicit* is positively associated with entry into entrepreneurship but negatively associated with entry to unincorporated self-employment. To the extent that *Smart & Illicit* is an additional proxy for effective entrepreneurial abilities that is imperfectly correlated with *Wages (25-29)*, these results are fully in line with the model's broad predictions. The combination of strong analytical skills and break-from-the-norm, risk-tolerant preferences is positively associated with expected success and hence entry into entrepreneurship. However, these *Smart & Illicit* traits are not productive, and might even be counterproductive, for

undertaking the manual-skills-based self-employment activities associated with unincorporated self-employment.

V.B. Section on wages and home wealth: Individual fixed effects and a falsification test

We next address the concern that omitted time-invariant individual traits drive the results on home wealth. For example, if individuals from rich families have characteristics that facilitate both entry into entrepreneurship and larger home equity stakes, then the Table II results might lead us to conclude inappropriately that collateral shapes entry into entrepreneurship when it is the other characteristics that drive both (as argued by Hurst and Lusardi, 2004).

To address this concern, we estimate linear probably models of entry into incorporated and unincorporated self-employment while (a) controlling for an array of observable characteristics and (b) conditioning on individual fixed effects. We report these results in Table III. Of course, including individual fixed effects will essentially eliminate *Wages (25-29)*, as it varies little over time. As explained in Section II, there is slight time variation in *Wages (25-29)* when individuals are between 27 and 30 years old. For comparison purposes, we present the key earlier analyses from Table II using a linear probability model. Table III shows that some of the association between wealth and entry into self-employment reflects person, rather than wealth, effects (as suggested by Hurst and Lusardi, 2004). Yet, even after controlling for person fixed effects, we continue to find positive selection into entrepreneurship on *Home Wealth(t-2)* but little relation between selection into unincorporated self-employment and *Home Wealth(t-2).*

We also provide a falsification test in Table III. Instead of examining selection into employment types in period *t* on home wealth in period *t-2*, we examine selection into employment types in period *t* on future home wealth in period *t+2* (i.e., on *Home Wealth(t+2)*). If *Home Wealth(t-2)* captures changes in wealth that can be used as collateral to finance entry into entrepreneurship in year *t*, then the model predicts that *Home Wealth(t-2)* will be positively associated with entry into incorporated self-employment. We would not, however, expect that a

change in future household wealth would influence past entry into entrepreneurship unless *Home Wealth(t+2)* is capturing something else about the evolving characteristics of the individual. When controlling for individual effects, we find positive selection into entrepreneurship on *Home Wealth(t-2)* but not on *Home Wealth(t+2)*. The results from this falsification test are consistent with the view that (a) home wealth is positively related to collateral and (b) collateral is important for entering entrepreneurship.

V.C. The impact of home wealth on entry into self-employment

Although the results reported in Tables II and III indicate positive selection into entrepreneurship on wages, collateral, and entrepreneurial traits and strong negative selection into unincorporated self-employment on wages and entrepreneurial traits, the empirical strategies employed in Tables II and III do not identify an external source of variation in collateral. The estimated impact of collateral on entry into entrepreneurship, therefore, might reflect factors other than liquidity effects. In particular, lagged housing wealth, even when including individual effects, might not represent an exogenous source of variation in collateral if other time-varying factors shape both home wealth and entry into self-employment.

In this section, we use a Bartik-type instrumental variable to evaluate the impact of collateral on entry into incorporated and unincorporated self-employment. Building on the work in Hurst and Lusardi (2004), Corradin and Popov (2015), and Schmalz, Sraer, and Thesmar (2017), we use $Home\ Wealth_{it-4} * g_{(t-4,t-1)}$, which equals the net value of the home owned by individual *i* in year *t-4* ($Home\ Wealth_{it-4}$) times the growth rate of home prices in the state in which the home is located from year *t-4* to year *t-1* ($g_{(t-4,t-1)}$). If the individual does not own a home in year *t-4*, $Home\ Wealth_{it-4}$ equals zero. Our identifying assumption is that conditional on the other regressors, the value of a person's home in *t-4* and the growth rate in state housing prices between *t-4* and *t-1* is exogenous to the individual's decision in year *t* about switching into incorporated or unincorporated self-employment.

We estimate the following multinomial logit model and report the results in Table IV:

$$Ln(P_{Jit}/P_{Sit}) = \beta_{JW}W_i + \beta_{JSI}SIL_i + \beta_{JC}Home\ Wealth_{ist-4} * g_{(t-4,t-1)} + \beta_{JX}\boldsymbol{X}_{it}, \quad (14)$$

where the link function is the log-odds ratio of entry into either incorporated or unincorporated self-employment relative to not switching into self-employment. $\boldsymbol{X}$ includes the same controls defined above. The sample includes individuals who were not self-employed in either *t-2* or *t-4*.

Before turning to the multinomial logit regressions, we assess—and validate—the "first-stage." That is, we evaluate whether $Home\ Wealth_{it-4} * g_{(t-4,t-1)}$ predicts $HomeWealth_{it}$ after controlling for $HomeWealth_{it-4}$, $g_{(t-4,t-1)}$, as well as Wages(25-29) and $\boldsymbol{X}$. We conduct these analyses using OLS in columns (1) and (2) of Table IV, where the column (2) regression includes individual fixed effects. As shown, $Home\ Wealth_{it-4} * g_{(t-4,t-1)}$ enters positively and significantly at the one percent level, when controlling for lagged values of the individual's home wealth, the recent growth rate of home prices in the state, early career wages, and the array of control variables and fixed effects listed above.

We next examine entry into the aggregate group of self-employed. For these analyses, we use a logit estimator since the dependent variable is a simple one-zero indicator variable. As shown in column (3), $Home\ Wealth_{it-4} * g_{(t-4,t-1)}$ does not help account for entry into aggregate self-employment. This is consistent with findings that, on average, liquidity constraints do not account for entry into self-employment, as reported by Hurst and Lusardi (2004).

When distinguishing between the incorporated and unincorporated, we discover that collateral impacts entry into entrepreneurship but not into unincorporated self-employment. As shown in columns (4) and (5), $Home\ Wealth_{it-4} * g_{(t-4,t-1)}$ enters positively and significantly when examining entry into incorporated self-employment, but $Home\ Wealth_{it-4} * g_{(t-4,t-1)}$ enters negatively and insignificantly when considering the odds of switching into unincorporated self-employment. The economic magnitudes are material. For example, consider two similar individuals, where each has $100,000 of home wealth in *t-4*. Let one live in a state where housing prices rise by 25% from *t-4* to *t-1* while the other resides in a state where housing prices stagnate. The coefficient estimates indicate that the odds that the individual receiving the positive housing price shocks switches from salaried employment to incorporated self-employment in year *t* are 4%

higher than the otherwise similar individual who did not receive this housing price boost (1.04=exp(0.25*0.1566)).

We were concerned that (a) state housing price growth might be correlated with changes in the state's overall economic conditions, (b) home wealth is correlated with other individual traits that independently shape entry into entrepreneurship, and (c) these other individual traits are sensitive to overall economic conditions. Under these conditions, $Home\ Wealth_{it-4} * g_{(t-4,t-1)}$ might proxy for the interactive impact of (non-home wealth) individual traits and changes in overall economic conditions on entry into entrepreneurship, so that the results cannot be interpreted as the impact of collateral on the odds of switching into entrepreneurship. To address this concern, we controlled for shocks to overall economic conditions by including changes in the state unemployment rate (individual *i*'s state) between t-1 and t (Δ*Unemployment*), and its interaction with housing wealth in period *t-4* ($Home\ Wealth_{it-4}$*Δ*Unemployment*. The results reported in Table IV hold.

We also conducted a falsification test, similar to the one presented in Table III, to address the concern that *Home Wealth(t-4)*g(t-4, t-1)* is capturing something else about an individual besides a shock to home wealth. If *Home Wealth(t-4)*g(t-4, t-1)* captures shocks to a person's collateral between year *t-4* and *t-1*, then we expect that (a) *Home Wealth(t-4)*g(t-4, t-1)* will positively influence selection into incorporated self-employment in year *t* and (b) *Home Wealth(t-4)*g(t+1, t+4)* will not explain entry into entrepreneurship. That is, we would not expect that a shock to *future* household wealth would influence entry into entrepreneurship unless these future shocks *are c*apturing something else about the evolving characteristics of the individual. In Appendix Table III, we show that *Home Wealth(t-4)*g(t+1, t+4)* does not explain entry into entrepreneurship in period *t*. While shocks to wealth before period *t* explain entry into entrepreneurship, shocks to wealth after period *t* do not.

V.D. Entry into entrepreneurship: Effective entrepreneurial human capital

Although we have focused on how entrepreneurial ability shapes selection into different employment types, we now expand the notion of entrepreneurial ability from one skill—entrepreneurial ability—to include a second skill: the "capacity," or willingness, to use entrepreneurial skills to undertake entrepreneurial ventures. The theoretical model with risk aversion developed in Section III.D motivates this examination. The model predicts positive selection into entrepreneurship on the *interaction* between entrepreneurial ability (θ_i) and noncognitive attitudes toward risk (γ_i), where these noncognitive attitudes shape the capacity/willingness to use entrepreneurial abilities to start and run a business. This "smart and illicit" interaction term represents *effective* entrepreneurial human capital as a mixture of narrowly defined entrepreneurial ability and the noncognitive traits that give individuals the capacity to exercise those skills.

Our extended model with risk aversion highlights the conceptual and empirical advantages of using a measure of effective entrepreneurial human capital. In a risk neutral economy, the model suggests that if early career wages are a good proxy for people's ability to establish a risk-free business, we may find positive selection into entrepreneurship on wages: The best-paid employees turn out to be the most successful business owners. Yet, when risk matters, this prediction does not necessarily hold. Even when early career wages are a good proxy for pure entrepreneurial ability, high wage employees will not necessarily make the most successful business owners. Rather, the positive selection into entrepreneurship on wages should hold only among people with the non-cognitive capacity to "deal with risk" and exercise their entrepreneurial skills in entrepreneurial ventures.

Our model, therefore, predicts that we should examine the interaction between *Wages (25-29)* and *Illicit* and that it should be this interaction term—and not *Wages (25-29)* or *Illicit* independently—that explains selection into entrepreneurship. The model also predicts that *Wages (25-29)*Illicit* will not account for selection into other forms of self-employment. To evaluate these

predictions, Table V presents the results from regressions that are similar to those in Table IV except that Table V also includes the interaction term *Wages (25-29)*Illicit.*

Two key findings emerge from the Table V regression results. First, we confirm the results from Table IV: shocks to collateral ($Home\ Wealth_{it-4} * g_{(t-4,t-1)}$) are positively associated with selection into incorporated self-employment but not into unincorporated self-employment. Second, and consistent with the model, we find that *Wages (25-29)* is positively associated with selection into incorporated self-employment only among individuals with above the median Illicit scores. These findings suggest that entrepreneurial ability is most strongly associated with selection into entrepreneurship among people with the noncognitive capacity to use those skills in entrepreneurial ventures.

These findings suggest that effective entrepreneurial human ability is a mixture of cognitive skills that are also valuable in paid employment and non-cognitive traits that might be a burden in paid-employment. A unique mixture of smart and illicit skills—cognition and personality—provides the capacity for successful entrepreneurial ventures.

VI. EMPIRICAL RESULTS: CYCLICALITY OF ENTREPRENEURSHIP

The model yields distinct predictions about the cyclicality of entrepreneurship and other self-employment. For example, consider a recession as involving (1) a drop in the demand for salaried workers (labor demand effect) and (2) a tightening of credit conditions (liquidity constraint effect). As discussed above, the model indicates that a drop in the demand for salaried workers will have a countercyclical effect on entrepreneurship and other self-employment: A deterioration of salaried job opportunities induces sorting into entrepreneurship and other self-employment. The liquidity constraint effect is different. A tightening of liquidity constraints discourages entry into entrepreneurship but has no effect on other self-employment, which does not require capital. Thus, the model predicts (1) that other self-employment is countercyclical and (2) entrepreneurship is procyclical when the liquidity constraint effect dominates the labor demand market effect. Under

this condition, aggregating entrepreneurs and other self-employed individuals will hide their distinctive cyclical patterns.

VI.A. The cyclicality of entrepreneurship: Stocks

To assess the cyclicality of entrepreneurship and evaluate whether self-employment provides a misleading perspective on the creation and destruction of new businesses over the business cycle, we document the basic cyclical patterns of salaried workers, the aggregate group of self-employed, the incorporated self-employed, and the unincorporated self-employed. To document these patterns, we use state unemployment rates to measure local economic conditions. The Bureau of Labor Statistics produces data on state unemployment for each month. We compute *Unemployment* as the average unemployment rate in an individual's state over the twelve months prior to the individual's interview with the NLSY79.

We estimate the following set of linear probability models:

$$E_{Jist} = \beta_J + \beta_{JU} Unemployment_{st} + \beta_{JX} \boldsymbol{X}_{it} + \varepsilon_{Jist}. \quad (15)$$

E_{Jist} is a binary indicator that equals one if person *i* from state *s* is observed in employment type *J* in time *t* and zero otherwise.[12] $Unemployment_{st}$ is the unemployment rate of state *s* in year *t*. $\boldsymbol{X}_{it}$ is the same set of controls discussed above. We provide the results without (Panel A) and with (Panel B) individual fixed effects.

Table VI reports the coefficient estimates on state unemployment and also gives the mean of the dependent variables. As shown in the column reporting the means of the dependent variables, the proportion of salaried workers, unincorporated self-employed, and incorporated self-employed in our sample are 80.7%, 6.8% and 1.7% respectively.

There are three key findings from Table VI: (1) entrepreneurship is procyclical, (2) unincorporated self-employment is countercyclical, and (3) aggregate self-employment is countercyclical when including individual fixed effects. As shown in Panel B, the state

[12] The results below hold when (1) using the Current Population Survey or (2) examining the extensive margin, i.e., using the number of hours that individuals work in each employment type *J* as the dependent variable.

unemployment rate enters negatively and significantly when the dependent variable is incorporated self-employment, but enters positively and significantly when the dependent variable is either unincorporated self-employment or the aggregate group of self-employed. Thus, we both confirm the common finding that aggregate self-employment is countercyclical and document that entrepreneurship is procyclical.

The estimated magnitudes are economically large. Consider, the analyses controlling for individual fixed effects. The coefficient estimates indicate that a one-percentage point increase in the state unemployment rate (i.e., an increase of 0.01) is associated with a 1.10% drop in salaried employment relative to the average number of salaried workers (1.10%=[100*0.01*0.89]/0.807). The "elasticity" is much larger for incorporated and unincorporated self-employment. Relative to the average number of incorporated and unincorporated self-employed respectively, a one-percentage point increase in the state unemployment rate is associated with 4.16% increase in unincorporated self-employed and a 5.35% decrease in incorporated self-employment.[13]

VI.B. The cyclicality of entrepreneurship: First differences

In this subsection, we further exploit the longitudinal nature of the NLSY79 to account for omitted state-year factors and draw more confident inferences about the relationship between business cycles and selection into entrepreneurship and other self-employment. Specifically, we estimate the following net entry regressions and report the results in Table VII:

$$\Delta E_{Jist} = \gamma_J + \gamma_{J\Delta U}\Delta Unemployment_{st} + \gamma_{JX}\Delta \boldsymbol{X}_{it} + \upsilon_{Jist}, \quad (16)$$

where ΔE_{Jist} is the change into employment type *J* of individual *i* between periods *t-2* and *t*, so that ΔE_{Jist} equals +1 if the individual moves into employment type *J*; -1 if the person leaves type *J*; and 0 if the individual does not change designation with respect to employment type *J*. $\Delta Unemployment_{st}$ is the change in the state unemployment rate between year *t* and *t-1*. Thus, $\gamma_{J\Delta U}$ is the coefficient estimate on the relationship between a *change* in the state's unemployment rate

[13] For the unincorporated, there is an increase of 4.16= (100*0.01*0.283)/0.068; and for the incorporated, there is a decrease of 5.35 = (100*0.01*0.091)/0.017.

and switches into and out of each employment type. As above, the regressions control for schooling, potential work experience, gender-year, race-year, and state fixed effects. We use lagged dependent variables to control for serial correlation. We also provide the results without (Panel A) and with (Panel B) individual fixed effects. In these first difference regressions, including state and individual fixed effects conditions out both individual and state specific linear trends.

As shown in Table VII, the results from the first difference regressions indicate that (1) self-employment is countercyclical, (2) entrepreneurship is procyclical, and (3) these patterns reflect the net entry and exit into unincorporated and incorporated self-employment respectively. The differential impact of the business cycle on incorporated and unincorporated self-employment is consistent with our model that highlights the adverse effect of a tightening of liquidity constraints on entrepreneurship in contrast to other self-employment, which demands little starting capital and human-capital. In demonstrating that entrepreneurship is procyclical and unincorporated self-employment is countercyclical, our findings highlight the importance of distinguishing between entrepreneurs and other types of self-employed individuals.[14]

VII. CONCLUSIONS

In this paper, we addressed several gaps that have emerged between theoretical and empirical analyses of entrepreneurship. We began by offering a new three-sector Roy model of selection into entrepreneurship, other self-employment, and salaried work on human capital and liquidity constraints. The model predicts that (1) entrepreneurs are positively selected on entrepreneurial talent and tolerance to risk, but the other self-employed are negatively selected on those same skills and traits, (2) entrepreneurs are positively selected on salaried wages—when there is a sufficiently strong connection between entrepreneurial ability and productivity as a salaried worker, but the other self-employed are negatively selected on salaried wages, (3) entrepreneurs are positively selected on collateral, but entry into other self-employment is unrelated to liquidity

[14] This finding relates to research exploring the entry and exit of businesses and the resultant creation and destruction of jobs, while differentiating among firms, e.g., Davis and Haltiwanger (1992, 1999). We show analytically and empirically that it is crucial to distinguish between entrepreneurs and other self-employed when examining business and employment dynamics in general and over the business cycle.

constraints. Thus, the model suggests that existing puzzles and unresolved debates concerning human capital, earnings, liquidity constraints, and the cyclicality of business starts might reflect the failure to distinguish between entrepreneurs and the other self-employed.

Consistent with the theoretical model, we discovered that (1) the incorporated are positively selected on proxies for entrepreneurial talent, but the unincorporated are negatively selected on entrepreneurial talent, (2) the incorporated are positively selected on salaried wages, but the unincorporated are negatively selected on wages, and (3) collateral exerts a large, positive impact on entry into incorporated self-employment, but collateral does not influence entry into unincorporated self-employment.

Our analyses also indicated that the sharp differences between entrepreneurship and other self-employment should be integrated into the study of business cycles. Our model suggests the conditions under which aggregate self-employment is countercyclical while entrepreneurship is procyclical. In our empirical analyses, we indeed discover that self-employment is countercyclical and entrepreneurship is procyclical. The results highlight the conceptual and empirical shortcoming of using the aggregate group of self-employed to assess selection into entrepreneurship as human capital and liquidity constraints shape entry into entrepreneurship very differently from entry into unincorporated self-employment.

REFERENCES

Adelino, M., Schoar, A., and Severino, F., 2015. House prices, collateral, and self-employment. *Journal of Financial Economic*, 117(2), pp. 288-306.

Aghion, P., and Howitt, P., 1992. A model of growth through creative destruction. *Econometrica*. 60(2), pp. 323-351.

Banerjee, Abhijit V., and Andrew F. Newman. 1993. Occupational choice and the process of development. *Journal of Political Economy* 101(2): 274-298.

Barlevy, Gadi. 2007. On the cyclicality of research and development. *American Economic Review* 97(4), pp. 1131-1164.

Baumol, William J. 1990. Entrepreneurship: Productive, unproductive, and destructive. *Journal of Political Economy* 98(5), pp. 893-921.

Bernanke, Ben, and Mark Gertler. 1989. Agency costs, net worth, and business fluctuations. *American Economic Review* 79(1), pp. 14-31.

Bernardo, A.E., and Welch, I., 2001. On the evolution of overconfidence and entrepreneurs. *Journal of Economics & Management Strategy*, *10*(3), pp.301-330.

Black, J., De Meza, D., and Jeffreys, D., 1996. House prices, the supply of collateral and the enterprise economy. *Economic Journal*, 106(1), pp. 6-75.

Blanchflower, David G., and Andrew J. Oswald. 1998. What makes an entrepreneur? *Journal of Labor Economics* 16(1), pp. 26–60.

Borghans, L., Heckman, J.J., Golsteyn, B.H. and Meijers, H., 2009. Gender differences in risk aversion and ambiguity aversion. *Journal of the European Economic Association*, *7*(2-3), pp.649-658.

Borjas, G.J., and Bronars, S.G., 1989. Consumer discrimination and self-employment. *Journal of political economy 97*(3), pp. 581-605.

Caballero, Ricardo J., and Mohamad L. Hammour. 1994. The cleansing effect of recessions. *American Economic Review* 84(5), pp. 1350-68.

Cagetti, M., and De Nardi, M., 2006. Entrepreneurship, frictions, and wealth. *Journal of Political Economy* 114(5), pp. 835-870.

Chaney, T., Sraer, D., and Thesmar, D., 2012. The collateral channel: How real estate shocks affect corporate investment. *American Economic Review*, *102*(6), pp.2381-2409.

Corradin, S., and Popov, A., 2015. House prices, home equity borrowing, and entrepreneurship. *Review of Financial Studies*, 28(8), pp. 2399-2428.

Cunha, Flavio, James J. Heckman, and Susanne M. Schennach. 2010. Estimating the technology of cognitive and noncognitive skill formation. *Econometrica* 78(3): 883-931.

Davis, S.J., and Haltiwanger, J., 1992. Gross job creation, gross job destruction, and employment reallocation. *The Quarterly Journal of Economics*, *107*(3), pp.819-863.

Davis, S.J., and Haltiwanger, J., 1999. Gross job flows. *Handbook of labor economics*, *3*, pp.2711-2805.

Dawson, C., de Meza, D., Henley, A. and Arabsheibani, G.R., 2014. Entrepreneurship: cause and consequence of financial optimism. *Journal of Economics & Management Strategy*, *23*(4), pp.717-742.

De Meza, D., and Southey, C., 1996. The borrower's curse: optimism, finance and entrepreneurship. *The Economic Journal*, pp.375-386.

Evans, David S., and Boyan Jovanovic. 1989. An estimated model of entrepreneurial choice under liquidity constraints. *Journal of Political Economy* 97(4), pp. 808-827.

Evans, David S., and Linda S. Leighton. 1989. Some empirical aspects of entrepreneurship. *American Economic Review* 79(3), pp. 519-535.

Fairlie, R.W., 1999. The absence of the African-American owned business: An analysis of the dynamics of self-employment. *Journal of Labor Economics*, *17*(1), pp.80-108.

Fairlie, R.W., 2002. Drug dealing and legitimate self-employment. *Journal of Labor Economics*, *20*(3), pp.538-537.

Fairlie, Robert W. 2013. Entrepreneurship, economic conditions, and the great recession. *Journal of Economics and Management Strategy* 22(2), pp. 207-231.

Fairlie, Robert W., and Harry A. Krashinsky. 2012. Liquidity constraints, household wealth, and entrepreneurship revisited. *Review of Income and Wealth* 58(2), pp. 279–306.

Fairlie, R.W., and Robb, A., 2007a. Families, human capital, and small business: Evidence from the characteristics of business owners survey. *ILR Review*, *60*(2), pp.225-245.

Fairlie, R.W. and Robb, A.M., 2007b Why are black-owned businesses less successful than white-owned businesses? The role of families, inheritances, and business human capital. *Journal of Labor Economics*, *25*(2), pp.289-323.

Fairlie, R., and Woodruff, C.M., 2010. Mexican-American Entrepreneurship. *The BE Journal of Economic Analysis & Policy*, *10*(1).

Farber, Henry S., 1999. Alternative and part-time employment arrangements as a response to job loss. *Journal of Labor Economics* 17(4), pp. S142-S169.

Fazzari, S.M., Hubbard, R.G., Petersen, B.C., Blinder, A.S., and Poterba, J.M., 1988. Financing constraints and corporate investment. *Brookings papers on economic activity*, *1988*(1), pp.141-206.

Fisher, Irving. 1933. The debt-deflation theory of great depressions. *Econometrica* 1(4), pp. 337-57.

Fort, T.C., Haltiwanger, J., Jarmin, R.S., and Miranda, J., 2013. How firms respond to business cycles: The role of firm age and firm size. *IMF Economic Review*, *61*(3), pp.520-559.

Francois, Patrick, and Huw Lloyd-Ellis. 2003. Animal spirits through creative destruction. *American Economic Review* 93(3), pp. 530-550.

Gan, Jie, 2007a. Collateral, debt capacity, and corporate investment. *Journal of Financial Economics* 85, pp. 709-734.

Gan, Jie, 2007b. The real effects of asset market bubbles: Loan-and-firm-level evidence of a lending channel. *Review of Financial Studies* 20, pp.1941-1973.

Gennaioli, Nicola, Rafael La Porta, Florencio Lopez-de-Silanes, and Andrei Shleifer, 2013. Human capital and regional development. *The Quarterly journal of economics*, *128*(1), pp. 105-164.

Gertler, Mark, and Simon Gilchrist, S. 1994. Monetary policy, business cycles, and the behavior of small manufacturing firms. *Quarterly Journal of Economics* 109(2), pp. 309-40.

Hamilton, Burton H., 2000. Does entrepreneurship pay? An empirical analysis of the returns to self-employment. *Journal of Political economy*, *108*(3), pp.604-631.

Halevy, Yoram. 2007. Ellsberg revisited: An experimental study. *Econometrica*, 75(2), pp. 503-536.

Hartog, Joop, Mirjam van Praag, and Justin 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 and Management Strategy*, 19(4), pp. 947-989.

Heckman, James J., 2000. Policies to foster human capital. Research in Economics, Elsevier, vol. 54(1): 3-56.

Heckman, James J., and Yona Rubinstein. 2001. The importance of noncognitive skills: Lessons from the GED testing program. *American Economic Review* 91(2): 145-149.

Heckman, James J., Jora Stixrud, and Sergio Urzua. 2006. The effects of cognitive and noncognitive abilities on labor market outcomes and social behavior. *Journal of Labor Economics* 24 (3): 411-482.

Holmstrom, Bengt, and Paul Milgrom. 1987. Aggregation and linearity in the provision of intertemporal incentives. *Econometrica*, 55(2), pp. 303-28.

Holmstrom, Bengt, and Paul Milgrom. 1994. The firm as an incentive system. *The American Economic Review* 84(4), pp. 972-91.

Holtz-Eakin, Douglas, David Joulfaian, and Harvey S. Rosen. 1994a. Entrepreneurial decisions and liquidity constraints. *RAND Journal of Economics* 25(2), pp. 334-347.

Holtz-Eakin, Douglas, David Joulfaian, and Harvey S. Rosen. 1994b. Sticking it out: Entrepreneurial survival and liquidity constraints. *Journal of Political Economy* 102(1), pp. 53-75.

Hoshi, Takeo, Kashyap, Anil K., and Scharfstein, David. 1991. Corporate structure, liquidity, and investment: Evidence from Japanese industrial groups. *Quarterly Journal of Economics* 106(1), pp. 33-60.

Hubbard, R. Glenn, and Anil K. Kashyap. 1992. Net worth and the investment process: An application to U.S. agriculture. *Journal of Political Economy* 100(3), pp. 506-34.

Hurst, Erik, Geng Li, and Benjamin Pugsley. 2014. Are household surveys like tax forms? Evidence from income underreporting of the self-employed. *Review of economics and statistics*, *96*(1), pp.19-33.

Hurst, Erik, and Benjamin W. Pugsley. 2015. Wealth, tastes, and entrepreneurial choice. *National Bureau of Economic Research Working Paper*, 21644.

Hurst, Erik, and Annamaria Lusardi. 2004. Liquidity constraints, household wealth, and entrepreneurship. *Journal of Political Economy* 112(2), pp. 319-347.

Hurst, Erik, and Benjamin W. Pugsley. 2011. What do small businesses do? *Brookings Papers on Economic Activity* (Fall 2011), pp. 73-118.

Jovanovic, Boyan. 1982. Selection and the Evolution of Industry. *Econometrica* 50(3), pp. 649-670.

Kerr, S., Kerr, W.R. and Nanda, R., 2015. *House money and entrepreneurship* (No. w21458). National Bureau of Economic Research.

Keynes, John Maynard. 1936. *The General Theory of Employment, Interest and Money*. London: Macmillan.

Kihlstrom, Richard, and Jean-Jacques Laffont. 1979. A general equilibrium entrepreneurial theory of firm formation based on risk aversion. *Journal of Political Economy* 87(4), pp. 719-748.

Kiyotaki, Nobuhiro, and John Moore. 1997. Credit cycles. *Journal of Political Economy* 105(2), pp. 211-248.

Knight, Frank H. 1921. *Risk, Uncertainty and Profit*. New York: Harper and Row.

Koellinger, Philipp D., and A. Roy Thurik. 2012. Entrepreneurship and the business cycle. *Review of Economics and Statistics* 94(4), pp. 1143-1156.

La Porta, Rafael, and Andrei Shleifer. 2008. The unofficial economy and economic development. *Brookings Papers on Economic Activity* 47(1), pp. 275–352.

La Porta, Rafael, and Andrei Shleifer. 2014. Informality and development, *Journal of Economic Perspectives* 28(3), pp. 109–126.

Levine, Ross, and Yona Rubinstein. 2017. Smart and illicit: who becomes an entrepreneur and do they earn more? *Quarterly Journal of Economics* 132(2), pp. 963-1018.

Lucas, Robert E., Jr. 1978. On the size distribution of business firms. *Rand Journal of Economics* 9, pp. 508-23.

Manso, Gustavo, 2016. Experimentation and the Returns to Entrepreneurship. *The Review of Financial Studies*, *29*(9), pp.2319-2340.

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

Murphy, Kevin M., Andrei Shleifer, and Robert W. Vishny. 1991. The allocation of talent, pp. Implications for growth. *Quarterly Journal of Economics* 106(2), pp. 503-530.

Nanda, R., and Sørensen, J.B., 2010. Workplace peers and entrepreneurship. *Management Science*, *56*(7), pp.1116-1126.

Parker, Simon C. 2009. The Economics of Entrepreneurship. Cambridge: Cambridge University Press.

Schmalz, M.C., Sraer, D.A., and Thesmar, D., 2017. Housing collateral and entrepreneurship. *Journal of Finance*, 72(1): 99-132.

Schoar, Antoinette. 2010. The divide between subsistence and transformational entrepreneurship. In: *Innovation Policy and the Economy*, Volume 10, Eds: Josh Lerner and Scott Stern. Chicago: University of Chicago Press, pp. 57-81.

Schumpeter, Joseph A. 2011. *Theorie Der Wirtschaftlichen Entwicklung (Theory of Economic Development)*. Leipzig: Duncker & Humblot.

Shleifer, Andrei. 1986. Implementation cycles. *Journal of Political Economy* 94(6): 1163-1190.

Smith, Adam. 1776. *An Inquiry into the Nature and Causes of the Wealth of Nations.* London: Methuen, 1776).

Veblen, Thorstein. 1904. *The Theory of Business Enterprise*. New York: Scribner.

Yu, L., Orazem, P.F., and Jolaghionly, R.W., 2014. Entrepreneurship over the business cycle. *Economics Letters* 122: 105-110.

TABLE I
SUMMARY STATISTICS

		Legal Form of Business		
	Employed	Total	Unincorporated	Incorporated
Human capital				
AFQT	49.2	51.4	48.3	59.8
Self-esteem	0.05	0.09	-0.02	0.35
Locus of control	-0.05	-0.21	-0.13	-0.43
Illicit	-0.02	0.17	0.21	0.07
Smart & Illicit	0.18	0.20	0.16	0.28
Years of schooling	13.8	13.7	13.5	14.4
College graduate	29%	28%	24%	39%
Demographics				
Female	49%	33%	37%	24%
Black	14%	11%	14%	5%
Hispanic	7%	5%	6%	4%
Wages:				
Wages (25-29)	2.35	2.39	2.32	2.57
Wealth				
Wealth	$49,939	$94,018	$69,017	$159,763
Home Wealth	$13,722	$22,982	$19,537	$32,007
Starting Capital				
Starting Capital (Mean)		$50,508	$35,715	$90,555
Starting Capital (Median)		$3,463	$2,033	$19,633
None needed		17%	21%	5%
Employees				
Employees (Mean)		2.7	0.7	8.2
Employees (Median)		0.0	0.0	2.0

Note: The table provides summary statistics on individuals and their businesses while differentiating by whether the person is not a business owners (Employed), a business owners (Total), and if the person is a business owners, the legal form of the business (Unincorporated or Incorporated). The data are from the 2010 and 2012 business ownership part of the NLSY79 survey. Individuals are classified as incorporated or unincorporated only if the legal form of the business from the business ownership part of the NLSY79 survey is confirmed by the individual employment type part of the survey. For the Sources of starting capital, the respondents indicate with each category was an actual component of the capital used to start the business. We examine full-time, full-year individuals. Appendix Table 1 provides variable definitions.

TABLE II
SELECTION ON WAGES AND HOME WEALTH: LOGIT AND M-LOGIT

	Logit	Multinomial Logit	
	Self Employed	Unincorporated	Incorporated
	(1)	(2)	(3)
Wages (25-29)	-0.1851***	-0.3713***	0.3139**
	(0.0587)	(0.0653)	(0.1491)
Smart & Illicit	-0.0861	-0.2683**	0.5198**
	(0.1198)	(0.1324)	(0.2628)
Home Wealth (*t-2*)	0.0654***	0.0344	0.1607***
	(0.0148)	(0.0246)	(0.0213)
Observations	93,755	93,755	93,755
R-Squared	0.0258	0.0912	0.0912

Notes: This table reports logit (columns 1) and multinomial logit (columns 2-3) analyses of selection into different employment types in year *t* on early career salaried wages (Wages (25-29)), Smart & Illicit (which is a zero-one indicator that equals one if the individual had above the median values of AFQT and Illicit in the initial years of the sample), and the net value of the individual's home in year *t-2* (Home Wealth (*t-2*)). In columns (1), the dependent variable is an indicator variable of whether the individual is self-employed (either unincorporated or incorporated) in year *t*. Columns (2-3) report the results of multinomial logit regressions, where we do not report the results on unpaid family and other business ownership categories. All regressions include Mincerian characteristics (a quartic expression for potential work experience and dummy variables for six education categories), measures of cognitive and non-cognitive traits (AFQT, Rosenberg self-esteem, Rotter Locus of Control), as well as gender-year, race-year, and state fixed effects. Since the data on home wealth begins in sample year 1985 and we restrict the sample to individuals with data on home wealth in *t-4*, the sample starts in 1989. The sample also excludes individuals who were self-employed in either *t-2* or *t-4*. Appendix Table 1 provides variable definitions. Heteroskedasticity robust standard errors, clustered at the individual level are in parentheses, where *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

TABLE III
SELECTION ON WAGES AND HOME WEALTH: OLS

	Self Employed			Unincorporated			Incorporated		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Wages (25-29)	-0.0058***	-0.0036	-0.0039	-0.0074***	-0.0039	-0.0042	0.0015**	0.0003	0.0002
	(0.0020)	(0.0037)	(0.0037)	(0.0018)	(0.0035)	(0.0035)	(0.0008)	(0.0018)	(0.0018)
Smart & Illicit	-0.0027			-0.0074**			0.0046**		
	(0.0039)			(0.0034)			(0.0019)		
Home Wealth (t-2)	0.0025***	0.0018**		0.0003	0.0004		0.0022***	0.0013**	
	(0.0007)	(0.0008)		(0.0005)	(0.0006)		(0.0005)	(0.0005)	
Home Wealth (t+2)			0.0005			0.0001			0.0004
			(0.0008)			(0.0006)			(0.0005)
Individual FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Observations	93755	93755	88448	93755	93755	88448	93755	93755	88448
R-square	0.0074	0.2545	0.2672	0.0073	0.2498	0.2623	0.0158	0.2454	0.2573

Notes: This table reports OLS analyses of selection into different employment types in year *t* on early career salaried wages (Wages (25-29)), Smart & Illicit (which is a zero-one indicator that equals one if the individual had above the median values of AFQT and Illicit in the initial years of the sample), and the net value of the individual's home in year *t-2* (Home Wealth (*t-2*)). As a falsification test, columns 3, 6, and 9, examine the net value of the individual's home in year *t+2 (Home Wealth (t+2)).* The dependent variable is a one-zero indicator variable of whether the individual is self-employed (columns 1-3), unincorporated self-employed (columns 4-6), or incorporated self-employed (columns 7-9) in year *t* . All regressions include Mincerian characteristics (a quartic expression for potential work experience and dummy variables for six education categories), measures of cognitive and non-cognitive traits (AFQT, Rosenberg self-esteem, Rotter Locus of Control), as well as gender-year, race-year, and state fixed effects. As indicated, all regressions, except those reported in columns 1, 4, and 7 include individual fixed effects. Since the data on home wealth begins in sample year 1985 and we require values of home wealth in t-4, the sample starts in sample year 1989. The sample also excludes individuals who were self-employed in either *t-2* or *t-4* . The sample if smaller in columns 3, 6, and 9 because the analyses require nonmissing values on Home Wealth in *t+2* . Appendix Table 1 provides variable definitions. Heteroskedasticity robust standard errors, clustered at the individual level are in parentheses, where *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

TABLE IV
SELECTION ON WAGES AND SHOCKS TO HOME WEALTH

	Home Wealth		Self-Employed	Unincorporated	Incorporated
	(OLS)	(OLS-FE)	(Logit)	(Multinomial Logit)	
	(1)	(2)	(3)	(4)	(5)
Wages (25-29)	0.1064***	0.0264	-0.1825***	-0.3637***	0.3143**
	(0.0138)	(0.0184)	(0.0585)	(0.0648)	(0.1496)
Smart & Illicit	-0.0371		-0.0853	-0.2718**	0.5244**
	(0.0310)		(0.1197)	(0.1322)	(0.2629)
Home Wealth(t-4)*g(t-4, t-1)	0.6265***	0.4883***	-0.0001	-0.0711	0.1566**
	(0.0748)	(0.0735)	(0.0482)	(0.0790)	(0.0769)
g(t-4, t-1))	0.3742***	0.3718***	0.2357	0.4295*	-0.8995*
	(0.0585)	(0.0595)	(0.2057)	(0.2231)	(0.5303)
Home Wealth (t-4)	0.7575***	0.4993***	0.0650***	0.0177	0.1679***
	(0.0246)	(0.0322)	(0.0163)	(0.0280)	(0.0228)
Observations	93755	93755	93755	93755	93755
R-Squared	0.5444	0.6475	0.0229	0.0867	0.0867

This table reports analyses of selection into different employment types in year t on Wages (25-29)), Smart & Illicit, and a Bartik instrument for changes in home wealth (Home Wealth(t-4)*g(t-4, t-1)), where Home Wealth(t-4) is the individual's net home wealth in year *t-4*, and g(t-4, t-1) is the growth rate in state housing prices between year *t-4* and year *t-1* for the state in which the individual lives. Columns (1-2) report OLS regressions in which the dependent variable is the individual's net home wealth in year *t*, where column (2) includes individual fixed effects. In column (3), the dependent variable is a one-zero indicator variable of whether the individual is self-employed in year *t*. In columns (4-5), the dependent variable is a one-zero indicator of employment type, where the reported categories are unincorporated and incorporated respectively, and the unreported categories are salaried, unpaid family, and other business ownership. All regressions include Mincerian characteristics (a quartic expression for potential work experience and dummy variables for six education categories), measures of cognitive and non-cognitive traits (AFQT, Illicit, Rosenberg self-esteem, Rotter Locus of Control), as well as gender, race, year, and state fixed effects. Since the data on home wealth begins in sample year 1985 and we require values of home wealth in *t-4*, the sample starts in 1989. We exclude individuals who were self-employed in either *t-2* or *t-4*. Appendix Table 1 provides variable definitions. Heteroskedasticity robust standard errors, clustered at the individual level are in parentheses, where *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

TABLE V

SELECTION ON WAGES AND SHOCKS TO HOME WEALTH: DIFFERENTIATING BY ILLICIT

	Unincorporated (Multinomial Logit)	Unincorporated (Multinomial Logit)	Incorporated (Multinomial Logit)	Incorporated (Multinomial Logit)
	(1)	(2)	(3)	(4)
Wages (25-29)	-0.3637***	-0.3653***	0.3143**	0.0703
	(0.0648)	(0.0869)	(0.1496)	(0.1779)
Smart & Illicit	-0.2718**	-0.2729*	0.5244**	0.3998
	(0.1322)	(0.1393)	(0.2629)	(0.2739)
Home Wealth(t-4)*g(t-4, t-1)	-0.0711	-0.0711	0.1566**	0.1541**
	(0.0790)	(0.0790)	(0.0769)	(0.0781)
g(t-4, t-1))	0.4295*	0.4297*	-0.8995*	-0.8992*
	(0.2231)	(0.2231)	(0.5303)	(0.5295)
Home Wealth (t-4)	0.0177	0.0177	0.1679***	0.1684***
	(0.0280)	(0.0280)	(0.0228)	(0.0228)
Wages (25-29)*Illicit		0.0031		0.5479*
		(0.1181)		(0.2841)
Observations	93755	93755	93755	93755
R-Squared	0.0914	0.0915	0.0914	0.0915

This table reports analyses of selection into different employment types in year t on Wages (25-29)), Smart & Illicit, the interaction between early career salaried waged and Illicit (Wages (25-29)*Illicit), and a Bartik instrument for changes in home wealth (Home Wealth(t-4)*g(t-4, t-1)), where Home Wealth(t-4) is the individual's net home wealth in year *t-4* , and g(t-4, t-1) is the growth rate in state housing prices between year *t-4* and year *t-1* for the state in which the individual lives. The dependent variable is a one-zero indicator of employment type, where the reported categories are unincorporated and incorporated respectively, and the unreported categories are salaried, unpaid family, and other business ownership. All regressions include Mincerian characteristics (a quartic expression for potential work experience and dummy variables for six education categories), measures of cognitive and non-cognitive traits (AFQT, Illicit, Rosenberg self-esteem, Rotter Locus of Control), as well as gender, race, year, and state fixed effects. Since the data on home wealth begins in sample year 1985 and we require values of home wealth in *t-4* , the sample starts in 1989. We exclude individuals who were self-employed in either *t-2* or *t-4* . Appendix Table 1 provides variable definitions. Heteroskedasticity robust standard errors, clustered at the individual level are in parentheses, where *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

TABLE VI
EMPLOYMENT TYPES VS. STATE UNEMPLOYMENT: NLSY79

	Worker	Salaried	Self-employed	Unincorporated	Incorporated
Panel A: Employment Type vs. State Unemployment					
State Unemployment	-0.782***	-0.962***	0.180	0.268***	-0.088*
	(0.137)	(0.167)	(0.110)	(0.100)	(0.052)
Mean	0.892	0.807	0.085	0.068	0.017
Observations	161518	161518	161518	161518	161518
R-square	0.068	0.041	0.020	0.013	0.015
Panel B: Employment Type vs. State Unemployment Including Individual Fixed Effects					
State Unemployment	-0.698***	-0.890***	0.193**	0.283***	-0.091**
	(0.087)	(0.109)	(0.077)	(0.070)	(0.039)
R-square	0.422	0.438	0.418	0.387	0.367
Observations	161518	161518	161518	161518	161518

Notes: This table reports OLS regression results of employment types, Worker, Salaried, Self-employed, Unincorporated, and Incorporated, on state unemployment. Panels A - B each reports the results of six OLS regressions, one for each employment type, where the dependent variable equals 1 if the person has the designated employment type in period *t* and 0 otherwise. In Panel B, the regressions control for individual fixed effects. Though not shown, all regressions control for schooling (measured in six categories), potential work experience (quartic), gender, race, state, and year-gender fixed effects, and lagged values of the dependent variable. The table also provides the means of the dependent variables. The sample includes who are least 25 years old. Appendix Table 1 provides variable definitions. Heteroskedasticity robust standard errors clustered at the state-year level are in parentheses, where *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

TABLE VII
EMPLOYMENT TYPES AND STATE UNEMPLOYMENT: FIRST DIFFERENCES

	Worker	Salaried	Self-employed	Unincorporated	Incorporated
Panel A: ΔEmployment Type vs. ΔState Unemployment					
ΔState Unemployment	-0.628***	-0.919***	0.291**	0.441***	-0.150**
	(0.154)	(0.193)	(0.143)	(0.132)	(0.068)
Observations	160108	160108	160108	160108	160108
R-square	0.409	0.311	0.195	0.209	0.156
Panel B: ΔEmployment Types vs. ΔState Unemployment: Individual Effects					
ΔState Unemployment	-0.615***	-0.912***	0.297**	0.456***	-0.159**
	(0.146)	(0.180)	(0.132)	(0.122)	(0.065)
R-square	0.514	0.438	0.340	0.347	0.283

Notes: This table reports OLS regression results of the change in employment type (Worker, Salaried, Self-employed, Unincorporated, and Incorporated) on the change in the state unemployment rate and a set of control variables. The dependent variable equals +1 if the individual moves into the indicated employment type between *t-2* and *t*; -1 if the person leaves the employment type; and 0 if the individual does not change designation with respect to the indicated employment type. Each panel reports the results of six OLS regressions, one for each employment type. Though not shown, all regressions control for schooling (measured in six categories), potential work experience (quartic), state, year-race, year-gender fixed effects, and lagged values of the dependent variable. The regressions in Panel B also control for individual fixed effects. Appendix Table 1 provides variable definitions. Heteroskedasticity robust standard errors clustered at the individual level are in parentheses, where *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

APPENDIX TABLE I:
VARIABLE DEFINITIONS AND SOURCES

Variable	Definition
1. Human capital	
AFQT	Armed Forces Qualifications Test score measures the aptitude and trainability of the respondent. Collected during the 1980 NLSY79 survey, the AFQT score is based on arithmetic reasoning, world knowledge, paragraph comprehension, and numerical operations. It is frequently employed as a general indicator of cognitive skills. This AFQT score is measured as a percentile of the NLSY79 survey, with a median value of 50.
Illicit	Illicit measures the aggressive, risk-taking, disruptive, "break-the-rules," behavior of individuals based on the 1980 NLSY79 survey. Taken from Levine and Rubinstein (2017), this index is based on 20 questions, where 17 concern delinquency, e.g., damaging property, fighting at school, shoplifting, robbery, using force to obtain things, assault, threatening to assault, drug use, dealing drugs, gambling, and so forth, and three are about interactions with the police, e.g., stopped by the policy, charged with an illegal activity, or convicted for activities other than minor traffic violations. For each question, a value of one is assigned if the person responds in 1980 that they engaged in that activity and zero otherwise. The average of the answers is then computed for each individual. Finally, we construct a standardized version by subtracting the sample mean and dividing by the standard deviation to create a mean zero, standard deviation of one indicator of illicit activity.
Smart & Illicit	Smart & Illicit equals one if the individual's AFQT score is greater than or equal to 50 and Illicit is greater than or equal to zero and Smart & Illicit equals zero otherwise.
Rosenberg self-esteem (standardized)	Rosenberg Self-Esteem score is based on a ten-part questionnaire given to all NLSY79 participants in 1980. It measures the degree of approval or disapproval of one’s self. The values range from six to 30, where higher values signify greater self-approval. Rosenberg Self-Esteem (standardized) standardizes the score, so that it has a mean of zero and a standard deviation of one.
Rotter locus of control (standardized)	Rotter Locus of Control measures the degree to which respondents believe they have internal control of their lives through self-determination relative to the degree that external factors, such as chance, fate, and luck, shape their lives. It was collected as part of a psychometric test in the 1979 NLSY79 survey. The Rotter Locus of Control ranges from 4 to 16, where higher values signify less internal control and more external control. This is standardized, so that it has a mean of zero and a standard deviation of one.
Years of schooling	The respondent’s maximum number of years of schooling, so it does not vary over time for a respondent.

College graduate	Graduated from college or obtained an advanced degree.
Educational Attainment	The six educational attainment categories: (i) high school dropouts: less than 12 years of schooling (ii) GED degree (iii) high school graduates: 12 years of schooling (iv) had some college education: 13-15 years of schooling (i) college education: 16 years of schooling (vi) advanced studies: 17+ years of schooling. These are measured at the end of the respondent's educational experience, so that they do not vary over time for a respondent.
Potential Experience	Age of the respondent minus the years of schooling minus six, or, if this computation is less than zero, then potential experience set equal to zero.
Female	Equals one if the respondent reports being female and zero otherwise.
Black	Equals one if the respondent reports being Black and zero otherwise.
Hispanic	Equals one if the respondent reports being Hispanic and zero otherwise.

2. Collateral, Wealth, and Earnings

Home Wealth	The market value of the respondent's home net of any mortgages.
Wealth	Created by summing all asset values and subtracting all debts.
Wages (25-29)	When the respondent if 31 or more years old, Wages (25-20) equals the respondent's average log real wages (2010 prices) as a salaried employee when the respondent is 25-29 years old. When the respondent is 27-30 years old, Wages (25-29) equals the individual's average log real hourly earnings as a salaried employee at the age of *t-2*.
Earnings	Wages plus income from business. Deflated by the CPI corresponding to when those earnings were realized. Earnings are in 2010 prices.

3. Employment Types

Unincorporated	If a respondent is self-employed, the NLSY79 further asks whether the business is incorporated or not. If the respondent is self-employed and the business is unincorporated, then Unincorporated Self-employed equals one and it is zero otherwise.
Incorporated	If a respondent is self-employed, the NLSY79 further asks whether the business is incorporated or not. If the respondent is self-employed and the business is incorporated, then Incorporated Self-employed equals one and it is zero otherwise. See Levine and Rubinstein (2017) for additional coding
Self-employed	From the NLSY79's unified class of worker (R24455.10), there are four responses for working respondents: (1) Private company, including non-profit, (2) government, (3) self-employed, and (4) those working without pay, including in family businesses. We set Self-employed equal to one if the respondent's class of worker is "(3)" and zero otherwise.
Salaried	From the NLSY79's unified class of worker (R24455.10), there are four responses for working respondents: (1) Private company, including non-profit, (2) government, (3) self-employed, and (4) those working without pay, including in family businesses. We set Salaried equal to one if the respondent's class of worker is either "(1)" or "(2)"and zero otherwise.
Unpaid family business	Equals one if the respondent indicates that they are unpaid and work in a family business and zero otherwise.

4. Legal Form of Business

Unincorporated (B)	Equals one if the respondent indicates that the legal form of the business is a sole proprietorship and zero otherwise. This information is obtained from the business ownership part of the NLSY79 that was given in survey years 2010 and 2012.
Incorporated (B)	Equals one if the respondent indicates that the legal form of the business is either (a) a partnership or limited liability partnership, (b) a limited liability corporation, (c) a sub-chapter S corporation, or (d) a general corporation and zero otherwise. This information is obtained from the business ownership part of the NLSY79 that was given in survey years 2010 and 2012.
Other Business (B)	Equals one if the respondent indicates that the legal form of the business is either (a) a nonprofit organization or (b) other and zero otherwise. This information is obtained from the business ownership part of the NLSY79 that was given in survey years 2010 and 2012.

6. State-Year Characteristics

g(x,y)	The growth rate in state housing prices between years x and y. The Federal Housing Finance Agency provides house price indices by state and year.
ΔUnemployment	The change in the unemployment rate in the respondent's state over the preceding twelve months. In particular, the Bureau of Labor Statistics produces data on state unemployment for each month. The NLSY79 gives the date when each person was sampled. We compute change in the state's unemployment over the preceding twelve months from the date of the interview.

Notes:

(1) All data are from the NLSY79 unless otherwise indicated.

(2) The NLSY79 is a representative survey of 12,686 individuals who were 15-22 years old when they were first surveyed

(3) We use the sampling weights provided by the NLSY79.

(4) In Table 1, which covers the survey years 2010 and 2012, we classify an individual as incorporated if both Incorporated and Incorporated (B) indicate that the individual is an incorporated business owner for the 2010 (2012) survey. We get very similar results if we instead use only the business survey (Incorporated (B) to classify the legal form of the business. The same holds for unincorporated business owners.

APPENDIX TABLE II
EARNINGS BY EMPLOYMENT TYPE AND EARLY SALARIED WAGES

Panel A: Earnings vs. early salary wages, standard controls

	Log Hourly Earnings (31+)			
	Salaried	Self-Employed	Unincorporated	Incorporated
	(1)	(2)	(3)	(4)
Wages (25-29)	0.510***	0.2367*	0.067	0.936***
	(0.036)	(0.1369)	(0.147)	(0.322)
Observations	41015	3488	2568	920
R-square	0.101	0.0732	0.102	0.104

Panel B: Earnings vs. early salary wages, standard controls and state-year effects

	Log Hourly Earnings (31+)			
	Salaried	Self-Employed	Unincorporated	Incorporated
	(5)	(6)	(7)	(8)
Wages (25-29)	0.5105***	0.2198	0.0275	1.0058**
	(0.0364)	(0.1480)	(0.1675)	(0.4282)
Observations	41015	3488	2568	920
R-square	0.1138	0.2039	0.2698	0.3631

Notes: This table provides regression results of log hourly earnings in year t on an individual's average log wages as a salaried employee during the ages of 25 through 29 (Wages (25-29)). All regressions include "standard controls:" Mincerian characteristics (a quartic expression for potential work experience and dummy variables for six education categories), measures of cognitive and non-cognitive traits (AFQT, Rosenberg self-esteem, Rotter Locus of Control), as well as race, gender, year, and state fixed effects. In Panel B, the regressions also include state-year fixed effects. As indicated, each regression includes the subsample of individuals who are salaried (columns 1-5), self-employed (columns 2-6), unincorporated self-employed (columns 3-7), or incorporated self-employed (columns 4-8) in year *t* . The sample includes full-time, full-year workers who are 31 years of age or older. Appendix Table 1 provides variable definitions. Heteroskedasticity robust standard errors, clustered at the individual level are in parentheses, where *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

APPENDIX TABLE III

SELECTION ON WAGES AND SHOCKS TO HOME WEALTH: FALSIFICATION TEST

	Self-Employed (Logit)	Unincorporated (Multinomial Logit)	Incorporated (Multinomial Logit)
	(1)	(2)	(3)
Wages (25-29)	-0.1831***	-0.3670***	0.3162**
	(0.0587)	(0.0651)	(0.1497)
Smart & Illicit	-0.0865	-0.2705**	0.5254**
	(0.1197)	(0.1323)	(0.2625)
Home Wealth(t-4)*g(t, t+4)	0.0818	0.1660	0.0719
	(0.0773)	(0.1113)	(0.1248)
g(t, t+4))	0.0619	-0.1745	1.3717***
	(0.2437)	(0.2751)	(0.5323)
Home Wealth (t-4)	0.0618***	0.0069	0.1737***
	(0.0175)	(0.0301)	(0.0252)
Observations	93722	93755	93755
R-Squared	0.0258	0.0914	0.0914

This table reports analyses of selection into different employment types in year t on Wages (25-29)), Smart & Illicit, and a Bartik instrument for changes in home wealth (Home Wealth(t-4)*g(t, t+4)), where Home Wealth(t-4) is the individual's net home wealth in year t-4, and g(t, t+4) is the growth rate in state housing prices between year *t+1* and year *t+4* for the state in which the individual lives. In column (1), the dependent variable is a one-zero indicator variable of whether the individual is self-employed in year *t*. In columns (2-3), the dependent variable is a one-zero indicator of employment type, where the reported categories are unincorporated and incorporated respectively, and the unreported categories are salaried, unpaid family, and other business ownership. All regressions include Mincerian characteristics (a quartic expression for potential work experience and dummy variables for six education categories), measures of cognitive and non-cognitive traits (AFQT, Illicit, Rosenberg self-esteem, Rotter Locus of Control), as well as gender, race, year, and state fixed effects. Since the data on home wealth begins in sample year 1985 and we require values of home wealth in *t-4*, the sample starts in 1989. We exclude individuals who were self-employed in either *t-2* or *t-4*. Appendix Table 1 provides variable definitions. Heteroskedasticity robust standard errors, clustered at the individual level are in parentheses, where *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively

APPENDIX TABLE IV
EMPLOYMENT TYPES AND HOURS OVER THE BUSINESS CYCLE: CPS

	Worker	Salaried	Self-employed	Unincorporated	Incorporated
Panel A: Employment Type vs. State Unemployment: OLS					
State Unemployment	-0.530***	-0.610***	0.080***	0.113***	-0.032*
	(0.042)	(0.047)	(0.026)	(0.023)	(0.019)
Mean	0.843	0.756	0.087	0.059	0.028
Observations	2199569	2199569	2199569	2199569	2199569
R-square	0.076	0.034	0.030	0.016	0.020
Panel B: Employment Type vs State Unemployment: Multinomial Logit					
	Not Working	Salaried	Self-employed	Unincorporated	Incorporated
State Unemployment	4.418***			2.654***	-0.805
	(0.354)			(0.400)	(0.713)

Notes: This table reports OLS and multinomial logit regression results of each employment type (Worker, Salaried, Self-employed, Unincorporated, and Incorporated,) on state unemployment using the CPS. Panel A reports the results of five OLS regressions, one for each employment type. The dependent variable is the proportion of individuals in the specified employment type. Panel C reports multinomial logit regression results, where the dependent variable is the log-odds of being in the indicated employment type rather than a salaried worker. Though not shown, all regressions control for race, schooling (measured in six categories), potential work experience (quartic), state fixed effects, and year-gender fixed effects. Panel A also report the means of the dependent variables. Heteroskedasticity robust standard errors clustered at the state-year level are in parentheses, where *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

Figure I: Selection into Employment Types by Entrepreneurial Ability

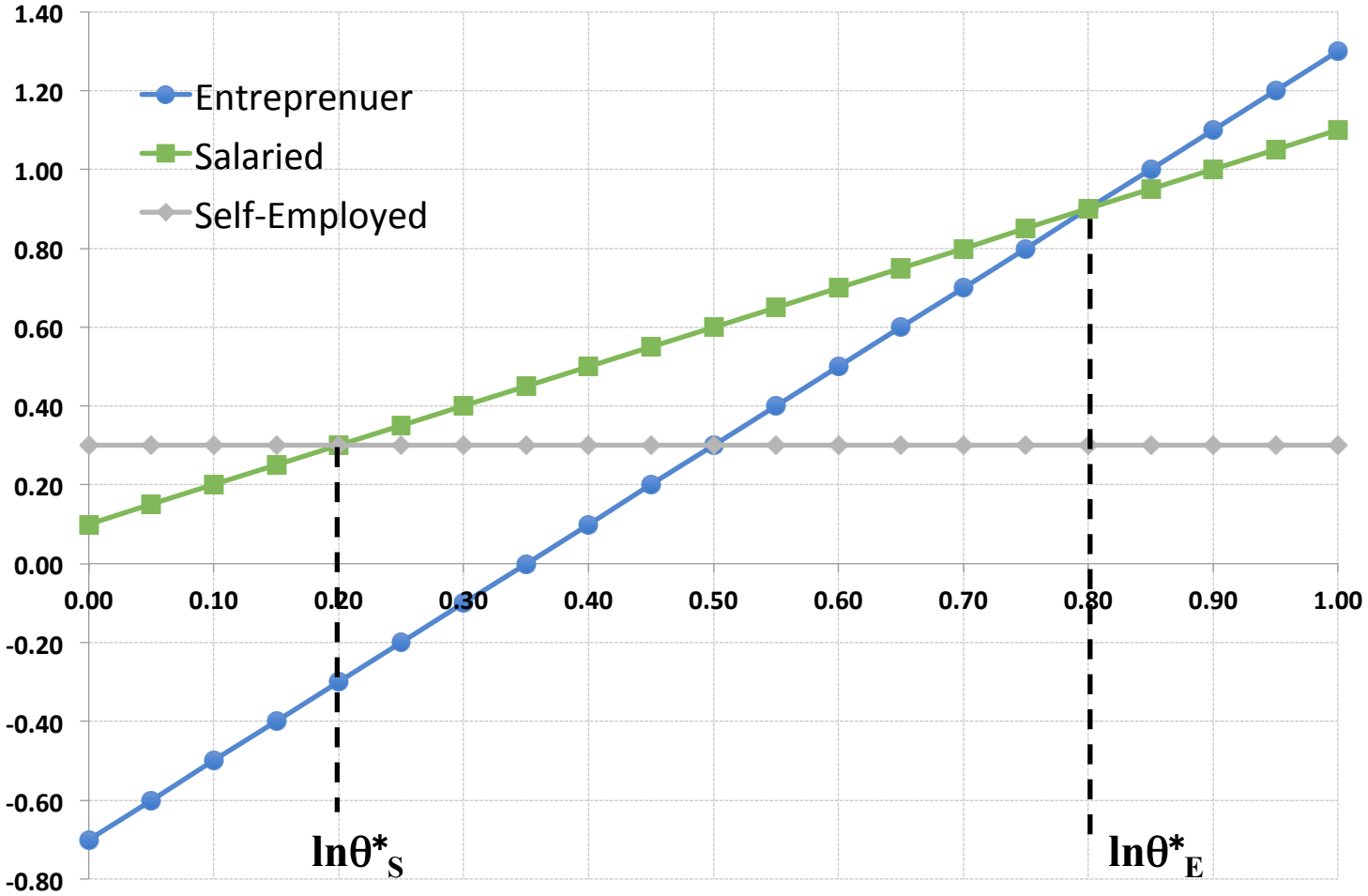

Figure I illustrates the relationship between the log utility in each employment type and the log of entrepreneurial ability ($ln\theta$). The horizontal line represents the log utility of other self-employment (lnV_{Ui}) and equals $\varepsilon_{Ui} + \delta_{Ui}$. The upward sloping line with squares is the log utility of salaried employment (lnV_{Si}), where the slope is ρ_S. lnV_{Si} intersects lnV_{Ui} at the first cutoff level of entrepreneurial ability: $ln\theta_S^*$. The upward sloping line with circles is the log utility of entrepreneurship (lnV_{Ei}), where the slope is ρ_E', and where lnV_{Ei} intersects lnV_{Si} at the second cutoff level: $ln\theta_E^*$.

Figure II: Selection into Employment Types: Tightening Liquidity Conditions

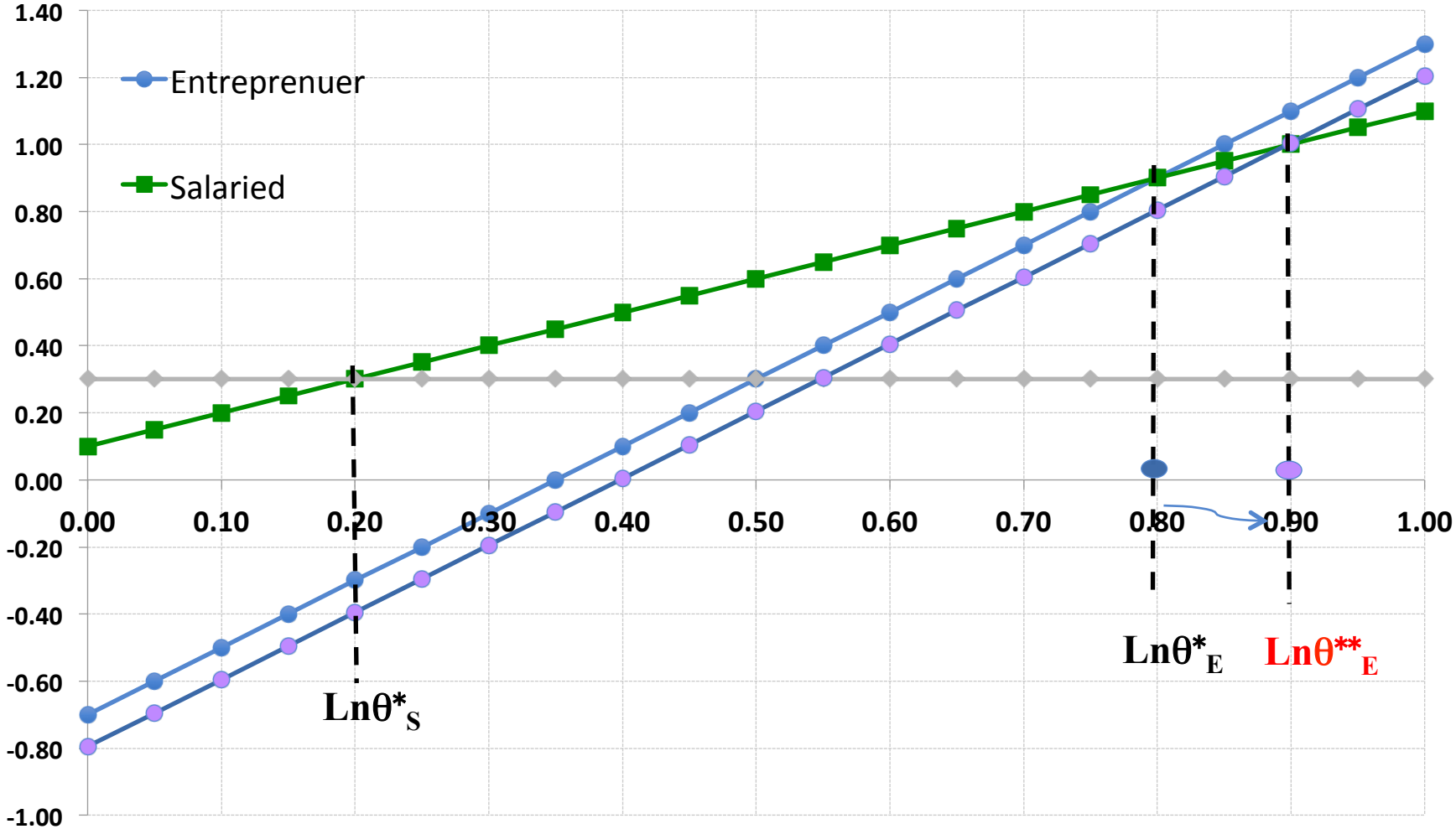

Figure II illustrates the change in selection into each employment type when credit conditions tighten, i.e., when r_i increases. The horizontal line represents the log utility of other self-employment (lnV_{Ui}); the upward sloping line with squares is the log utility of salaried employment (lnV_{Si}), where the slope is ρ_S, and the upward sloping line with circles is the log utility of entrepreneurship (lnV_{Ei}), where the slope is ρ'_E. lnV_{Si} intersects lnV_{Ui} at the first cutoff level of entrepreneurial ability: $ln\theta^*_S$. lnV_{Ei} intersects lnV_{Si} at the second cutoff level: $ln\theta^*_E$. When credit conditions tighten this shifts downward the intercept of the line for the log utility of entrepreneurship, constraining entry into entrepreneurship. Changes in r_i, however, do not alter the intercepts or slopes of the other lines and therefore liquidity conditions do not affect entry into other self-employment.

Figure III: Selection into Employment Types: A Recession

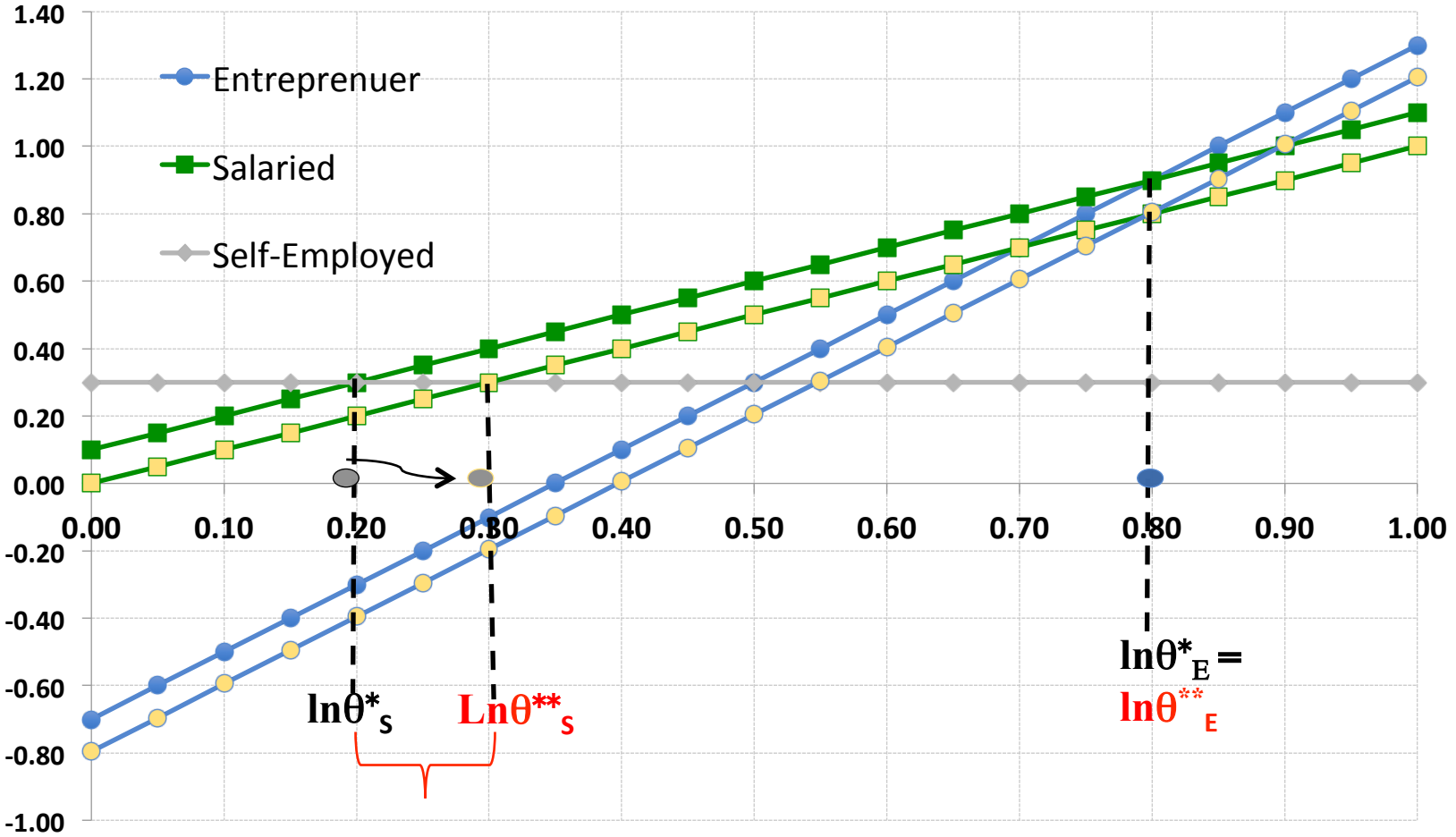

Figure III illustrates the change in selection into each employment type when there is a recession that tightens credit conditions and reduces the demand for salaried workers. The tightening of liquidity conditions involves a parallel fall in the log utility of entrepreneurship line (lnV_{Ei}), i.e., the upward sloping line with circles. As shown, this tightening reduces selection into entrepreneurship but has no effect on entry into other self-employment, i.e., the liquidity effect exerts a procyclical influence on entrepreneurship, but not on other self-employment. The reduction in the demand for salaried workers involves a parallel fall in the log utility of salaried employment (lnV_{Si}) line, i.e., the upward sloping line with squares. This labor demand effect exerts a countercyclical influence on both entrepreneurship and other self-employment. The figure depicts the special case when liquidity and labor demand effects exactly counterbalance each other with respect to entrepreneurship.