The Right Stuff? Personality and Entrepreneurship*

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Abstract: A puzzling feature of entrepreneurship is that many individuals are self-employed even though they would earn more in paid employment. To shed light on this puzzle, we examine the role of personality traits in determining entrepreneurial decisions and earnings. We estimate a model in which agents maximize expected utility by choosing between self and paid employment. We allow personality traits to affect earnings in each sector along with underlying preferences over sectors. We find that the personality traits that make entrepreneurship profitable are not always the same personality traits that drive people to open their own business. This means that, in terms of personality traits, individuals who would be the highest earning entrepreneurs are not always the individuals who choose to be entrepreneurs. We go on to use the estimated model to assess various policies designed to encourage entrepreneurship. In general, we find that these policies either subsidize businesses that would have been started without a subsidy or that they attract individuals with personality traits associated with preferences for entrepreneurship, but who have low-quality business ideas.

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1 Introduction

Entrepreneurship has occupied economic thought for nearly a century. This sustained interest reflects a widely-held view that individuals pursuing their own business ventures drive innovation and economic growth (Schumpeter, 1949). Entrepreneurship, however, remains poorly understood. Most small businesses fail, but it is unclear why some individuals are successful entrepreneurs while others are not. Even more puzzling is the fact that many individuals who remain self-employed would earn more in traditional, paid employment (Hamilton, 2000). Recent research in economics has led to the acknowledgement of the role of non-cognitive or *soft* skills—including personality traits—in driving economic behavior like labor supply.[1] This shift raises the question: could personality differences explain which individuals become entrepreneurs and—among those who enter—which ones succeed?

In this paper, we examine the role of personality traits in determining entrepreneurial decisions and earnings. We estimate a model in which agents who face credit constraints maximize utility by choosing between self and paid employment. Personality can affect earnings in each sector and can also capture underlying preferences over sectors. In the model, we also exploit multiple measures of personality taken over the lifecycle to identify the distributions of latent, stable personality traits, thus circumventing possible mis-measurement issues associated with standard personality assessments. Using our setup, we obtain sector-specific market prices of latent personality traits along with estimates of how personality links to preferences over sectors.

The model captures two reasons why agents opt for a sector generating low relative earnings. The first is credit constraints, which potentially prevent good business ideas from being realized since individuals lack the resources to invest in them sufficiently. The second is preferences. If an agent prefers self-employment and is relatively more productive in paid employment—and if this discrepancy is strong enough—he may choose to open his own business despite the fact that he would earn more as a paid employee. Both sources of friction might lower the average value of business ideas that make it to market. Which ideas are realized is an important and policy relevant consideration as it affects job creation, tax revenues and the menu of available products. Further, if innovation is path-dependent, the set of ideas that are currently realized also influences the sequence of future innovations.

Using data from the 1995 and 2004 waves of the National Survey of Midlife Development in the United States (MIDUS), the estimated model reveals that individual differences in

[1] Economists have yet to settle on the nomenclature. In this paper, we focus on "personality traits" which we sometimes refer to collectively as "personality". In our discussion, we view personality traits as a subset of "non-cognitive skills", which are also known in the literature as "soft skills" or "non-cognitive traits".

personality help to explain what appear to be puzzling entrepreneurial decisions. Our main result is that the personality traits that make entrepreneurship most profitable are not the same personality traits that drive people to open their own business. The starkest illustration of this dichotomy involves the trait "openness to new experiences". Income-maximizing individuals with this trait would do better to remain in paid employment, where their relative earnings are higher. However, individuals that are open to new experiences also reveal a preference for entrepreneurship and thus start businesses with low returns if they choose self-employment. We also show that credit constraints play a fairly minor role in driving entrepreneurial decisions. We find limited evidence that these constraints deter relatively low-productivity entrepreneurs from developing their business ideas, although they may lead to sub-optimal enterprise scale.

We assess various policies that have been proposed to encourage entrepreneurship. In particular, we consider subsidies that essentially pay people to open their own business and also examine tournaments, where a subsidy is offered to support the best business ideas.[2] We show that these policies are largely ineffective. One reason is that they subsidize businesses that would have been started absent support. Alternatively, such payments attract individuals into entrepreneurship who possess traits associated with preferences for self-employment, but whose ideas generate low income. The result of these policies is an increase in entry but a decline in the average pecuniary value of realized business ideas. These findings suggest that policies that encourage entrepreneurship—even those that support the best business ideas—are inefficient.

Our findings on personality traits and self-employment highlight a broader and more general point regarding analyses of non-cognitive skills. Though most agree that better health or stronger cognitive skills improve expected outcomes on most dimensions, it is difficult to think of non-cognitive skills as being good or bad *per se*. Personality can have mixed effects. A trait may yield higher earnings or utility in one sector and lower earnings or utility in another. For example, the trait openness to new experiences has complicated effects: it carries an income penalty in precisely the sector where it also confers the highest utility. The notion that non-cognitive skills can have different impacts in different sectors has received surprisingly little attention in previous work. One notable exception is Lundberg (2012), who shows that the returns to personality factors vary both by tenure and by educational group, suggesting that different personality traits may enhance productivity in some occupations, but not others.[3] At the very least, heterogeneity in the impact of non-cognitive

[2]The tournament structure we consider is similar to the mechanism used by many business plan competitions in which the best business ideas receive financial grants or equity investments.

[3]See also Almlund et al. (2011), who stress the importance of accounting for varying returns to non-

skills suggests that policies designed to influence them could have positive or negative effects depending on the individual, sector or scenario.[4]

This study contributes to three separate literatures. The first studies the decision to open a business. In a seminal paper, Evans and Jovanovic (1989) show that credit constraints are binding for many would-be entrepreneurs, so that individuals with especially profitable ideas, but few assets, are unable to pursue their business venture.[5] Building on this work and using a similar conceptual framework, Paulson, Townsend, and Karaivanov (2006) show that credit constraints alone cannot explain why good business ideas are not pursued and that moral hazard also plays a role. Both these papers suggest that some paid employees would be successful entrepreneurs were it not for market imperfections. On the other hand, Hamilton (2000) shows that many entrepreneurs who are "successful" in that their businesses have not failed would have earned more had they remained in traditional, paid employment.[6] This finding may reflect important non-pecuniary benefits to self-employment, such as autonomy.[7] Taken together, this research leads to the following somewhat startling conclusion: entrepreneurship does not necessarily attract the subset of individuals for whom it would generate the highest pecuniary returns. If so, society may lose out on valuable innovations that could increase wealth, raise employment and tax revenue, improve the quality of available goods and, perhaps most importantly, spur future innovation.

A second related literature, much of it from personnel psychology, studies how measurements of personality traits relate to job performance and job satisfaction. The correlations discussed in this research are intriguing and highlight the importance of including personality measurements in studies of entrepreneurship. For example, Barrick and Mount (1991) show that individuals who are open to new experiences are especially good trainees, perhaps since they are eager to try new things.[8] However, they are not necessarily better employees.

cognitive skills and Cattan (2011), who develops this point for traits related to an individual's self-confidence and attitudes towards women.

[4]For a review of interventions aimed at changing character traits for the better, see Heckman and Kautz (2013).

[5]Their framework is similar to a Roy model of sector choice as discussed in (Heckman and Honore, 1990).

[6]Levine and Rubinstein (2013) argue that the payoff to entrepreneurship may be higher than Hamilton (2000) suggests, though their analysis focuses on a subsample of entrepreneurs who may be non-randomly selected because they are already successful.

[7]In another key contribution to the literature on entrepreneurship, Lazear (2004) shows that a successful entrepreneur must be a "jack-of-all-trades" with a wide variety of skills. Our focus is different in that we emphasize the role of a fixed set of non-cognitive traits in determining entrepreneurial entry and returns whereas Lazear (2004) considers skills that are acquired or learned through optimal investments. Fairlie and Holleran (2012) and Fairlie, Karlan, and Zinman (2012) connect these two ideas, showing that personality can affect short-run responsiveness to a training program for entrepreneurs (though they find no evidence of long-run effects of the program).

[8]Section 2 provides a discussion of personality measures that are typically used in economic analysis and that will be used in this analysis.

In line with our results, this work shows that traits like openness to new experiences might have different impacts on labor market choices versus labor market performance.

More closely related to self-employment, Barrick and Mount (1993) show that two other traits, conscientiousness and extraversion, are associated with better job performance, especially for managers who exercise more autonomy at work. Since autonomy is a hallmark of self-employment, this finding suggests that the relationship between personality and success differs in paid versus self-employment. Further work from psychology has directly examined how self-employment and personality are connected, suggesting, for example, that entrepreneurs score highly on the trait openness to new experiences, which is generally consistent with our findings.[9] Research relating personality to job satisfaction has been inconclusive. Judge, Heller, and Mount (2002) study this connection and generally find very mixed results or zero correlations.[10] In general, these studies do not offer a consensus on the various mechanisms underlying relationships between personality and self-employment. The lack of a consensus may reflect the shortcomings of simple correlations: in particular, the inability to use correlations to explicitly account for selection or to distinguish between the impact of personality on earnings versus preferences. These shortcomings underscore the need for a model that takes explicit account of counterfactual earnings distributions to capture more nuanced linkages between personality traits and entrepreneurial decisions and returns.

A third, burgeoning literature to which we contribute incorporates non-cognitive skills and personality traits into economic models of rational decision-making. Much of this work can be traced to Heckman and Rubinstein (2001).[11] They show that non-cognitive skills can account for much more of the observed variance in sociodemographic outcomes than cognitive skills alone. Building on this work, economists have studied how personality traits and non-cognitive skills relate to a host of outcomes, including marriage (Lundberg, 2012, 2011), education (Barón and Cobb-Clark, 2010; Savelyev, 2010; Gensowski, Heckman, and Savelyev, 2011; Heckman and LaFontaine, 2010; Heckman, Pinto, and Savelyev, 2012) and health (Heckman, 2012). More closely related to our study are papers relating personality to labor market behavior (Heckman, Stixrud, and Urzua, 2006; Urzua, 2008; Wichert and

[9]These analyses include: Hisrich, Langan-Fox, and Grant (2007), Zhao and Seibert (2006), Brandstätter (2011), Zhao, Seibert, and Lumpkin (2010) and Rauch and Frese (2007).

[10]Further contributions to this line of work include: Mount, Barrick, and Stewart (1998), Berings, De Fruyt, and Bouwen (2004), Barrick, Mount, and Judge (2001), Costa Jr and McCrae (1995), Barrick and Mount (1993), Mount, Barrick, and Stewart (1998), Hurtz and Donovan (2000), Judge and Bono (2001), Roccas et al. (2002) and Stawski et al. (2010).

[11]Excellent summaries of the state of this line of research are found in Borghans et al. (2008) and Almlund et al. (2011). The techniques used in this literature draw upon Goldberger (1972) and Jöreskog and Goldberger (1975).

Pohlmeier, 2009; Heineck, 2010; Störmer and Fahr, 2013). This research has led to some particularly striking results, showing, for example, that non-cognitive skills differences can help explain education and earnings differences between men and women or between blacks and whites.

Comparatively little research has directly connected self-employment and non-cognitive skills. Notable exceptions include Hartog, Van Praag, and Van Der Sluis (2010), who examine "social ability" and entrepreneurial firms, albeit in a reduced-form setting, and Asoni (2010) who studies self-employment spells and self-confidence. Most similar to us, Caliendo, Fossen, and Kritikos (2011) relate personality to entry and tenure in self-employment. Like us, they focus on a set of widely-used personality traits that have been shown to be stable over the lifecycle. These are known as the *Big 5* and will be discussed in detail in Section 2. These authors find that openness and extraversion are important predictors of self-employment and that proxies for wealth are also correlated with self-employment. Our approach differs in three key respects. First, we explicitly model various features of selection into self-employment, which includes specification of counterfactual earnings distributions, sector preferences and credit constraints.[12] Second, we allow personality to affect both sector-specific preferences and earnings. Third, we use multiple measures of personality traits to identify stable latent factors rather than relying on a single, potentially mis-measured assessment.

The remainder of the paper proceeds as follows. After discussing the Big 5 personality traits in Section 2, we introduce the MIDUS data in Section 3. Section 4 describes the model and Section 5 discusses estimation. Sections 6-8 present results, including a discussion of parameter estimates (Section 6), an exploration of model implications (Section 7) and an assessment of counterfactual policies that encourage entrepreneurship (Section 8). Section 9 concludes.

2 The "Big Five" Personality Traits

A large literature in psychology has settled upon five traits (the Big 5), which summarize an individual's personality. These five are chosen using statistical models (often known as factor models) intended to focus attention on traits that are neither overlapping nor redundant. As with any rubric, there is some debate surrounding the Big 5, but they are attractive for a few reasons. Perhaps most appealing for economists, they appear to be stable over

[12] Caliendo, Fossen, and Kritikos (2011) do not account for expected earnings at all when explaining sector choices, though they do consider income from dividends and capital holdings.

the lifecycle (Caspi, 2000; Cobb-Clark and Schurer, 2012). This feature dispels concerns about simultaneity if the Big 5 are used as exogenous right-hand-side variables in regressions explaining economic behavior. One explanation for this permanence comes from evidence using data on twins suggesting a genetic basis for personality traits (Zhang et al., 2009; Shane et al., 2010; Shane and Nicolaou, 2013). Despite the possible role of genetics in determining personality traits, other evidence points to the possible mutability of character for children and adolescents (Heckman and Kautz, 2013). We bypass this problem as our study focuses on adults and since we exploit multiple assessments of a given individual's personality traits to identity the distribution of permanent components of latent personality traits. This approach will focus our attention on the economic importance of stable, latent traits that are measured (or possibly mis-measured) by standard personality assessments. A second reason the Big 5 are widely used is that research in psychology and, of late, economics, has found them to be highly predictive of a wide range of economically relevant behavior. A third and related reason, which is less conceptually driven, but highly pragmatic, is that widespread use of the Big 5 in psychology means that many data sets contain measurements of them. Originally proposed in Goldberg (1971), the Big five are: *agreeableness*, *extraversion*, *neuroticism*, *conscientiousness* and *openness to new experiences*. Characteristics and attributes that they embody, are listed in Table 1.

Table 1: The Big 5 Personality Traits

Personality Trait	Associated With:
Agreeableness	◇ Trust, altruism, lack of selfishness, kindness, affection, and other pro-social behaviors.
Extraversion	◇ Excitability, sociability, talkativeness, assertiveness, and high amounts of emotional expressiveness.
Neuroticism	◇ Emotional instability, anxiety, moodiness, irritability, and sadness.
Conscientiousness	◇ Thoughtfulness, good impulse control, goal-directed behaviors, rule consciousness, good organization and mindfulness of details.
Openness to New Experiences	◇ Imagination and insight; having a broad range of interests.

The Big 5 along with the attributes and characteristics that they are widely acknowledged as embodying.

Despite the growing and fruitful integration of personality measures into economic models, important conceptual problems remain (Almlund et al., 2011). Most problematic is

how (or even whether) personality fits within the utility paradigm in economics. Personality traits may reflect or be correlated with preferences. Alternatively, as Almlund et al. (2011) propose, personality and preferences may both reflect some deeper, as yet unknown characteristic, which drives human behavior. Some recent work has begun to address this issue, proposing models that explicitly link preferences with non-cognitive skills (Bowles, Gintis, and Osborne, 2001; Anderson et al., 2011). Bowles, Gintis, and Osborne (2001), for example, model personality as enhancing preferences. Other researchers have used laboratory experiments to ascertain how non-cognitive abilities relate to measures more familiar to economists, including preferences over risk, time and ambiguity (Dohmen et al., 2008, 2010; Fréchette, Schotter, and Trevino, 2011; Vandenberghe, St-Onge et al., 2008).

Nevertheless, it remains an open question how best to incorporate personality into economic models. If we accept that hours spent in each employment sector imply a distinct utility cost, our model effectively suggests that sector-specific utility costs can differ by personality. Agents with different personalities will then differ in their sector choices once we have controlled for differences in pecuniary returns in each sector. In this sense, and in line with the work of Lancaster (1966) (or even Stigler (1945)) on how utility is "produced", the utility cost of sector-specific production is itself the output of a production function that takes as its inputs the type of work along with personality traits. A further possibility is that personality traits affect the amount of effort or time used to produce a given amount of output in each sector so that the opportunity costs of production differ by personality traits in self versus paid employment. This thinking would align our model with the sort of framework proposed in Becker (1965), who emphasizes that preferences over consumption reflect how different goods take different amounts of time to consume.

Despite these conjectures, we do not claim to offer the final word on a complete mapping between standard preferences and personalty traits. However, rather than side-step the issue, we return to it when we discuss our parameter estimates. By carefully considering how each personality trait is interpreted, we suggest possible links between preferences, productivity and personality that are consistent with our findings and that could provide a useful set of ideas for future work. For example, we find that agreeable individuals tend to earn less in both paid and self-employment. Consistent with this finding, one interpretation of agreeableness is that it captures unselfish behavior. Understood this way, agreeableness is conceptually linked to other-regarding (or social) preferences, which have been shown to play an important role in a variety of economic contexts.[13]

[13]Further work on issues integrating personality into economics is found in Heckman and Kautz (2012), Roberts et al. (2011) and Borghans et al. (2011).

3 Data

We use data from the National Survey of Midlife Development in the United States, which studies midlife from an unusually rich variety of perspectives. Information is collected on the labor market choices and outcomes, physical health, and psychological well-being of a representative sample of working age men and women in the United States. Also included in the data set is a host of variables rarely seen in a representative sample, including measures of social responsibility, exposure to violence as a child and religiosity. Crucial for the present study, the MIDUS data set includes information on whether individuals are self-employed, their assets and standard measures of the Big 5 personality traits.[14]

MIDUS data collection occurred in two waves, the first (MIDUS I) in 1995 and the second (MIDUS II) in 2004. The sample surveyed in 1995 included over 7,100 men and women between ages 25 and 74 from the United States. The second wave surveyed a nationally representative subsample of 3,485 individuals with the goal of understanding the physical, health and psychological effects of aging. In our study, we use both waves of data, including each individual's answers on two personality assessments. Using both assessments helps us to circumvent possibly mis-measured personality traits (including the effect of aging on responses to personality assessments). In particular, we use multiple measures to identify the distribution of latent traits that are measured by the personality assessments.

In our study, we restrict attention to the sector choice (paid or self-employment) of male workers that are under age 65 in 2004. The subsample for analysis includes individuals who are not missing information on key explanatory variables, including personality assessments in both 1995 and 2004, or assets, which are measured in 1995. The fact that we use assets in 1995 to identify credit constraints in 2004 is not ideal, though preferable to using 2004 assets, which are measured at the same time as retrospective sector choice is measured. This means that assets measured in 2004 are potentially endogenous to sector choice. Of course, we would prefer to use assets measured in, say, 2003. Instead, 1995 assets provide a noisy measure of assets at the time of the decision to become self-employed, which we prefer to a possibly endogenous measure.

Summary statistics are found in Table 2 for the subsample used in our analysis and then separately for individuals in self versus paid employment. We also include differences in means between these two groups and p-values from t-tests of whether these differences are significant.[15] According to Table 2, entrepreneurs earn more, on average, than paid

[14]To our knowledge, only two previous papers in economics make use of the MIDUS data set. They are Lundborg (2013) and Cutler and Lleras-Muney (2010).

[15]A similar summary statistics table for all working-age males who participated in the second wave is found in Appendix B (Table B1).

employees. A possible explanation of this earnings differential is that entrepreneurship is more lucrative than paid employment. However, as Hamilton (2000) points out, these types of averages ignore selection into sectors. High earning entrepreneurs may earn the same or more in paid employment. In constructing the model estimated in this paper, it will therefore be important to take explicit account of sector choice, which requires us to specify the counterfactual earnings distributions that agents face when choosing between sectors.

Also important to the selection question is the possibility of credit constraints. Following Evans and Jovanovic (1989), we exploit data on assets to take account of possible credit constraints that would-be entrepreneurs face. Table 2 supports this possibility, showing that entrepreneurs, on average, have double the assets of paid employees. Moreover, this difference is not driven solely by a highly skewed distribution, i.e., by a small number of entrepreneurs with very high assets. By plotting histograms of assets for the full subsample and then separately by paid and self-employed individuals, we show that some part of the difference in assets comes from paid employees being more likely to have zero assets than the self-employed (see Figure 1). A natural question to ask is whether assets are a valid way to measure credit constraints as successful entrepreneurship may be correlated with higher assets and therefore endogenous to the choice to become self-employed. How this is handled will be discussed in the specification of the model. We follow Evans and Jovanovic (1989) and allow assets to influence the quality of business ventures.

Table 2 also reports average sociodemographic variables. We find that education, marriage, number of children and spouse's education do not seem to differ between sectors. However, spousal employment in 1995 is significantly higher for individuals who choose self-employment in 2004. There are many reasons why this might be the case, including the possibility of risk-sharing or access to benefits like subsidized health insurance. Entrepreneurs can effectively use their spouse's more steady employment or benefits as a safety net given the high probability of failure and the lack of benefits typical in self-employment.

Cognitive skill, as measured by *fluid cognitive ability* does not differ by sector, though some of the Big 5 personality traits do. For example, Table 2 shows that entrepreneurs tend to be more agreeable, extraverted and open to new experiences than paid employees. Other trait differences are not significant, though point to paid employees being more neurotic. Turning to sector choices, Table 3 reports probit estimates of the probability of entering self-employment in 2004 conditional on employment in 2004. We find that older people are more likely to enter self-employment as are individuals with more assets. In terms of personality traits, few are significant, except for openness, which significantly predicts entry. Here, it is important to note that the reduced-form sector choice model is similar to the sort of model estimated in previous work linking entrepreneurship and personality. The estimates

from this model highlight empirical regularities, but offer little in the way of a structural interpretation underlying these patterns. In particular, the reduced form model of sector choice does not take account of how personality might relate to differences in sector-specific earnings. Nor does it account for credit constraints, error in the measurement of personality traits or sector-specific preferences. As selection, counterfactual earnings, credit constraints and mis-measurement all potentially play a role in explaining how personality affects the decision to enter self-employment, we incorporate these features into a structural model of entry and returns, which we will subsequently estimate. We now turn to the specification of the model.

4 Model

In the model, agents begin by learning their entrepreneurial ability θ_i. Next, agents decide between paid and self-employment, choosing the option delivering the highest expected utility.[16] Utility for sector s is denoted V^s, where $s \in \{\text{SE}, \text{PE}\}$ with SE and PE referring to self-employment and paid employment, respectively. Utility in sector s is composed of income I^s and flow utility $\tilde{u}^s$. Each of these will be derived below.

4.1 Latent Factors and Measurements

Suppose there are J latent traits that affect entrepreneurial preferences and returns. These could include cognitive skills, non-cognitive skills, personality traits and genetic traits. In specifying the model in this section, we refer to these collectively as *latent skills*. Further, suppose there is a system of measurements to be used to identify these latent skills. An observed measurement of skill $j \in \{1, \ldots, J\}$ for person i at time t is denoted C_{ijt} and specified as:

$$C_{ijt} = M_{it}\rho_{jt} + d^C_{jt} f_{ij} + \epsilon^C_{ijt} \tag{1}$$

where M_{it} is a row-vector of observed characteristics with accompanying vector of coefficients ρ_{jt}, f_{ij} is the value of latent skill j for person i, d^C_{jt} is the period-t factor loading on trait j and ϵ^C_{ijt} is an error term capturing mis-measurement.[17] Latent factors f_{ij} are drawn from

[16] We ignore non-workers and, therefore, selection into employment, though extending our analysis to include the decision to become employed would be straightforward.

[17] Throughout the paper, t refers to calendar time and is used to distinguish data collected in different years: 1995 and 2004. It is not meant to index the sequence of decisions assumed in the theoretical model.

normal distributions so that for each j:

$$f_{ij} \sim N(\mu_j^C, \sigma_j^C). \tag{2}$$

Further, we assume that $\text{cov}(f_{ij}, \epsilon_{ijt}^C) = 0 \ \forall t$ (latent traits are independent of measurement error), $\text{cov}(f_{ij}, f_{ij'}) = 0$ for $j \neq j^{'}$ and that latent trait j does not affect the measured value of trait $j^{'}$: $\text{cov}(C_{ij't}, f_{ijt}) = 0$ for $j \neq j^{'}, \forall t$.[18]

4.2 Entrepreneurial Ability and Returns

If the agent chooses paid employment, he earns wage w_i:

$$\ln(w_i) = x_i^w \beta^w + \sum_{j=1}^{J} \kappa_j^w f_{ij} + e_i^w \tag{3}$$

where x_i^w is a row-vector of observable characteristics that influence wage with prices β^w, κ_j^w is the price of latent skill j in the wage sector and e_i^w is a disturbance term that is distributed according to:

$$e_i^w \sim N(-\sigma_w^2/2, \sigma_w^2). \tag{4}$$

Entrepreneurial earnings are generated according to the production function

$$y_i = \theta_i k_i^\alpha \xi_i \tag{5}$$

where k_i is agent i's capital invested in the entrepreneurial venture and $\alpha \in [0, 1]$ is a technology parameter that captures returns to capital. We can rewrite this equation in logs so that:

$$\ln(y_i) = \ln(\theta_i) + \alpha \ln(k_i) + e_i^y \tag{6}$$

where $e_i^y \equiv \ln(\xi_i)$ and ξ_i is a disturbance term that is not observed by the agent before he chooses a sector. Further,

$$e_i^y \sim N(-\sigma_y^2/2, \sigma_y^2) \tag{7}$$

[18] We have also permitted that the measurement error be mixed-normally distributed (with two points of support), but cannot reject that errors are normally distributed since the estimation routine places nearly zero probability on the second distribution. Importantly, preference and earnings coefficients do not change. Therefore, we continue with the assumption that measurement error is normally distributed.

where the mean is specified as such so that $\mathrm{E}[\xi] = 1$. Entrepreneurial productivity will be treated similarly to other latent factors and is generated as follows:

$$\ln(\theta_i) = x_i^\theta \beta^\theta + \psi \ln A_i + \sum_{j=1}^{J} \kappa_j^\theta f_{ij} + e_i^\theta \tag{8}$$

where x_i^θ is a vector of observable characteristics influencing entrepreneurial ability, β^θ is a vector of coefficients, κ_j^θ governs how latent skills affect entrepreneurial ability and e_i^θ is a disturbance.[19] We assume e_i^θ has a mixed-normal distribution to account for the possibility of skew in entrepreneurial earnings.[20] Formally,

$$e_i^\theta \sim \left[p^\theta N(\mu_{\theta,1}, \sigma_{\theta,1}^2) + (1 - p^\theta) N(\mu_{\theta,2}, \sigma_{\theta,2}^2) \right]. \tag{9}$$

Net income from self-employment is given by

$$I_i^{SE} = y_i + r(A_i - k_i) \tag{10}$$

where A_i denotes agent i's assets and r is the risk-free interest rate. Income from paid employment is given by

$$I_i^{PE} = w_i + rA_i. \tag{11}$$

Credit constraints are imposed upon the entrepreneur such that $k_i \leq \lambda A_i$, where $\lambda \geq 1$. The entrepreneur is a net borrower when $A_i < k_i^*$ and a net-saver when $A_i \geq k_i^*$, where k_i^* denotes the optimal investment in the entrepreneurial venture conditional on having chosen self-employment.

The agent chooses the sector $s \in \{\mathrm{SE}, \mathrm{PE}\}$ that generates the highest expected utility V_i^s given by

$$V_i^s = \rho I_i^s + \tilde{u}_i^s, \tag{12}$$

where $\tilde{u}_i^s$ are non-pecuniary returns for sector s and ρ is a scaling parameter that converts dollars to utils. As we can only identify differences in non-pecuniary returns from choosing one sector versus the other, we specify net non-pecuniary benefits to self-employment as:

$$u_i^{SE} = \tilde{u}_i^{SE} - \tilde{u}_i^{PE} \equiv z_i \gamma^{SE} \tag{13}$$

[19] Similar to Evans and Jovanovic (1989), we also permit entrepreneurial ability to be a function of assets. The intention is to control for the possibility that higher assets reflect previous success in entrepreneurship, which may be correlated with the quality of current business ideas.

[20] Estimating means of e_i implies that equation (8) does not include a constant. Further, we choose a mixed-normal distribution since summary statistics show that earnings are skewed and the mixed-normal assumption, though still very tractable, does not impose normality.

which is equivalent to setting $\tilde{u}^{PE} = 0$. Here, z_i is a vector of characteristics and γ^{SE} are net non-pecuniary returns to observable characteristics in self-employment.

Specified as such, preferences over sectors amount to a residual after we have controlled for the portion of sector selection that can be attributed to observed earnings. Therefore, the utility function captures preferences that are revealed in the sense that they reflect entry into self-employment that is not a function of earnings in the first period after entry. We may be capturing factors that are related to preferences, but could alternatively be capturing other factors affecting entry, such as errors in beliefs (e.g. optimism with regard to entrepreneurial returns). Our interpretation of these revealed preferences, which will be discussed in greater detail as we present and discuss results, must therefore be fairly broad.

4.3 Optimal Investment and Sectoral Choice

When deciding between paid employment versus self-employment, the agent must first determine how much he will earn as an entrepreneur. To this end, he computes the optimal choice of k_i (supposing θ_i is known) by solving the following maximization problem:

$$\begin{aligned} \max_k \quad & E[V_i^{SE}] \\ = \; & E[I_i^{SE} + u_i^{SE}] \\ = \; & E[\rho(y_i + rA_i - rk_i) + u_i^{SE}] \\ = \; & E[\rho\theta_i k_i^{\alpha}\xi_i + \rho r A_i - \rho r k_i + u_i^{SE}] \\ = \; & \theta_i k_i^{\alpha} - rk_i, \end{aligned} \tag{14}$$

where the last equality holds since any additive components of V_i^{SE} not including k_i can be treated as constants. We obtain:

$$k_i^* = \left(\frac{\alpha\theta_i}{r}\right)^{\frac{1}{1-\alpha}} = \phi \times \theta_i^{\frac{1}{1-\alpha}}, \tag{15}$$

where

$$\phi \equiv \left(\frac{\alpha}{r}\right)^{\frac{1}{1-\alpha}}. \tag{16}$$

Plugging the optimal capital into the credit constraint inequality yields the following condition: the entrepreneur is capital-constrained whenever:

$$\theta_i > \frac{r}{\alpha}(\lambda A_i)^{1-\alpha}. \tag{17}$$

To understand this inequality, suppose $\lambda = 1$. Then, the agent is credit constrained when his entrepreneurial productivity is very high (a high draw of θ_i) in relation to the assets available to invest in the project A_i. In other words, credit constraints are more relevant for poorer agents with high entrepreneurial skill.

The decision to engage in entrepreneurship amounts to comparing utility in paid versus self-employment and in cases where credit constraints are binding versus when they are not. In particular, the value of the optimal choice, denoted V_i^* is given by:

$$V_i^* = \begin{cases} \max\{(\phi^\alpha - r\phi)\theta_i^{\frac{1}{1-\alpha}} + u_i^{SE}, w_i\} & \text{if} \quad \theta_i \leq \frac{r}{\alpha}(\lambda A_i)^{1-\alpha} \\ \max\{(\theta_i(\lambda A_i)^\alpha - r\lambda A_i + u_i^{SE}, w_i\} & \text{if} \quad \theta_i > \frac{r}{\alpha}(\lambda A_i)^{1-\alpha} \end{cases} \tag{18}$$

4.4 Parameters

Given the specification of the model, the vector of parameters to be estimated is:

$$\Phi \equiv \left[\beta^w, \sigma_w^2, \alpha, \sigma_y^2, \beta^\theta, \mu_{\theta,1}, \mu_{\theta_2}, \sigma_{\theta,1}^2, \sigma_{\theta,1}^2, \lambda, \gamma^{SE}, \kappa^w, \kappa^\theta, \Xi_f\right]$$

where Ξ_f includes all parameters of the measurement system of the latent factors f_{ij}:

$$\Xi_f \equiv \left[\rho_{jt}, d_{jt}^C, \mu_j^C, \sigma_j^C\right] \quad , \quad j \in \{1, \ldots, 5\}, t \in \{1995, 2004\}$$

In the following section, we discuss the estimation of Φ.

5 Estimation

We estimate the parameters of the model described in the previous section via simulated maximum likelihood. There are three main steps to the estimation procedure. First, at each set of parameter value suggestions, indexed by g and denoted $\Phi^{(g)}$, and for each individual i, we simulate earnings, personality traits and sector choice K times, where K represents the number of draws of unobservables for each individual.[21] Second, we compute each individual's average likelihood contribution, where the average is taken over the K draws. Third, we sum over average likelihood contributions from each individual and compute the log, which yields the value of the simulated log likelihood function, the negative of which is then maximized as with standard likelihood functions.

[21] During estimation, we set $K = 2,500$.

5.1 Simulation

The simulation procedure begins as follows: we draw a block matrix (denoted B) of size $K \times I \times J+2$ from a standard normal distribution. Recall that J is the number of personality traits and K is the number of draws per individual. We need a block matrix of size $J+2$ since we draw J personality traits, but also draw unobservables for the mixed-normal distribution of business ideas. We draw B once. Next, at each parameter suggestion $\Phi^{(g)}$ and for each individual i, we compute expected earnings in the paid employment (denoted $w_{ik}^{(g)}$), expected earnings in self-employment (denoted $y_{ik}^{(g)}$) and the resulting sector choice (denoted $d_{ik}^{(g)}$). For earnings and choices, the superscript (g) indexes the parameter suggestion and the subscript ik refers to the k-th draw of individual i.

The simulation of earnings and sectoral choice occurs in several steps. Using parameters $\Xi_f^{(g)}$, we simulate vectors of latent factors $f_{ikj}^{(g)}$, $j \in \{1, \ldots, J\}$ for each individual i, and draw k. Similarly, we use the parameters $\mu_{\theta,1}^{(g)}$, $\mu_{\theta,2}^{(g)}$, $\sigma_{\theta,1}^{2(g)}$, $\sigma_{\theta,2}^{2(g)}$ and p^{θ} to simulate a business draw for each individual i and draw k, which we denote $\theta_{ik}^{(g)}$. From here, we can determine whether or not each individual-draw pair is credit constrained using equation (8) suitably modified to permit multiple draws. In particular, individual i with draw k and at parameters (g) is credit constrained if:

$$\theta_{ik}^{(g)} > \frac{r}{\alpha^{(g)}} \left(\lambda^{(g)} A_i\right)^{1-\alpha^{(g)}}. \tag{19}$$

Note that the k subscript is omitted from α, which remains constant across all K draws. Moreover, assets A_i, which are data, and the interest rate r (set to 1.1 for this analysis) do not change with draws or with suggested parameters (g). $\theta_{ik}^{(g)}$, however, is different for each individual i, draw k and parameter suggestion (g).

Once it is clear which individuals are credit constrained, we can compute $y_{ik}^{(g)}$ for each individual, using r, A_i, $\alpha^{(g)}$ and $\lambda^{(g)}$ when the credit constraints are binding and r, $\alpha^{(g)}$ and $\theta_{ik}^{(g)}$ when they are not binding. Similarly, we compute utility $u_i^{SE(g)}$ and paid earnings $w_i^{(g)}$ using parameter suggestions. Then, using equation (18), we compute a sector choice for each individual-draw pair, denoting this $d_{ik}^{(g)}$. In what follows, we use $f_{ikj}^{(g)}$, $w_{ik}^{(g)}$, $y_{ik}^{(g)}$ and $d_{ik}^{(g)}$ to construct the likelihood.

5.2 Likelihood

Ultimately, we want to match paid employment earnings, self-employment earnings, measured personality traits and sector choices, meaning that the likelihood function will consist of several components. Given the assumption that earnings shocks are normally distributed, we form the earnings portion of the likelihood using the normal density function, which

we denote $h(y_{ik}^{(g)})$ and $h(w_{ik}^{(g)})$ for self-employment wage density and paid employment wage density, respectively, for individual i, draw k and parameter suggestion g. Next, given assumptions on the normality of the measurement error in latent traits, we can also derive the density function for personality measurements for each individual i, draw k and parameter vector g, denoting this $h(M_{ik}^{(g)})$. Then, we must average these, though these averages are conditional on the relevant sector being chosen for a given draw:

$$L_i^{y(g)} \equiv \frac{1}{K_{i,SE}^{(g)}} \sum_{k=1}^{K_{i,SE}^{(g)}} \left[h\left(y_{ik}^{(g)}\right) \times h\left(M_{ik}^{(g)}\right) | d_{ik}^{(g)} = \text{SE}) \right] \tag{20}$$

and

$$L_i^{w(g)} \equiv \frac{1}{K_{i,PE}^{(g)}} \sum_{k=1}^{K_{i,PE}^{(g)}} \left[h\left(w_{ik}^{(g)}\right) \times h\left(M_{ik}^{(g)}\right) | d_{ik}^{(g)} = \text{PE}) \right]. \tag{21}$$

In the above equations, $K_{i,SE}^{(g)}$ denotes the number of draws for which individual i at parameter draw (g) chooses self-employment. Similarly, $K_{i,PE}^{(g)}$ denotes the number of draws for which individual i at parameter draw (g) chooses paid employment. $L_i^{y(g)}$ and $L_i^{w(g)}$ are the product of average earnings densities for each sector and average personality trait densities, conditional on a sector being chosen. Therefore, they are a weighted average of each individual's likelihood contribution, where the average is taken over the subset of the K draws where the individual chooses the relevant sector at draw k.

Next, we weight likelihood contributions by the probability that the model predicts that a sector is chosen by a given individual. We denote this probability $\tilde{P}_i$, defined as the number of times that the individual chooses self-employment given K draws:

$$\tilde{P}_i = \frac{K_{i,SE}^{(g)}}{K}. \tag{22}$$

Then, the likelihood contribution for individual i and draw k will be given by:

$$L_i^{(g)} = \left[\tilde{P}_i^{(g)} \times L_i^{y(g)} \right]^{d_{it}=\text{SE}} \left[\left(1 - \tilde{P}_i^{(g)}\right) L_i^{w(g)} \right]^{d_{it}=\text{PE}}, \tag{23}$$

where d_{it} is the observed sector choice so that, for each individual, the contribution to the likelihood is only a function of the probability the model predicts their observed sector is chosen, multiplied by the average of the product of the earnings density in that sector and and personality traits density, where the average is conditional on the model predicting that sector.

After constructing $L_i^{(g)}$ for each individual i, we take the log of each individual's contribution and then sum over individuals to obtain the log-likelihood:

$$l^{(g)} = \sum_{i=1}^{I} \log\left(L_i^{(g)}\right). \tag{24}$$

We evaluate $l^{(g)}$ at different values in the parameter space, indexing these suggestions by (g) and, using both simplex and gradient methods, search until a maximum is found.

6 Parameter Estimates

In this section, we interpret estimates of model parameters, including those governing measurements of personality traits, earnings and preferences. We also highlight estimates where preferences and productivity go in different directions, creating a discrepancy that drives agents towards a sector where they will earn less.

6.1 Measurement of Latent Traits

Estimated coefficients of the measurement system that relates latent, stable personality traits to measurements from personality assessments are presented in Table 4. Means are not very far from raw data means of the personality assessments, though variance is significant, implying that measurement error could be a concern if we simply included both 1995 and 2004 measurements in our earnings and utility equations. Moreover, the factor loadings, though near one, are significantly different from one, implying that the assessments are not perfect measurements. Finally, there are important changes as agents age. For example, the age parameter in the measurement equation for extraversion is 0.001 in 1995 and 0.005 in 2004. Age thus leads to a higher assessment in 2004 versus 1995 for the same underlying trait. For these reasons, it is important to exploit multiple measures of personality to identify the distribution of latent traits, which are then used in the choice and earnings equations.

6.2 Earnings

Structural estimates of the earnings equations are found in Table 5 for paid employment and Table 6 for self-employment. Using our estimates, we plot the distribution of earnings distributions, comparing the model versus the data in both the paid employment and self-employment sectors, shown in Figures 2 and 3. In both sectors, earnings are considerably

skewed, which is captured quite well by the model parameter estimates. In paid employment, agents earn more when they are more highly educated, older, married and of higher intelligence. In self-employment, education leads to even higher returns, which means the sectoral price of a year of education is higher for entrepreneurs versus paid employees. Further, age does not lead to higher earnings in self-employment, though marriage does, and more strongly so than in paid employment.

Interestingly, fluid cognitive ability, our measure of intelligence, does not have a positive return in entrepreneurship. In fact, it has a significant and negative impact on self-employment earnings. In particular, a one standard deviation increase is equivalent to a decrease of two-thirds of a year of education. This difference is not enormous, but the direction of the sign is puzzling. One possibility arises from well-established findings that fluid cognitive ability varies over the lifecycle, peaking around age 30 and declining thereafter.[22] Hence, this coefficient captures avenues through which aging encourages less productive entrepreneurs to start a business. One example would be that assets tend to rise with age in which case the coefficient reflects how older agents face relaxed credit constraints. If so, then the fluid cognitive ability variable amounts to a mis-measurement of a latent trait. Unfortunately, this cognitive skill is only measured once in the MIDUS data, implying that we do not have enough information to identify a latent cognitive factor that would allow us to circumvent this sort of mis-measurement. These types of problems underscore the need to apply methods that isolate latent, potentially mis-measured factors, which is what we do in the case of personality traits.

Turning to the impact of latent personality traits on sector earnings and returns, several key findings emerge from the parameter estimates. First, from Tables 5 and 6, agreeableness carries an earnings penalty in both sectors, though more strongly so in self-employment. In fact, wage penalties for agreeableness have been shown in several studies (Heineck, 2010; Nyhus and Pons, 2005; Mueller and Plug, 2006). Recall that a hallmark of agreeableness is a lack of selfish behavior. Laboratory evidence has confirmed this. Ben-Ner, Kong, and Putterman (2004) relate behavior in dictator games to measurements of personality and find that agreeable individuals who are assigned the role of the dictator are more likely to offer higher amounts of money. If agreeableness indeed captures unselfishness, our findings are not surprising and instead reflect how higher earnings may sometimes require profit-taking at the expense of others. Our results therefore suggest that agreeableness captures other-regarding preferences or altruism, and may signal a preference for others to be well-off or a high psychic cost of making demands and acting selfishly. Other-regarding or social preferences have been studied in great detail in behavioral economics and found to play a significant role in a wide

[22]See, for example Horn and Cattell (1967) and Bugg et al. (2006).

variety of economic scenarios.[23] It should therefore not be surprising that a trait capturing social preferences would carry a wage penalty.

Extraversion is profitable in both sectors, though more so in self-employment, a finding that is also consistent with previous work on personality and the labor market (Bowles, Gintis, and Osborne, 2001; Viinikainen et al., 2010; Caliendo, Fossen, and Kritikos, 2011). The third trait, conscientiousness is profitable in paid employment, though costly in self-employment. This latter finding is somewhat surprising as one would expect characteristics such as an attention to detail to be helpful in running a successful business. To understand this result, we must once again consider detailed interpretations of the trait to better understand what it is capturing. Lacking conscientiousness is related to self-indulgence or a penchant for ignoring rules for personal gain. This possibly links conscientiousness to a high disutility from breaking rules even if doing so will improve business performance. Consistent with this finding, Levine and Rubinstein (2013) find that deviant behaviors can be profitable in entrepreneurship. Further, a literature in personnel and organizational psychology has studied pro-social rule-breaking, also known as constructive deviance, whereby individuals break rules when it makes a business run better (Dahling et al., 2012). This research suggests that conscientious people could earn less in self-employment since they are inflexible or overly concerned with following rules even when doing so harms their business.

Neuroticism is profitable in both sectors, though the impact is noisy and very small. Not surprisingly, previous results on neuroticism are mixed. Whereas Mueller and Plug (2006) and Heineck (2010) find a negative impact of neuroticism on earnings, Viinikainen et al. (2010) do not once they have controlled for work experience, which they offer as evidence that neuroticism leads to a less stable work history. This thinking is in line with the contention that neuroticism is linked to depression, which like other chronic illnesses can lead to gaps in work history (Artazcoz et al., 2004).

Perhaps most striking is the final trait: openness to new experiences. Though marginally profitable in paid employment, it carries a sharp wage penalty in self-employment. This finding is surprising since openness captures creativity and insight and entrepreneurs choose careers that often require creativity and entail new experiences. These results on openness are, however, consistent with mixed findings from previous literature. For example, results in Barrick and Mount (1991) indicate that open individuals are eager trainees though not better employees. Further, Barrick and Mount (1993) find no evidence that open individuals fare better in jobs with greater autonomy.

[23]For a relatively early contribution on social preferences, see Kahneman, Knetsch, and Thaler (1986).

6.3 Preferences

To better understand how personality relates to self-employment, we now turn to the utility parameters found in Table 7. Several notable findings emerge. First, factors that were excluded from the earnings equation play an important role in the decision to enter self-employment. For example, spousal employment in 1995, which is a noisy measure of spousal employment in 2004, induces men to choose self-employment. This may be a signal that self-employment entails a lower cost in families with a second, steady income. For similar reasons of stability, more children seems to lower the desire to enter self-employment. Fluid cognitive ability, though costly in self-employment, is consistent with a strong preference for entrepreneurship. This finding suggests that intelligent people are more likely to be entrepreneurs, but may not be successful in terms of earnings.

Turning to personality traits and sector-specific preferences, the most striking finding is that openness to new experiences, though it lowers earnings, seems to capture a strong preference for entrepreneurship. This result illustrates an important general point. Personality traits that are consistent with high earnings in self-employment are not necessarily the same ones that induce agents to choose entrepreneurship. Rather, personality traits, like other non-cognitive traits, can have different impacts in different sectors and along different dimensions. Non-cognitive traits like personality are thus not properly understood as being purely beneficial or not. Each trait may have different effects on different people and in different scenarios and should be analyzed as such. This stands in stark contrast to how we think about good health or strong cognitive skills, which are generally understood as improving outcomes on most conceivable socioeconomic dimensions.

6.4 Discrepancies between Earnings and Preferences

Our results highlight the idea that preferences may drive entry into a relatively low-earning sector precisely when the return (in terms of earnings) goes in the opposite direction of preferences. Openness to new experiences illustrates this discrepancy, being unprofitable in precisely the sector where it confers the highest non-pecuniary benefit. To highlight this phenomenon, Table 8 lists the characteristics affecting both earnings and utility, indicating those where a discrepancy exists. According to Table 8, higher education is associated with a stronger preference for paid employment even though higher education leads to higher relative earnings in self-employment. Age and being married work the opposite way. Older agents may prefer self-employment despite earning more in paid employment in part since self-employment offers greater flexibility as agents move towards semi-retirement. Further,

older self-employed agents would not have to contend with the risk of being replaced by younger employees with lower tenure who are therefore cheaper to employ. Married agents may choose self-employment despite higher earnings in paid employment since they can enjoy the non-pecuniary benefits of a working spouse including risk-sharing and benefits like health insurance. Turning to personality traits, both agreeableness and openness to new experiences lead to higher relative earnings in self-employment and a preference for paid employment. This pattern is much stronger for openness versus agreeableness. In the following section, we highlight how these discrepancies between sector specific prices and preferences influence entry into self-employment.

Since our model is static in the sense that we focus on a single year of earnings, one could raise the argument that utility parameters capture unobserved changes in wage profiles over time. This would be especially concerning if the sorts of discrepancies we highlight in this section reflect rational expectations about future earnings rather than a preference for a low-productivity sector. To assess whether this is the case, we use data on 1995 and 2004 sector choices and earnings and find no evidence that this is the case.[24] For example, among individuals who were entrepreneurs in 1995, being open to new experiences, is associated with lower rates of entrepreneurship in 2004. In general, this suggests that our results on personality, preferences and sector choices are not driven by first-year earnings being unrepresentative of future entrepreneurial success.

7 Frictions and Personality in Entrepreneurship

In this section, we use the estimated model to explore how earnings, preferences and credit constraints affect self-employment entry decisions. We highlight the role of two frictions that may deter individuals from maximizing their earnings: credit constraints and preferences over sectors. Next, we analyze the role of personality in determining sector-specific earnings, entry into self-employment and the quality of business ideas that are ultimately realized. In assessing personality and counterfactual policies as they impact business ideas that make it to the market, our main measure is the average value of θ_i from equation (5) conditional on entry into self-employment.[25]

[24] Results available from the authors upon request.

[25] An alternative measure would be income from self-employment conditional on entry. However, recall that credit constraints can lead to sub-optimal investments in high quality ideas. Therefore, we consider the value of the idea itself to be a more straightforward measure of the economic impact of policies affecting entrepreneurship.

7.1 Credit Constraints, Preferences and Starting a Business

A key feature of the estimated model is that it permits an investigation of how earnings and preferences interact to affect entrepreneurial choice and, in particular, how entrepreneurial decisions are not driven solely by earnings maximization. Recall that the model permits two sources of friction. The first is credit constraints, which potentially keep profitable business ideas from being realized. The second is preferences: agents may choose to start their own business despite earning less than in paid employment. A simple way to illustrate this interaction is to simulate the entry decisions of each individual in the sample when one or both of these frictions is removed. In addition, we examine the values of business ideas (θ_i) that make it to market under these counterfactual scenarios.

Table 9 shows that in the baseline model, the average value of a business idea (i.e., the average value of θ_i) is \$71,089. The second row shows that when we simulate the removal of liquidity constraints, self-employment entry increases slightly by 3.3%. Note, however, that these new entrants have lower quality business ideas, since the average value of business ideas (measured by θ_i) declines to \$69,847. This means that credit constraints, rather than obstruct the realization of good business ideas generated by agents with few assets, instead appear to keep less-productive business ideas from making it to the market.

In the third row of Table 9 we assume that agents choose the sector that maximizes earnings (liquidity constraints are imposed). In the absence of the non-pecuniary benefits of entrepreneurship, self-employment entry declines approximately 19%. Not surprisingly, the reduction in entry reflects the screening out of lower quality business ideas, so that the average value of the realized business ideas that remain increases to \$83,316. When we assume earnings maximization and remove liquidity constraints, the impact on entry is slightly reduced, but again we observe that individuals deterred from entrepreneurship due to credit constraints tend to be less productive entrepreneurs. Overall, the simulations show that credit constants play a role in preventing lower quality businesses from reaching the market. However, preferences over sector-specific non-pecuniary benefits appear to compel many agents to open a business even though they would earn more elsewhere.

Our findings on frictions do not imply that liquidity constraints have no impact at all. Hurst and Lusardi (2004) argue that liquidity constraints may do little to deter small business entry, but instead may force entrepreneurs to operate at sub-optimal scale. To investigate this effect, Figure 4 plots expected self-employment minus paid employment earnings with and without frictions. The distribution of earnings differentials is plotted as predicted by the model, when preferences play no role, and then finally where neither preferences nor credit constraints affect decisions. Consistent with the findings in Table 9, for relatively

low-quality business ideas the removal of credit constraints induces a subset of individuals with fairly low earnings differentials to enter entrepreneurship. To see this point, compare the dotted to the dashed line in Figure 4 for earnings differentials up to about $100,000. Conversely, individuals at the upper tail of the distribution (i.e., those with high quality business ideas) earn more relative to paid employment when credit constraints are removed. For these individuals, the removal of credit constraints permits higher investments in very high quality business ideas. Note that the average quality of business ideas does not improve with the removal of credit constraints, which can be seen in Figure 5, where this average is plotted according to model estimates and then absent frictions. Together these findings show that while removing liquidity constraints does induce larger investments in high quality businesses, these businesses would still be started in the presence of these constraints.

7.2 Personality and Entrepreneurship

Having understood the importance of preferences in driving agents to sectors with low earnings, we now focus specifically on the role of personality traits, since these traits have large effects on both earnings and preferences. To illustrate how different combinations of personality traits can affect sector choices, we focus on two traits that have been highlighted in previous literature as being associated with self-employment or autonomous work environments: openness to new experiences and extraversion. To understand how these two combine to affect behavior and outcomes, we first compute the deciles of each. Then, for each of the resulting possible one hundred combinations, we set traits to these levels for each individual in the sample. Then, we simulate optimal earnings and decisions to illustrate the labor market impact of latent, stable personality traits.

Figure 6 plots earnings in self-employment for different combinations of values of extraversion and openness applied to all individuals in the sample regardless of their optimal choice. We see that low levels of extraversion combined with high levels of openness have the starkest income penalties in self-employment. Introverted individuals who are open to new experiences can expect the lowest returns to opening their own business. The differences are not small, ranging between about $52,000 and $131,000. In paid, employment, the highest wage penalties accrue to those who are neither extraverted nor open to new experiences (Figure 7). Here, the range of earnings is smaller: about $73,000 to $95,000. Figure 8 plots utility u_i^{SE} (converted to dollars using the estimated multiplier). Utility of self-employment ranges from about 0 to about $40,000. This range helps to explain why many individuals choose to run a business that will not be particularly lucrative: the sheer enjoyment of doing so is worth tens of thousands of dollars.

Personality enters non-linearly into the agent's decision problem and so it is not a surprise that average entry for different combinations of traits is not only not linear but can also be non-monotonic. According to Figure 9, higher levels of extraversion encourage entry. However, whereas a marginal increase in openness decreases entry (due to lower expected earnings) at low levels, at higher levels of openness the marginal impact on entry is positive. This occurs because the increase in utility supersedes the decrease in the quality of the business idea at higher levels of openness. In general, Figure 9 illustrates how the interplay between personality traits, earnings and preferences leads to a non-linear relationship between non-cognitive traits and key decisions like business ownership.[26]

Ultimately, the landscape of personality traits affects the distribution of business ideas that are realized, i.e., that turn into actual businesses. Figure 10 plots the average value of business ideas θ_i conditional on self-employment for different combinations of deciles of the distributions of openness and extraversion. Why is this important? Most people are not business owners and yet society benefits when better ideas make it to the market. Therefore, it behooves us to understand that, for example, the quality of realized business ideas diminishes for agents who tend to be less extraverted or more open to new experiences. In the following section we focus our attention on assessing public policies to encourage entrepreneurship similar to the sorts of programs that have already been implemented. In particular, we use the estimated model to consider two counterfactual policies: (i) subsidies for all small businesses and (ii) tournaments that aim to identify and fund high quality business ideas.

8 Personality and Policies Promoting Entrepreneurship

Many policymakers have considered how best to design and implement policies that foster successful entrepreneurship.[27] The motivation appears to be the following: if good ideas do not make it to the market, then society loses out on innovations, tax revenue, better products and—assuming path-dependence—future innovation. However, one should be careful in designing policies affecting self-employment. It is not worthwhile to foster entrepreneurship *per se*, but to encourage the realization of good business ideas. In this section, we use our estimated model to assess several policy approaches. By using the estimated model to assess

[26]These non-linearities also highlight the shortcomings of reduced form models of entry that ignore selection.

[27]See, for example, Lerner (2009) for a discussion of the pitfalls associated with public policies promoting entrepreneurship and venture capital.

alternative policies, we take explicit account of sector-specific preferences and productivity along with how personality traits affect both.

8.1 Subsidizing Entrepreneurship

To see how policies encouraging entrepreneurship affect behavior and outcomes, we begin by considering a fairly blunt instrument: all entrepreneurs are given a subsidy of $25,000 if they open their own business.[28] Here, and in other counterfactual policy simulations, we assess the effect of the policy on the distribution of realized business ideas. The underlying question is whether the policy improves the distribution of ideas or simply encourages individuals to open less profitable businesses.

The effect of the blanket $25,000 subsidy is to encourage the realization of relatively low quality ideas. Table 10 lists changes to the average value of realized business ideas (i.e., the average value of θ_i) using estimated model parameters and then under the subsidy. The average value of θ_i goes from slightly more than $71,000 to under $44,000. Entry into self-employment nearly doubles, rising about 90%. Preferences for the non-pecuniary benefits of entrepreneurship exacerbate this effect. If agents are assumed to be income maximizers, the post-subsidy average value of realized business ideas declines from $83,316 to $67,238 and entry rises almost 30 percentage points (minus 19% to plus 10% relative to the baseline). This suggests that a key mechanism of the subsidy is to attract agents with a predisposition for self-employment, but low expected returns, into entrepreneurship, where they start businesses based on low-quality ideas.[29]

Shifts in the distributions of entry probabilities and the value of realized ideas induced by the subsidy are plotted in Figures 11 and 12. Here, these shifts are measured using estimated preference parameters and again where preferences for the non-pecuniary aspects of entrepreneurship are assumed to play no role. These figures illustrate that the shifts are much sharper due to preferences. The notion that agents with poor ideas are being induced into entrepreneurship is illustrated in Figure 13, where the distribution of each personality trait in self-employment is plotted according to model parameters and again assuming the counterfactual subsidy. The subsidy induces individuals into entrepreneurship who are agreeable, neurotic and open to new experiences, none of which is predictive of future

[28] For each draw, once an agent has solved the maximization problem conditional on the realization of his business idea, $25,000 is added to his self-employment earnings. The linear structure of consumption utility means that the subsidy does not affect the optimal capital investment.

[29] In supplementary regressions available from the authors, we show that low income entrepreneurs in 1995 had significantly lower incomes if they remained self-employed in 2004, and were not more likely to remain in business over that period than high income entrepreneurs in 1995. It does not seem to be the case that initial self-employment incomes are lower due to steeper investment profiles (Hamilton, 2000).

entrepreneurial success. This effect is somewhat attenuated by the fact that the subsidy seems to encourage individuals into self-employment who are less conscientious. On balance, however, a blunt instrument like an across-the-board subsidy for entrepreneurship seems ill-advised as it simply encourages less productive ventures, having the most dramatic effect on individuals with low quality ideas, but who reveal a strong preference for entrepreneurship.

8.2 Business Plan Tournaments: Subsidizing the Best Ideas?

One alternative to a blanket subsidy is to subsidize high-quality business ideas via a tournament. Business plan competitions rewarding the best ideas are widely used and the estimated model can provide insight into their effectiveness. It is important to remember that tournaments increase the average value of realized business ideas only if they attract a group of individuals that we will refer to as "reluctant entrepreneurs": those with above average ideas, but with personality traits leading them to prefer (or be paid relatively well in) paid employment. For example, a tournament funding the top 10% of business ideas is helpful only if some individuals with ideas in the top decile who would normally choose paid employment can be induced by the tournament prize to open a business. Otherwise, the tournament at best subsidizes businesses that would have been started absent financial support. At worst, it attracts individuals with traits associated with less productive ideas into self-employment, with the perverse effect of lowering rather than raising the average quality of ideas that enter the market. Finally, even if a tournament does manage to attract reluctant entrepreneurs with high quality ideas, policymakers still need to assess whether it does so in a cost-effective manner.

We simulate the tournament as follows. For each individual, a random draw from the distribution of business ideas is selected. These draws are ordered from highest to lowest value. Then, a portion of the top ideas (5%, 10%, 15% and 20%) is subsidized. We consider subsidy amounts of \$10,000, \$25,000, \$50,000, \$100,000 and \$500,000. Next, for each individual, a second random draw is selected and the ordering and subsidization procedure is repeated. In all, we simulate 2,500 business ideas per person. For each combination of the fraction of ideas subsidized and subsidy amount, we calculate the average value of realized ideas (where averages are taken over individual-draw pairs) and also calculate the percent change in entry probability.

The results reported in Table 11 indicate that tournaments are relatively ineffective tools for inducing the "reluctant entrepreneur" to start a business, even before accounting for tournament costs. To understand why, suppose we first limit the winners to the top 5% of business ideas. The first row of Table 11 shows that increasing the prize induces only a tiny

fraction of individuals to choose self-employment: the increase in entry is roughly 0.004%. Even when the subsidy increases to $500,000, entry does not increase. This finding arises due to the fact that virtually every individual with an idea in the top 5% is already choosing to start their business. Consequently, the tournament is redundant in the sense that the top ideas are already making it to the market. To be sure, the new entrants have very high quality ideas (worth about $104,000 on average). However, these valuable additions to entrepreneurship comprise such a small proportion of the top 5% of ideas that the average value of all realized business ideas remains nearly the same, rising about $1.32. This rise is negligible and comes at great cost, especially when we take into account that the tournament prize is paid to all agents in the top 5%, not just the 0.004% induced to enter by the prize.

The remainder of the table shows that increasing the fraction of top ideas funded does increase entrepreneurial entry, with the magnitude of the effect increasing in the size of the prize. Note, however, that increased entry is accompanied by a decline in the average value of the realized business idea. For example, awarding a $50,000 prize to the top 20% of business ideas increases self-employment entry by 5.9%, but the average value of the business ideas that now make it to market declines over $2,000. This finding highlights the fact that increasing the fraction of tournament winners induces more individuals with lower quality ideas to try entrepreneurship. In other words, the tournament begins to have the same impact as a subsidy, attracting individuals with personalities such that they favor entrepreneurship, but are unproductive in it. Moreover, the tournament is inefficient: All business owners with top 20% ideas are given $50,000 in this example, even though 93% of them would have opened their business without the prize.

In summary, we show that a tournament is capable of attracting reluctant entrepreneurs, but the increases in value and entry are quite small. Our simulations show that the vast majority of tournament "winners" would have made it to the market absent a tournament, and so paying them to start a business is inefficient. We also observe that the tournament runs the risk of attracting entry from individuals with personalities that generate lower quality ideas as the number of winners is increased. Consequently, an already costly and largely ineffective policy can have the perverse effect of lowering rather than raising the average value of realized ideas.[30] Finally, we note that our results on tournaments are generalizable in contexts where credit markets function well. For our sample, we have shown that credit markets appear to be well-functioning in that they screen out bad ideas without preventing the good ones. Nonetheless, a tournament could be a good policy if it helps

[30]In results that are not shown, but that are available upon request, we simulate entry and average value of ideas for larger subsidies and for higher proportions of rewarded ideas. We find that at quantities larger than those presented in Table 11, entry rises precipitously and the average value of ideas that make it to the market plummets.

potential entrepreneurs to overcome credit constraints that act as poor screening devices and instead keep good ideas from turning into innovative businesses. This could occur in economies with nascent credit markets, e.g., in developing countries.

9 Conclusion

We have shown that the personality traits that make entrepreneurship the lucrative choice are not the personality traits that *ceteris paribus* induce people to become entrepreneurs. The most striking example of this discrepancy involves the trait "openness to new experiences", which lowers earnings in self-employment, but drives people to be entrepreneurs. We also find that credit constraints are only marginally important in determining which business ideas are realized. Further, we show evidence suggesting that rather than obstructing productive business ideas from entering the market, credit constraints deter individuals who have less productive ideas, but would choose entrepreneurship since their earnings in paid employment are even lower. We go on to study the effect of policies encouraging entrepreneurship and show that they are largely ineffective. The main reason is that these policies effectively subsidize businesses that would already be started. Alternatively, they fund individuals with low quality ideas, but a preference for self-employment. In particular, we show that subsidies encourage people with the wrong personality traits (in terms of profitable entrepreneurship) into self-employment.

More broadly, our findings highlight that personality traits, like other non-cognitive skills, are not properly understood as being either good or bad *per se*. In contrast to cognitive skills or health, both of which improve outcomes on just about any conceivable socioeconomic dimension, personality traits can enhance productivity or utility in one sector and carry a wage or utility penalty in another. More striking, the same trait can enhance productivity, but confer a utility cost in the same sector. As such, policies or efforts to boost a trait could certainly be helpful along one dimension, but costly along another.

Although we have explored how personality traits capture underlying preferences, we do not claim to have provided a complete mapping between the two. In fact, personality might be capturing some other factor that could affect sector choices. One example would be beliefs biases. For example, individuals who are open to new experiences might be more likely to be optimistic or overconfident about their abilities as entrepreneurs. Previous work on "excess entry" supports this notion (Camerer and Lovallo, 1999; Elston, Harrison, and Rutström, 2006; Koellinger, Minniti, and Schade, 2007). Dawson et al. (2014), for example, show that over-estimation of financial outcomes predicts a tendency to open a business. Relatedly,

Heger and Papageorge (2014) explore different ways that agents over-estimate high-payoff outcomes, distinguishing between pure optimism versus a tendency to over-estimate one's talents or abilities. Both of these biases could nudge individuals towards opening their own business and one (or both) of these biases could be correlated to personality traits like openness to new experiences. We have provided a useful framework that could lead to further research exploring the relationship between personality and beliefs, and the impact on self-employment entry and success.

References

Almlund, Mathilde, Angela Lee Duckworth, James Heckman, and Tim Kautz. 2011. "Personality Psychology and Economics." *Handbook of the Economics of Education* 4 (1).

Anderson, Jon, Stephen Burks, Colin DeYoung, and Aldo Rustichini. 2011. "Toward the Integration of Personality Theory and Decision Theory in the Explanation of Economic Behavior." IZA Working Paper.

Artazcoz, Lucía, Joan Benach, Carme Borrell, and Immaculada Cortès. 2004. "Unemployment and Mental Health: Understanding the Interactions among Gender, Family Roles, and Social Class." *American Journal of Public Health* 94 (1):82–88.

Asoni, Andrea. 2010. "What Drives Entrepreneurship?" Mimeo, University of Chicago.

Barón, Juan D and Deborah A Cobb-Clark. 2010. "Are Young People's Educational Outcomes Linked to their Sense of Control?" IZA Working Paper.

Barrick, Murray R and Michael K Mount. 1991. "The Big Five Personality Dimensions and Job Performance: A Meta-Analysis." *Personnel Psychology* 44 (1):1–26.

———. 1993. "Autonomy as a Moderator of the Relationships Between the Big Five Personality Dimensions and Job Performance." *Journal of Applied Psychology* 78 (1):111.

Barrick, Murray R, Michael K Mount, and Timothy A Judge. 2001. "Personality and Performance at the Beginning of the New Millennium: What Do We Know and Where Do We Go Next?" *International Journal of Selection and Assessment* 9 (1-2):9–30.

Becker, Gary S. 1965. "A Theory of the Allocation of Time." *Economic Journal* 75 (299):493–517.

Ben-Ner, Avner, Fanmin Kong, and Louis Putterman. 2004. "Share and Share Alike? Gender-Pairing, Personality, and Cognitive Ability as Determinants of Giving." *Journal of Economic Psychology* 25 (5):581–589.

Berings, Dries, Filip De Fruyt, and René Bouwen. 2004. "Work Values and Personality Traits as Predictors of Enterprising and Social Vocational Interests." *Personality and Individual Differences* 36 (2):349–364.

Borghans, Lex, Angela Lee Duckworth, James J Heckman, and Bas Ter Weel. 2008. "The Economics and Psychology of Personality Traits." *Journal of Human Resources* 43 (4):972–1059.

Borghans, Lex, Bart HH Golsteyn, James Heckman, and John Eric Humphries. 2011. "Identification Problems in Personality Psychology." NBER Working Paper.

Bowles, Samuel, Herbert Gintis, and Melissa Osborne. 2001. "Incentive-Enhancing Preferences: Personality, Behavior, and Earnings." *The American Economic Review* 91 (2):155–158.

Brandstätter, Hermann. 2011. "Personality Aspects of Entrepreneurship: A Look at Five Meta-Analyses." *Personality and Individual Differences* 51 (3):222–230.

Bugg, Julie M, Nancy A Zook, Edward L DeLosh, Deana B Davalos, and Hasker P Davis. 2006. "Age Differences in Fluid Intelligence: Contributions of General Slowing and Frontal Decline." *Brain and Cognition* 62 (1):9–16.

Caliendo, Marco, Frank Fossen, and Alexander Kritikos. 2011. "Personality Characteristics and the Decision to Become and Stay Self-Employed." DIW Berlin Discussion Paper.

Camerer, C. and D. Lovallo. 1999. "Overconfidence and Excess Entry: An Experimental Approach." *American Economic Review* 89 (1):306–318.

Caspi, Avshalom. 2000. "The Child is Father of the Man: Personality Continuities from Childhood to Adulthood." *Journal of Personality and Social Psychology* 78 (1):158.

Cattan, Sarah. 2011. "The Role of Workers Traits in Explaining the Early Career Gender Wage Gap." Mimeo, University of Chicago.

Cobb-Clark, Deborah A and Stefanie Schurer. 2012. "The Stability of Big-Five Personality Traits." *Economics Letters* 115 (1):11–15.

Costa Jr, Paul T and Robert R McCrae. 1995. "Domains and Facets: Hierarchical Personality Assessment Using the Revised NEO Personality Inventory." *Journal of Personality Assessment* 64 (1):21–50.

Cutler, David M. and Adriana Lleras-Muney. 2010. "Understanding Differences in Health Behaviors by Education." *Journal of Health Economics* 29 (1):1–28.

Dahling, Jason J, Samantha L Chau, David M Mayer, and Jane B Gregory. 2012. "Breaking Rules for the Right Reasons? An Investigation of Pro-Social Rule Breaking." *Journal of Organizational Behavior* 33 (1):21–42.

Dawson, Christopher, David Emmanuel De Meza, Andrew Henley, and G Reza Arabsheibani. 2014. "Entrepreneurship: Cause or Consequence of Financial Optimism?" Discussion Paper Series, Forschungsinstitut zur Zukunft der Arbeit.

Dohmen, Thomas, Armin Falk, David Huffman, and Uwe Sunde. 2008. "Representative Trust and Reciprocity: Prevalence and Determinants." *Economic Inquiry* 46 (1):84–90.

———. 2010. "Are Risk Aversion and Impatience Related to Cognitive Ability?" *American Economic Review* 100 (3):1238–1260.

Elston, J.A., G. Harrison, and E. Rutström. 2006. "Experimental Economics, Entrepreneurs and the Entry Decision." Mimeo, University of Central Florida.

Evans, David S and Boyan Jovanovic. 1989. "An Estimated Model of Entrepreneurial Choice under Liquidity Constraints." *The Journal of Political Economy* 97 (4):808–827.

Fairlie, Robert W and William Holleran. 2012. "Entrepreneurship Training, Risk Aversion and other Personality Traits: Evidence from a Random Experiment." *Journal of Economic Psychology* 33 (2):366–378.

Fairlie, Robert W, Dean Karlan, and Jonathan Zinman. 2012. "Behind the GATE Experiment: Evidence on Effects of and Rationales for Subsidized Entrepreneurship Training." NBER working paper.

Fréchette, Guillaume R, Andrew Schotter, and Isabel Trevino. 2011. "Personality and Choice in Risky and Ambiguous Environments: An Experimental Study." Mimeo, Dept. of Economics, New York University.

Gensowski, Miriam, James Heckman, and Peter Savelyev. 2011. "The Effects of Education, Personality, and IQ on Earnings of High-Ability Men." Mimeo, University of Chicago.

Goldberg, Lewis R. 1971. "Five Models of Clinical Judgment: An Empirical Comparison between Linear and Nonlinear Representations of the Human Inference Process." *Organizational Behavior and Human Performance* 6 (4):458–479.

Goldberger, Arthur S. 1972. "Structural Equation Methods in the Social Sciences." *Econometrica* 40 (6):979–1001.

Hamilton, B.H. 2000. "Does Entrepreneurship Pay? An Empirical Analysis of the Returns of Self-Employment." *Journal of Political Economy* 108 (3):604–631.

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 & Management Strategy* 19 (4):947–989.

Heckman, James J. 2012. "The Developmental Origins of Health." *Health Economics* 21 (1):24–29.

Heckman, James J and Bo E Honore. 1990. "The Empirical Content of the Roy Model." *Econometrica* 58 (5):1121–1149.

Heckman, James J and Tim Kautz. 2012. "Hard Evidence on Soft Skills." *Labour economics* 19 (4):451–464.

———. 2013. "Fostering and Measuring Skills: Interventions that Improve Character and Cognition." NBER working paper.

Heckman, James J and Paul A LaFontaine. 2010. "The American High School Graduation Rate: Trends and Levels." *The Review of Economics and Statistics* 92 (2):244–262.

Heckman, James J, Rodrigo Pinto, and Peter A Savelyev. 2012. "Understanding the Mechanisms through which an Influential Early Childhood Program Boosted Adult Outcomes." NBER working paper.

Heckman, James J and Yona Rubinstein. 2001. "The Importance of Noncognitive Skills: Lessons from the GED Testing Program." *The 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." *The Journal of Labor Economics* 24 (3):411.

Heger, Stephanie A and Nicholas W Papageorge. 2014. "We Should Totally Open A Restaurant: Performance Over-Estimation and Optimistic Beliefs." Mimeo, Johns Hopkins University.

Heineck, Guido. 2010. "Does It Pay to Be Nice-Personality and Earnings in the United Kingdom." *Industrial and Labor Relations Review* 64:1020–1047.

Hisrich, Robert, Janice Langan-Fox, and Sharon Grant. 2007. "Entrepreneurship Research and Practice: A Call to Action for Psychology." *American Psychologist* 62 (6):575.

Horn, John L and Raymond B Cattell. 1967. "Age Differences in Fluid and Crystallized Intelligence." *Acta Psychologica* 26:107–129.

Hurst, Erik and Annamaria Lusardi. 2004. "Liquidity Constraints, Household Wealth, and Entrepreneurship." *Journal of Political Economy* 112 (2):319–347.

Hurtz, Gregory M and John J Donovan. 2000. "Personality and Job Performance: the Big Five Revisited." *Journal of Applied Psychology* 85 (6):869.

Jöreskog, Karl G and Arthur S Goldberger. 1975. "Estimation of a Model with Multiple Indicators and Multiple Causes of a Single Latent Variable." *Journal of the American Statistical Association* 70 (351a):631–639.

Judge, Timothy A and Joyce E Bono. 2001. "Relationship of Core Self-Evaluations Traits—Self-Esteem, Generalized Self-Efficacy, Locus of Control, and Emotional Stability—With Job Satisfaction and Job Performance: A Meta-Analysis." *Journal of Applied Psychology* 86 (1):80.

Judge, Timothy A, Daniel Heller, and Michael K Mount. 2002. "Five-Factor Model of Personality and Job Satisfaction: a Meta-Analysis." *Journal of Applied Psychology* 87 (3):530.

Kahneman, Daniel, Jack L Knetsch, and Richard Thaler. 1986. "Fairness as a Constraint on Profit Seeking: Entitlements in the Market." *The American Economic Review* :728–741.

Koellinger, P., M. Minniti, and C. Schade. 2007. ""I Think I Can, I Think I Can": Overconfidence and Entrepreneurial Behavior." *Journal of Economic Psychology* 28 (4):502–527.

Lancaster, K.J. 1966. "A New Approach to Consumer Theory." *The Journal of Political Economy* 74 (2):132–157.

Lazear, Edward P. 2004. "Entrepreneurship." *Journal of Labor Economics* 23 (4):pp. 649–680.

Lerner, Josh. 2009. *Boulevard of Broken Dreams: Why Public Efforts to Boost Entrepreneurship and Venture Capital Have Failed–and What to Do about It.* Princeton University Press.

Levine, Ross and Yona Rubinstein. 2013. "Smart and Illicit: Who Becomes an Entrepreneur and Does it Pay?" NBER working paper.

Lundberg, Shelly. 2011. "Psychology and Family Economics." *Perspektiven der Wirtschaftspolitik* 12 (s1):66–81.

———. 2012. "Personality and Marital Surplus." *IZA Journal of Labor Economics* 1 (1):1–21.

Lundborg, Petter. 2013. "The Health Returns to Schooling—What Can We Learn from Twins?" *Journal of Population Economics* 26 (2):673–701.

Mount, Michael K, Murray R Barrick, and Greg L Stewart. 1998. "Five-Factor Model of Personality and Performance in Jobs Involving Interpersonal Interactions." *Human Performance* 11 (2-3):145–165.

Mueller, Gerrit and Erik Plug. 2006. "Estimating the Effect of Personality on Male and Female Earnings." *Industrial and Labor Relations Review* :3–22.

Nyhus, Ellen K and Empar Pons. 2005. "The Effects of Personality on Earnings." *Journal of Economic Psychology* 26 (3):363–384.

Paulson, Anna L, Robert M Townsend, and Alexander Karaivanov. 2006. "Distinguishing Limited Liability from Moral Hazard in a Model of Entrepreneurship." *Journal of Political Economy* 114 (1):100–144.

Rauch, Andreas and Michael Frese. 2007. "Let's Put the Person Back into Entrepreneurship Research: A Meta-Analysis on the Relationship between Business Owners' Personality Traits, Business Creation, and Success." *European Journal of Work and Organizational Psychology* 16 (4):353–385.

Roberts, Brent, Joshua J Jackson, Angela L Duckworth, and Katherine Von Culin. 2011. "Personality Measurement and Assessment in Large Panel Surveys." *Forum for Health Economics and Policy* 14 (3):9.

Roccas, Sonia, Lilach Sagiv, Shalom H Schwartz, and Ariel Knafo. 2002. "The Big Five Personality Factors and Personal Values." *Personality and Social psychology Bulletin* 28 (6):789–801.

Savelyev, Peter A. 2010. "Conscientiousness, Education, and Longevity of High-Ability Individuals." Mimeo, University of Chicago.

Schumpeter, Joseph A. 1949. *Change and the Entrepreneur: Postulates and Patterns for Entrepreneurial History*. Harvard University Press.

Shane, S, N Nicolaou, L Cherkas, and T Spector. 2010. "Openness to Experience and Opportunity Recognition: Evidence of a Common Genetic Etiology." *Human Resource Management* 29:291–303.

Shane, Scott and Nicos Nicolaou. 2013. "The Genetics of Entrepreneurial Performance." *International Small Business Journal* 31 (5):473–495.

Stawski, Robert S, David M Almeida, Margie E Lachman, Patricia A Tun, and Christopher B Rosnick. 2010. "Fluid Cognitive Ability is Associated with Greater Exposure and Smaller Reactions to Daily Stressors." *Psychology and Aging* 25 (2):330.

Stigler, G.J. 1945. "The Cost of Subsistence." *Journal of Farm Economics* 27 (2):303–314.

Störmer, Susi and René Fahr. 2013. "Individual Determinants of Work Attendance: Evidence on the Role of Personality." *Applied Economics* 45 (19):2863–2875.

Urzua, S. 2008. "Racial Labor Market Gaps The Role of Abilities and Schooling Choices." *Journal of Human Resources* 43 (4):919–971.

Vandenberghe, Christian, Sylvie St-Onge et al. 2008. "An Analysis of the Relation Between Personality and the Attractiveness of Total Rewards Components." *Relations Industrielles/Industrial Relations* 63 (3):425–453.

Viinikainen, Jutta, Katja Kokko, Lea Pulkkinen, and Jaakko Pehkonen. 2010. "Personality and Labour Market Income: Evidence from Longitudinal Data." *Labour* 24 (2):201–220.

Wichert, Laura and Winfried Pohlmeier. 2009. "Female Labor Force Participation and the Big Five." Mimeo, University of Konstanz Department of Economics.

Zhang, Zhen, Michael J Zyphur, Jayanth Narayanan, Richard D Arvey, Sankalp Chaturvedi, Bruce J Avolio, Paul Lichtenstein, and Gerry Larsson. 2009. "The Genetic Basis of Entrepreneurship: Effects of Gender and Personality." *Organizational Behavior and Human Decision Processes* 110 (2):93–107.

Zhao, Hao and Scott E Seibert. 2006. "The Big Five Personality Dimensions and Entrepreneurial Status: A Meta-Analytical Review." *Journal of Applied Psychology* 91 (2):259.

Zhao, Hao, Scott E Seibert, and G Thomas Lumpkin. 2010. "The Relationship of Personality to Entrepreneurial Intentions and Performance: A Meta-Analytic Review." *Journal of Management* 36 (2):381–404.

10 Tables and Figures

Table 2: Summary Statistics

	Analysis Sample	Paid Employment	Self Employment	Δ (Self−Paid)	p-values
Earnings in 2004	\$78,153.61	\$74,482.67	\$93,988.64	\$19,505.97	0.044
Assets in 1995	\$120,595.20	\$101,371.10	\$203,520.70	\$102,149.60	0.000
High school degree	0.19	0.19	0.20	0.01	0.669
Some college	0.27	0.27	0.26	-0.01	0.821
College graduate	0.25	0.25	0.25	0.00	0.946
Married	0.79	0.78	0.83	0.05	0.117
No. of children	2.19	2.19	2.19	0.00	0.991
Spouse educ. (years)	12.03	12.00	12.16	0.16	0.739
Spouse employed (1995)	0.58	0.56	0.66	0.10	0.020
Fluid Cognitive Ability	0.35	0.36	0.32	-0.04	0.608
Agreeableness (1995)	3.29	3.28	3.31	0.02	0.587
Agreeableness (2004)	3.24	3.23	3.30	0.07	0.087
Extraversion (1995)	3.14	3.12	3.25	0.14	0.002
Extraversion (2004)	3.04	3.02	3.16	0.14	0.002
Neuroticism (1995)	2.16	2.18	2.10	-0.08	0.170
Neuroticism (2004)	2.02	2.03	1.99	-0.04	0.469
Conscientiousness (1995)	3.40	3.39	3.44	0.04	0.224
Conscientiousness (2004)	3.46	3.46	3.48	0.02	0.586
Openness (1995)	3.07	3.06	3.13	0.07	0.075
Openness (2004)	2.97	2.95	3.06	0.11	0.004

Summary statistics for the subsample used in analysis.

Table 3: Sector Choice

	[1]	[2]
Assets in 1995	9.54e-07***	9.54e-07***
	(2.41e-07)	(2.44e-07)
Education (years)	-0.02	-0.02
	(0.02)	(0.02)
Age (2004)	0.03***	0.03***
	(0.007)	(0.007)
Married	0.13	0.16
	(0.13)	(0.13)
Cognitive Ability Measure	.	0.02
		(0.06)
Agreeableness (2004)	.	0.01
		(0.12)
Extraversion (2004)	.	0.12
		(0.11)
Neuroticism (2004)	.	0.05
		(0.09)
Conscientiousness (2004)	.	-0.1
		(0.12)
Openness (2004)	.	0.23*
		(0.12)
Observations	898	898

Probit estimates where the outcome variable is an indicator for self-employment (as opposed to paid employment) reported in 2004. Standard errors are in parentheses and significance at the 10%, 5% and 1% levels are indicated with one, two and three stars, respectively.

Table 4: Results: Latent Personality Traits

Variable	Coefficient	Std. Error
Agreeableness:		
Mean	3.147	0.089
Variance	0.451	0.016
Factor loading	0.917	0.034
Age parameter (1995)	0.003	0.002
Age parameter (2004)	0.007	0.002
Meas. error variance (1995)	0.320	0.018
Meas. error variance (2004)	0.339	0.016
Extraversion:		
Mean	3.096	0.083
Variance	0.484	0.015
Factor loading	0.902	0.033
Age parameter (1995)	0.001	0.002
Age parameter (2004)	0.005	0.002
Meas. error variance (1995)	0.294	0.017
Meas. error variance (2004)	0.350	0.014
Neuroticism:		
Mean	2.494	0.090
Variance	0.497	0.020
Factor loading	0.942	0.041
Age parameter (1995)	-0.008	0.002
Age parameter (2004)	-0.007	0.002
Meas. error variance (1995)	0.410	0.019
Meas. error variance (2004)	0.409	0.017
Conscientiousness:		
Mean	3.299	0.057
Variance	0.343	0.011
Factor loading	1.004	0.026
Age parameter (1995)	0.002	0.001
Age parameter (2004)	0.003	0.002
Meas. error variance (1995)	0.280	0.011
Meas. error variance (2004)	0.273	0.012
Openness to New Experiences:		
Mean	3.171	0.068
Variance	0.412	0.014
Factor loading	0.927	0.028
Age parameter (1995)	-0.003	0.002
Age parameter (2004)	0.001	0.002
Meas. error variance (1995)	0.244	0.016
Meas. error variance (2004)	0.335	0.012

Coefficients: distribution of latent personality traits.

Table 5: Results: Paid Employment

Variable	Coefficient	Std. Error
Education	0.067	0.005
Age	0.008	0.000
Married	0.190	0.073
Fluid Cognitive Ability	0.109	0.021
Agreeableness	-0.200	0.045
Extraversion	0.108	0.049
Neuroticism	0.086	0.035
Conscientiousness	0.153	0.034
Openness to New Experiences	0.039	0.041
Constant	9.167	0.076
Variance	0.836	0.005

Coefficients: paid-employment earnings.

Table 6: Results: Self Employment

Variable	Coefficient	Std. Error
Log Assets	-0.004	0.014
Education	0.156	0.010
Age	-0.010	0.002
Married	0.256	0.166
Fluid Cognitive Ability	-0.095	0.049
Agreeableness	-0.291	0.073
Extraversion	0.227	0.054
Neuroticism	0.039	0.049
Conscientiousness	-0.072	0.067
Openness to New Experiences	-0.294	0.055
Constant 1	8.478	0.166
Constant 2	10.647	0.284
Variance 1	0.494	0.059
Variance 2	0.007	0.488
Mixture Probability	0.844	0.008
Earnings Uncertainty	1.560	0.069
Technology Parameter	0.135	0.015
Credit Constraints	1.990	1.090

Coefficients: self-employment earnings.

Table 7: Results: Preference Parameters

Variable	Coefficient	Std. Error
Earnings Utility Parameter	0.000	0.000
Number of Kids	-0.108	0.057
Spouse Education	0.005	0.016
Spouse Employment (1995)	0.379	0.131
Education	-0.025	0.017
Age	0.085	0.002
Married	0.045	0.281
Fluid Cognitive Ability	0.178	0.080
Agreeableness	0.105	0.123
Extraversion	0.085	0.123
Neuroticism	-0.002	0.097
Conscientiousness	-0.025	0.106
Openness to New Experiences	0.687	0.104
Constant	-6.115	0.303

Coefficients: utility parameters.

Table 8: Preferences versus Earnings

	Highest Relative Payoff in Self or Paid?		
Characteristic	Earnings	Utility	Discrepancy?
Education	Self	Paid	✓
Age	Paid	Self	✓
Married	Paid	Self	✓
Fluid Cognitive Ability	Self	Self	
Agreeableness	Paid	Self	✓
Extraversion	Self	Self	
Neuroticism	Paid	Paid	
Conscientiousness	Paid	Paid	
Openness to New Experiences	Paid	Self	✓

For individual characteristics, we identify whether the marginal payoff (earnings and utility) is higher in paid or self-employment and then add a checkmark if there is a discrepancy. For example, openness to new experiences leads to higher relative earnings in paid-employment, but higher utility in self-employment, leading to a discrepancy.

Table 9: Removing Market Imperfections

Counterfactual Policy Simulation	Average Value of Business Ideas	% Change in Entry Probability
Baseline	\$71,089.82	0
No Credit Constraints	\$69,847.26	3.30
Preferences do not Affect Entry	\$83,315.91	-18.99
Both	\$81,866.66	-15.97

The average value of business ideas that are realized, i.e., conditional on self-employment under counterfactuals where (i) there are no credit constraints, (ii) where preferences do not affect entry (agents maximize earnings) and (iii) where there are no credit constraints and preferences do not affect entry. Also recorded are percent changes to entry relative to the baseline where credit constraints and preferences influence entry.

Table 10: Subsidizing Entrepreneurship

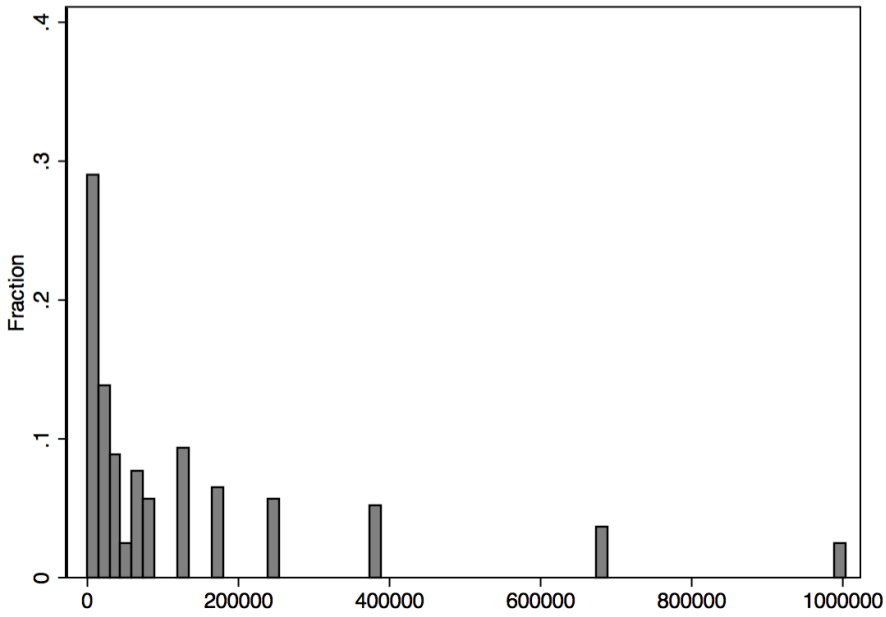
Counterfactual Policy Simulation	Average Value of Business Ideas	% Change in Entry Probability
Baseline	\$71,089.82	0
Subsidy	\$43,861.76	87.56
Preferences do not Affect Entry	\$83,315.92	-18.99
No Preferences and Subsidy	\$67,237.68	10.05

The average value of business ideas that are realized, i.e., conditional on self-employment under counterfactuals where (i) there is a blanket subsidy of \$25,000 for any individual who starts a business, (ii) where preferences do not affect entry (agents maximize earnings) and (iii) where there is a blanket subsidy of \$25,000 for any individual who starts a business and preferences do not affect entry. Also recorded are percent changes to entry relative to the baseline where preferences influence entry and there is no subsidy.

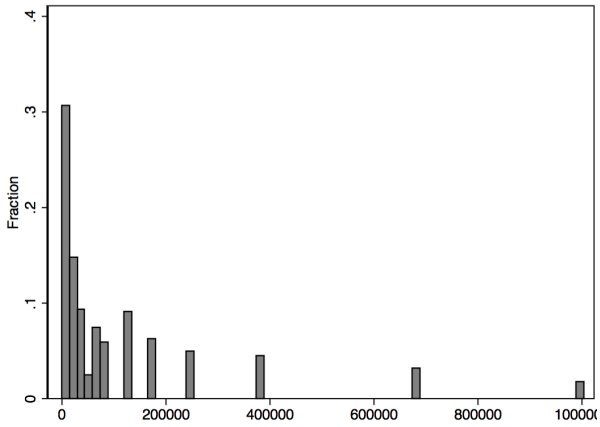
Table 11: Business Plan Tournaments: Subsidizing the Best Ideas

	Amount of Tournament Prize Awarded to Best Ideas		
Percent of Top Ideas Funded	$0	$10,000	$25,000
5%	$71,089.82 [0.00%]	$71,091.05 [0.0036%]	$71,091.09 [0.0038%]
10%	$71,089.82 [0.00%]	$71,096.72 [0.0625%]	$71,098.54 [0.0851%]
15%	$71,089.82 [0.00%]	$71,063.62 [0.2968%]	$71,035.73 [0.5028%]
20%	$71,089.82 [0.00%]	$70,369.93 [2.0684%]	$69,600.54 [4.2155%]
	$50,000	$100,000	$500,000
5%	$71,091.14 [0.0040%]	$71,091.14 [0.0040%]	$71,091.14 [0.0040%]
10%	$71,099.30 [0.0928%]	$71,099.38 [0.0942%]	$71,099.38 [0.0942%]
15%	$71,017.90 [0.6019%]	$70,999.81 [0.6835%]	$70,999.56 [0.6842%]
20%	$68,997.53 [5.8907%]	$68,671.59 [6.8636%]	$68,659.59 [6.8978%]

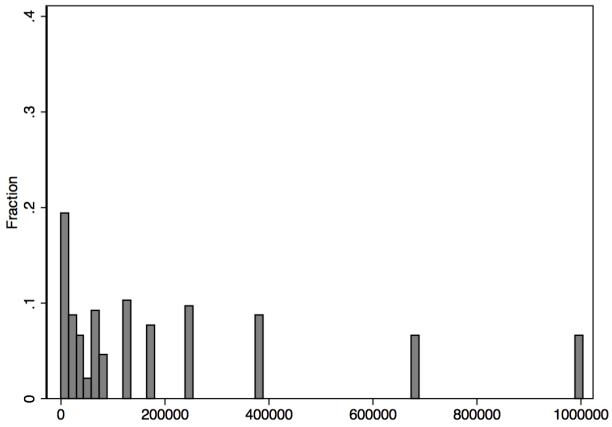
Each cell contains the average value of realized business ideas and the percent increase in entry (the latter in brackets) for varying tournament prize amounts awarded to varying proportions of the highest value business ideas. When the tournament prize is zero, there is no change in average value (which remains at $71,089.82) and no change in entry probability. If the tournament prize is $100,000 for the top 10% of ideas, the average value of ideas rises to $71,099.38 and entry increases by 0.09%. If the tournament prize is $100,000 for the top 20% of ideas, the average value of ideas sinks to $68,671.59 and entry increases by 6.86%.



(a)



(b)



(c)

Figure 1: Histograms of assets in 1995 for the full sample (Panel 1(a)) and then separately by 2004 sector choice: paid employment (Panel 1(b)) and self-employment (Panel 1(c)).

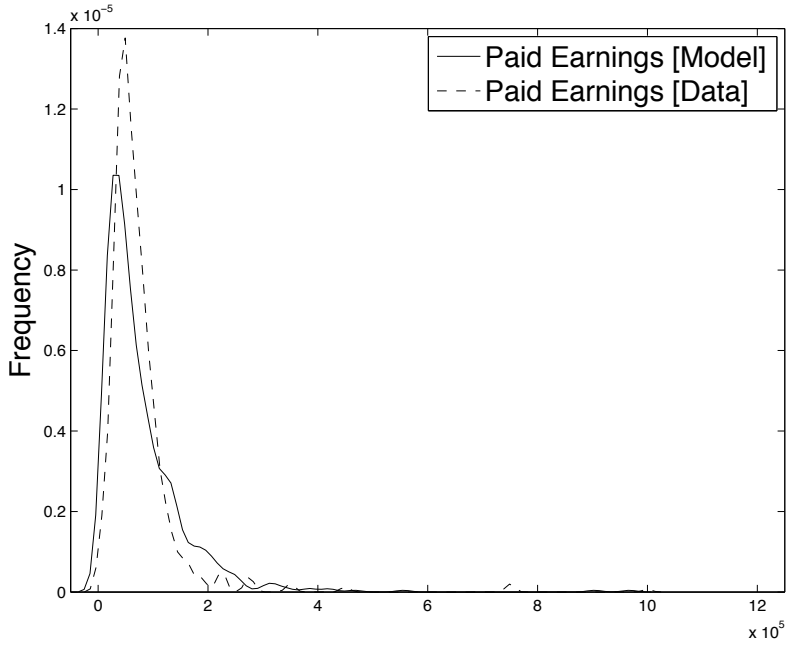


Figure 2: Model fit: Observed and simulated paid employment earnings using estimated model parameters.

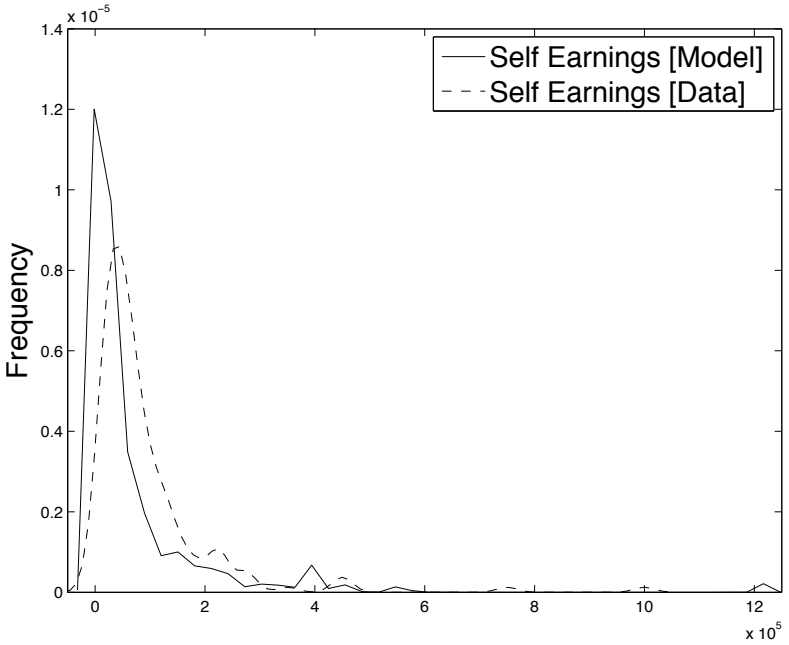


Figure 3: Model fit: Observed and simulated self-employment earnings using estimated model parameters.

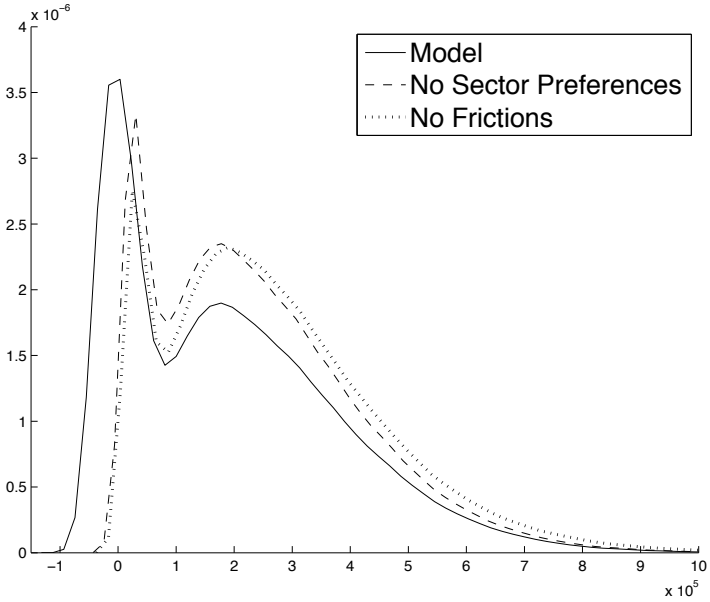


Figure 4: Earnings differential (expected self minus paid employment earnings) conditional on choosing self-employment and simulated using: (i) estimated model parameters, (ii) under the counterfactual where preferences do not affect entry (agents maximize earnings) and (iii) under the counterfactual where preferences do not affect entry and credit constraints are removed.

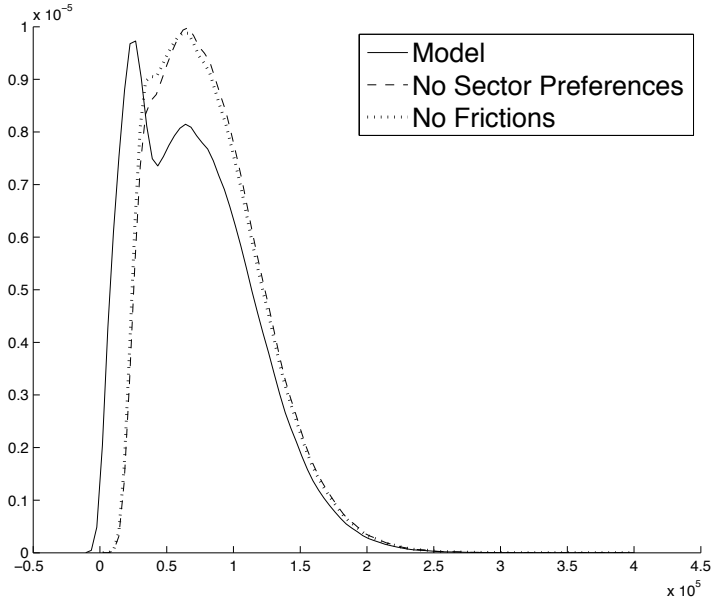


Figure 5: Simulated value of realized business ideas, i.e., conditional on entry into self-employment using: (i) estimated model parameters, (ii) under the counterfactual where preferences do not affect entry (agents maximize earnings) and (iii) under the counterfactual where preferences do not affect entry and credit constraints are removed.

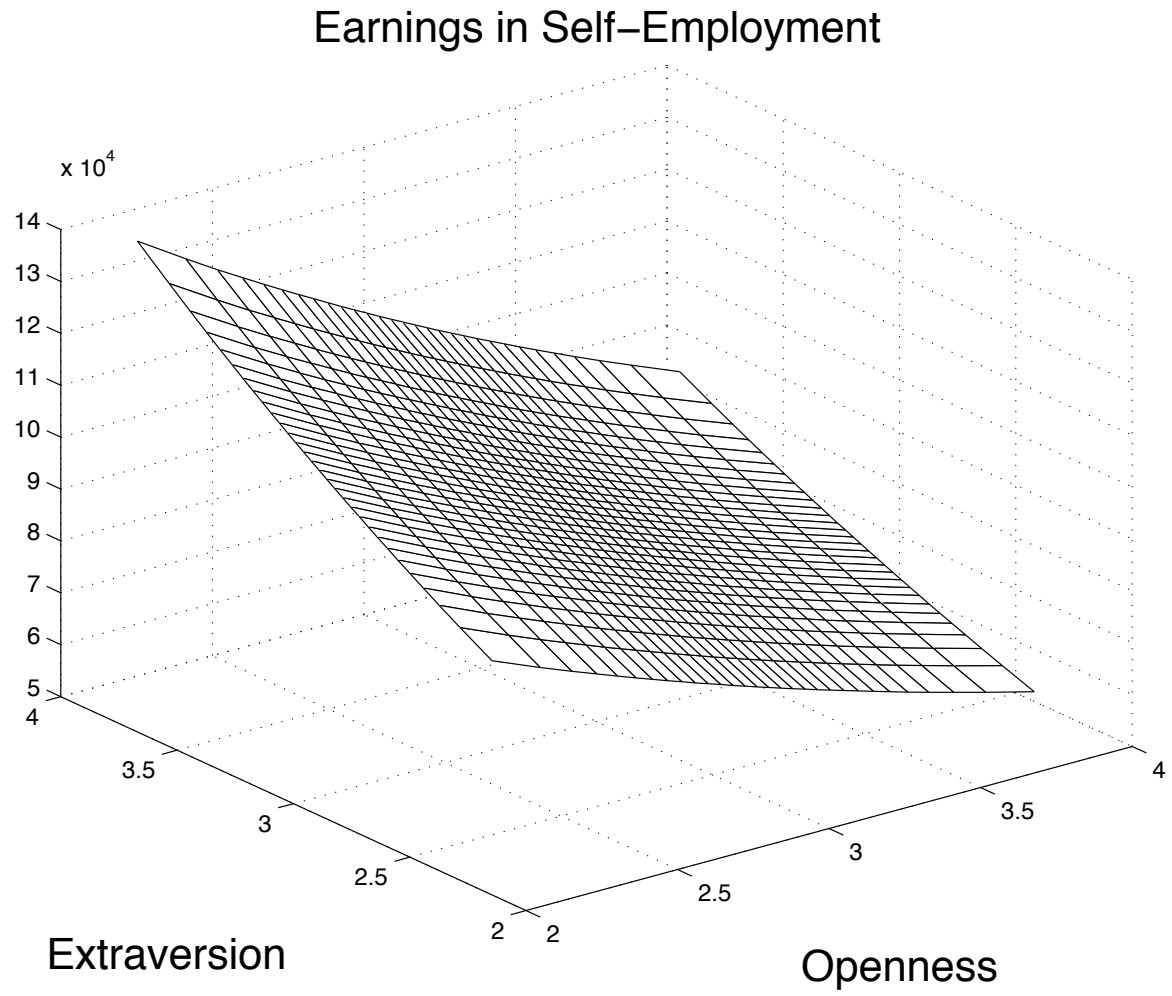


Figure 6: Simulated expected earnings in self-employment evaluated where Openness to New Experiences and Extraversion are set equal to each combination of deciles for the sub-sample of individuals used in our analysis.

Figure 7: Simulated expected earnings in paid employment evaluated where Openness to New Experiences and Extraversion are set equal to each combination of deciles for the sub-sample of individuals used in our analysis.

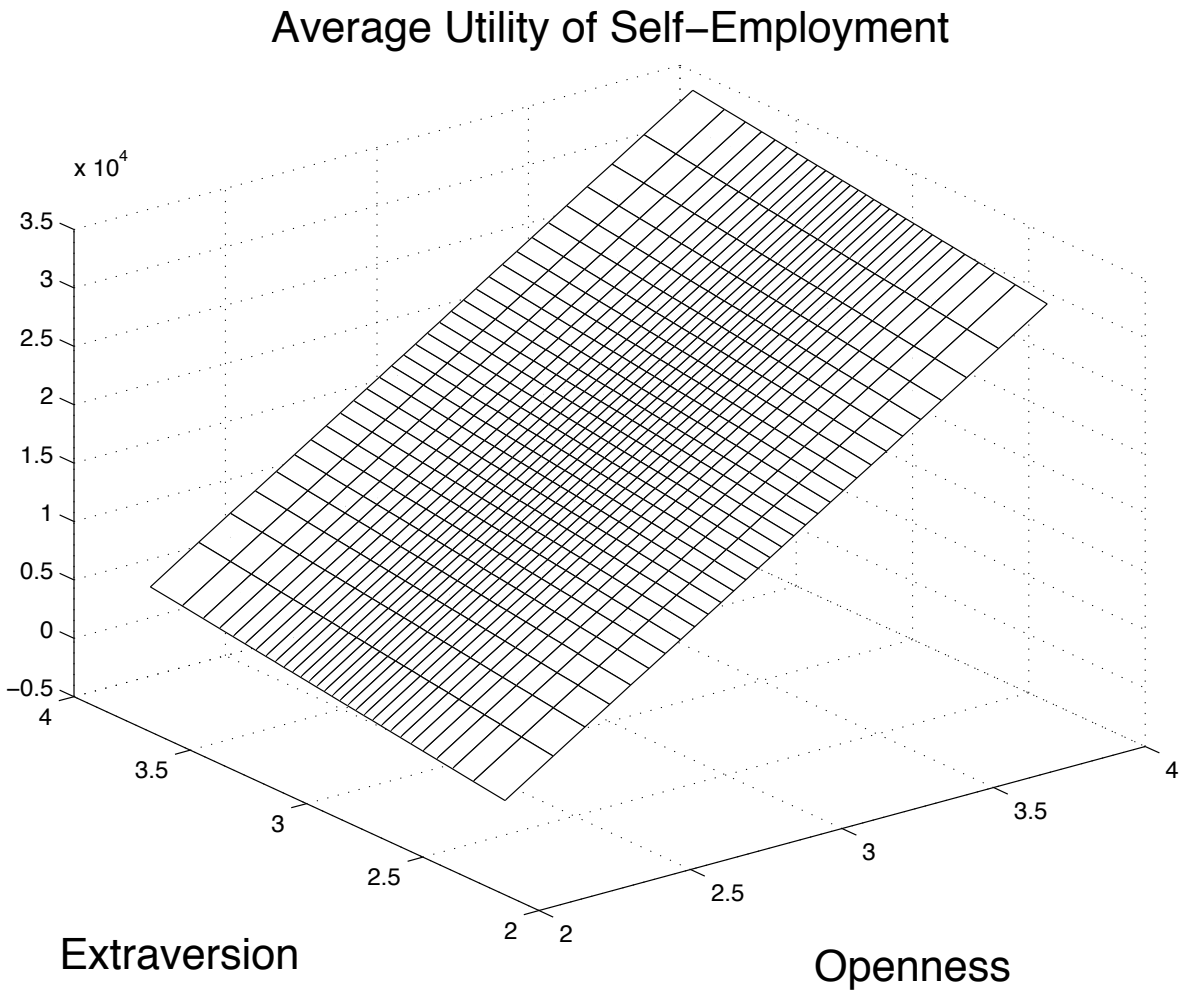


Figure 8: Simulated expected relative utility from self-employment evaluated where Openness to New Experiences and Extraversion are set equal to each combination of deciles for the sub-sample of individuals used in our analysis.

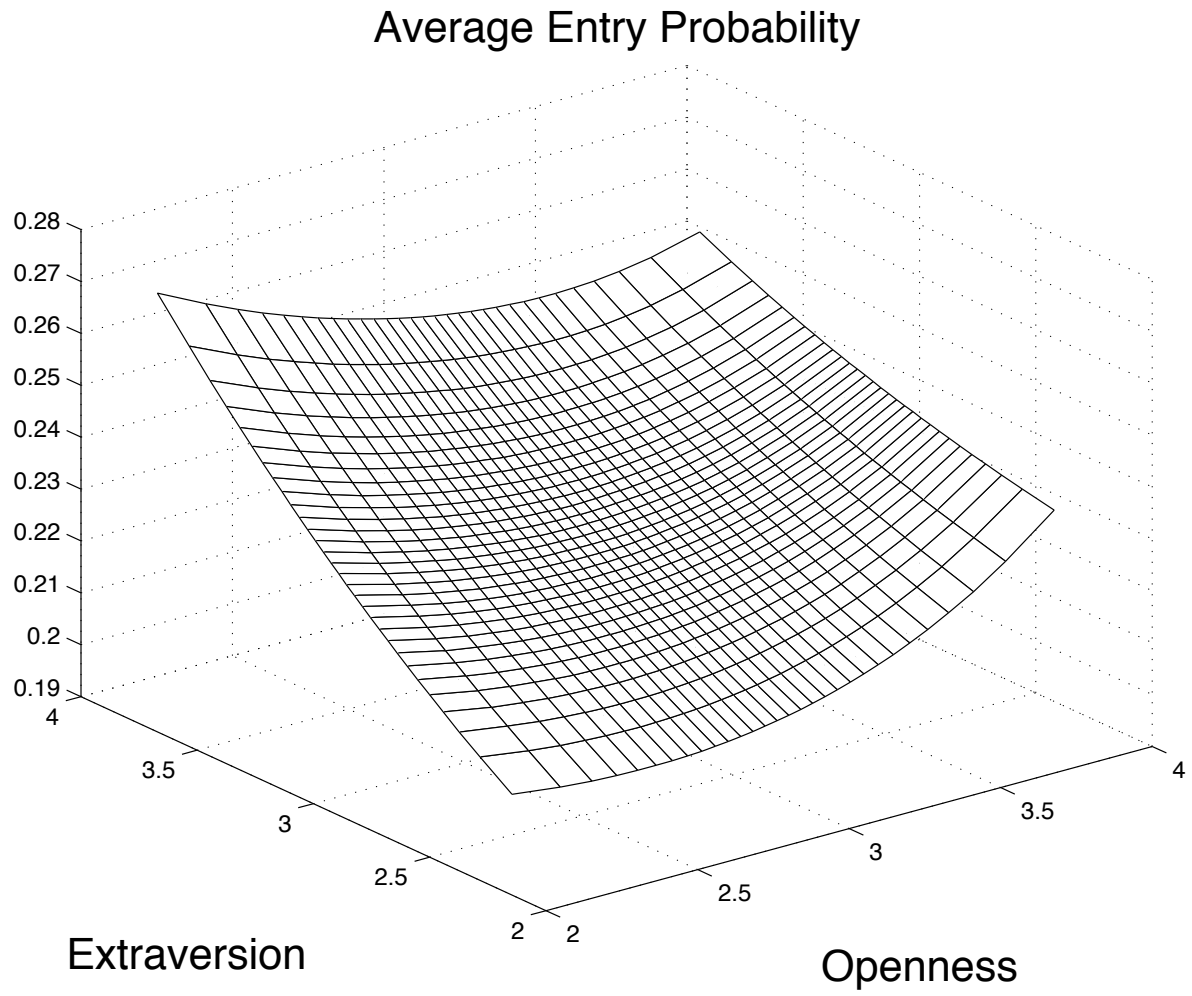


Figure 9: Simulated expected probability of entry into self-employment where Openness to New Experiences and Extraversion are set equal to each combination of deciles for the sub-sample of individuals used in our analysis.

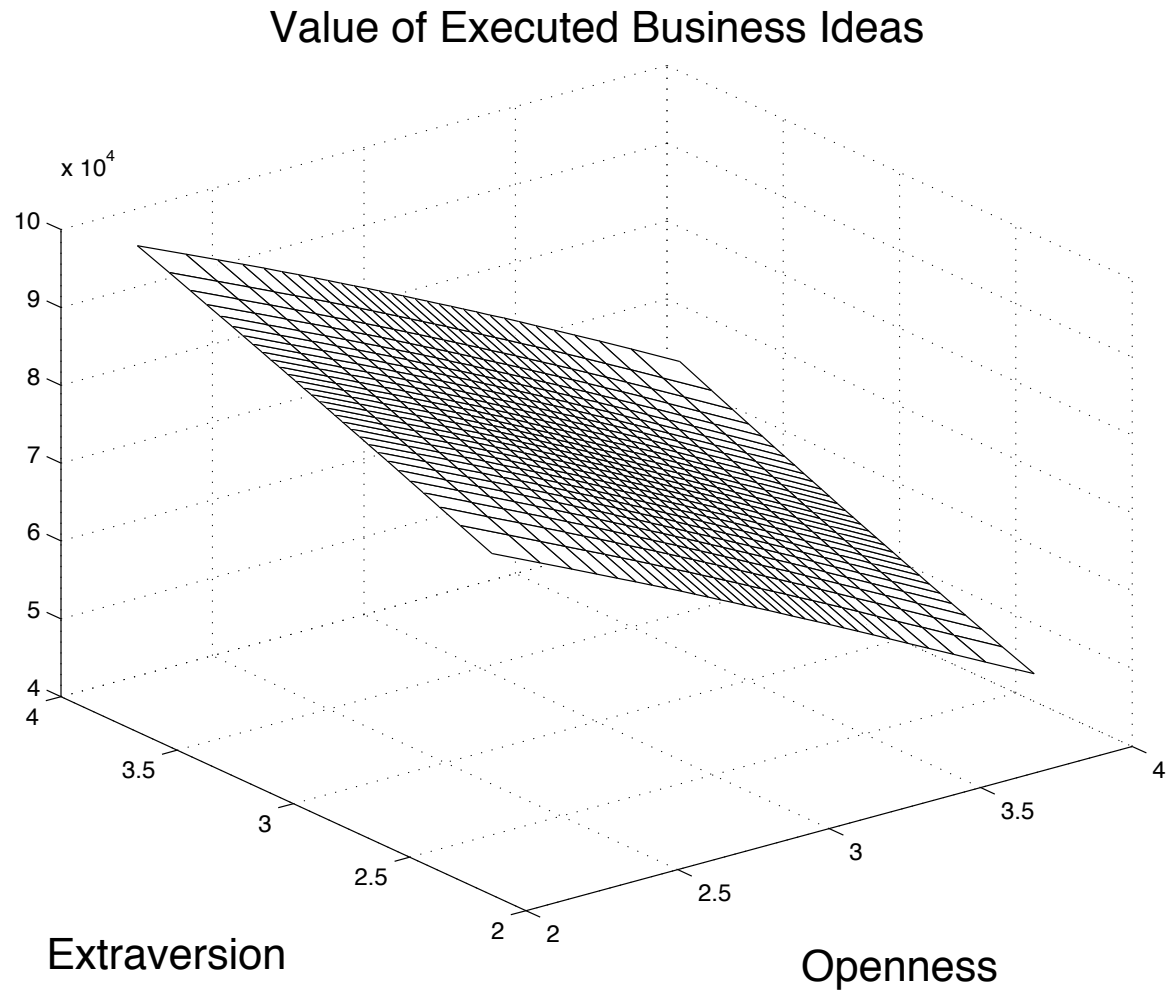


Figure 10: Simulated expected value of business ideas conditional on self-employment evaluated where Openness to New Experiences and Extraversion are set equal to each combination of deciles for the sub-sample of individuals used in our analysis.

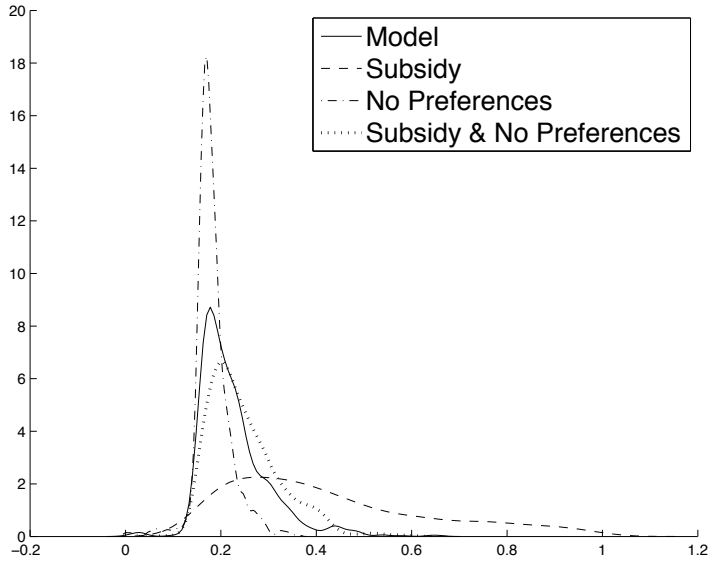


Figure 11: Simulated entry probability using estimated model parameters and then under the counterfactuals where (i) self-employment is subsidized ($25,000 for all businesses) (ii) individuals maximize earnings, i.e., preferences play no role in the self-employment decision and (iii) self-employment is subsidized and preferences play not role.

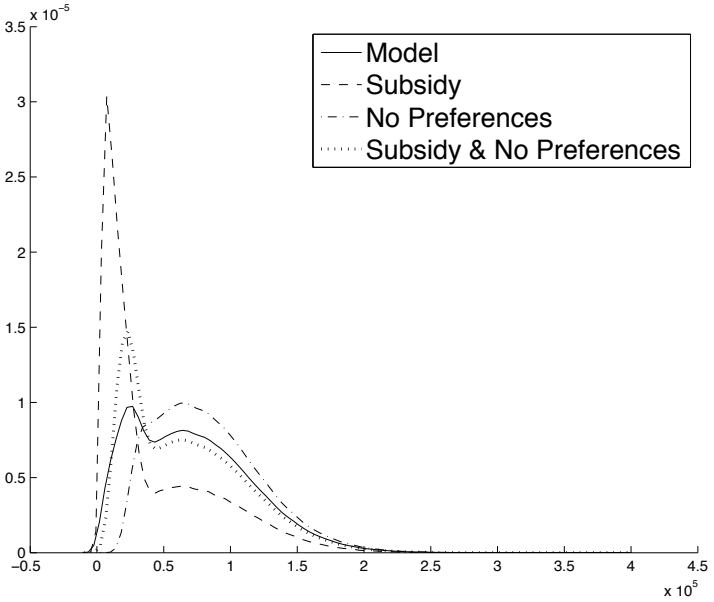
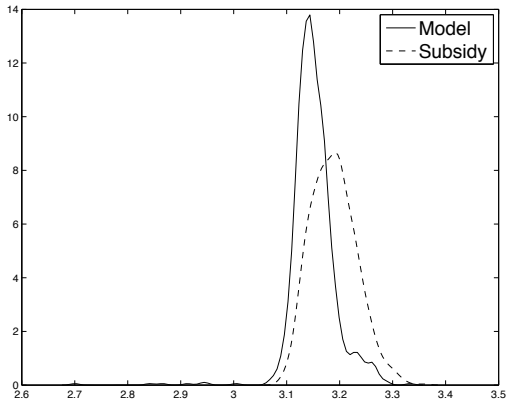
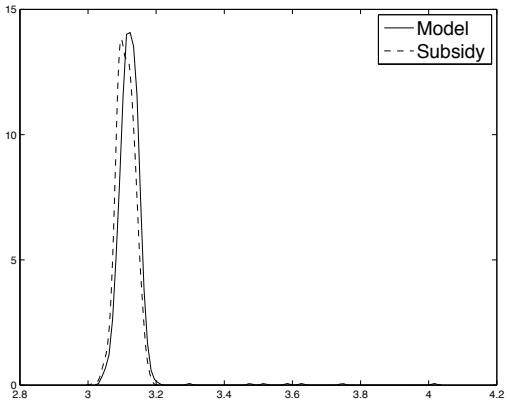


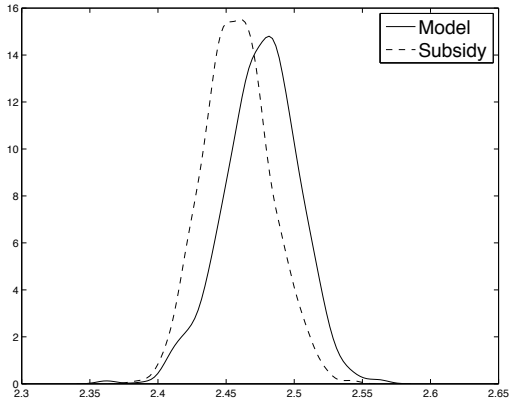
Figure 12: Simulated value of realized business ideas, i.e., conditional on entry into self-employment using estimated model parameters and then under the counterfactuals where (i) self-employment is subsidized ($25,000 for all businesses) (ii) individuals maximize earnings, i.e., preferences play no role in the self-employment decision and (iii) self-employment is subsidized and preferences play not role.



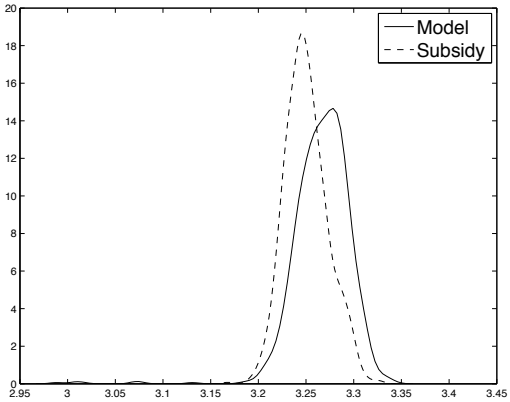
(a) Agreeableness



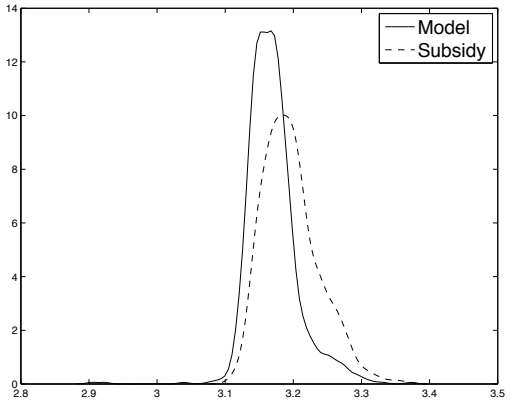
(b) Extraversion



(c) Neuroticism



(d) Conscientiousness



(e) Openness

Figure 13: Distribution of personality traits simulated from the model and then under the counterfactual where entrepreneurship is subsidized ($25,000 for all small businesses).

Appendix A Identification of Latent Factors

We are interested in identifying the distributions of five latent personality traits, as measured by the Big 5 along with latent intelligence, as measured by fluid intelligence. For now, we focus on the Big 5, where the measurement of trait $j \in \{1 \dots 5\}$ for agent i at time $t \in \{1995, 2004\}$ is specified as follows (where we suppress notation indicating conditioning on a vector of observables):

$$C_{ijt} = d^C_{jt} f_{ij} + \epsilon^C_{itj} \tag{25}$$

Without loss of generality, focus on trait 1. For latent trait 1, there are two measurements:

$$\begin{aligned} C_{i1(04)} &= d^C_{1(04)} f_{i1} + \epsilon^C_{i1(04)} \\ C_{i1(95)} &= d^C_{1(95)} f_{i1} + \epsilon^C_{i1(95)}. \end{aligned} \tag{26}$$

Further, for each individual in the sample, we record earnings in one of the two sectors. If individual i is in the paid sector, we observe wages, specified as:

$$\ln(w_i) = x^w_i \beta^w + \sum_{j=1}^{J} \kappa^w_j f_{ij} + e^w_i. \tag{27}$$

If individual i is self-employed, we observe earnings (or entrepreneurial returns), specified as:

$$\ln(y_i) = \ln(\theta_i) + \alpha \ln(k^*_i) + e^y_i \tag{28}$$

where:

$$\ln(\theta_i) = x^\theta_i \beta^\theta + \psi \ln A_i + \sum_{j=1}^{J} \kappa^\theta_j f_{ij} + e^\theta_i \tag{29}$$

and, from first order conditions,

$$k^*_i = \left(\frac{\alpha \theta_i}{r} \right)^{\frac{1}{1-\alpha}} = \phi \times \theta_i^{\frac{1}{1-\alpha}}, \tag{30}$$

We can rewrite equation [28] as:

$$\ln(y_i) = x^\theta_i \beta^\theta + \psi \ln A_i + \sum_{j=1}^{J} \kappa^\theta_j f_{ij} + e^\theta_i + \alpha \ln(k^*_i) + e^y_i \tag{31}$$

and therefore show that for every individual in the sample there are two measurements of latent factor 1 as well as an outcome that is also function of latent factor 1. Assuming that

$\epsilon^C_{i1(04)} \perp \epsilon^C_{i1(04)} \perp e^y_i \perp e^w_i$, we have that:

$$\begin{aligned} \text{Cov}\left(C_{i1(04)}, \ln(w_i)\right) &= d^C_{1(95)}\gamma_1\sigma^2_{fj} \\ \text{Cov}\left(C_{i1(95)}, \ln(w_i)\right) &= d^C_{1(04)}\gamma_1\sigma^2_{fj} \end{aligned} \tag{32}$$

Then,

$$\frac{\text{Cov}\left(C_{i1(04)}, \ln(w_i)\right)}{\text{Cov}\left(C_{i1(95)}, \ln(w_i)\right)} = \frac{d^C_{1(95)}}{d^C_{1(04)}} \tag{33}$$

If we normalize $d^C_{1(04)} = 1$, we have that:

$$\frac{\text{Cov}\left(C_{i1(04)}, \ln(w_i)\right)}{\text{Cov}\left(C_{i1(95)}, \ln(w_i)\right)} = d^C_{1(95)} \tag{34}$$

Next, we go back to two measurement equations:

$$\begin{aligned} C_{i1(04)} &= f_{i1} + \epsilon^C_{i1(04)} \\ C_{i1(95)} &= d^C_{1(95)} f_{i1} + \epsilon^C_{i1(95)} \end{aligned} \tag{35}$$

Rewrite the second equation as:

$$\begin{aligned} C_{i1(04)} &= f_{i1} + \epsilon^C_{i1(04)} \\ \frac{C_{i1(95)}}{d^C_{1(95)}} &= f_{i1} + \frac{\epsilon^C_{i1(95)}}{d^C_{1(95)}} \end{aligned} \tag{36}$$

Under these conditions, we can apply a theorem attributed to Kotlarski, which is:

Theorem 1. *Suppose X_2, X_2 and ν are three independent, real-valued random variables where we define $Y_1 = X_1 + \nu$ and $Y_2 = X_2 + \nu$. If the characteristic function of (Y_1, Y_2) does not vanish, then the joint distribution of (Y_1, Y_2) determines the distributions of X_1, X_2 and ν up to a change of the location.*

In our case, ν is the latent factor, X_1 and X_2 are the measurement error and Y_1 and Y_2 are the measurements. Given that our system of equations satisfies the conditions under which Kotlarski's theorem applies, we can identify the densities of f_{i1}, $\epsilon^C_{i1(04)}$ and $\epsilon^C_{i1(95)}$. Further, the previous identification argument applies to the remaining "Big-5" measures, which means we can identify all 5 latent personality traits using the repeated measurements along with data on earnings.

Appendix B Additional Tables

Table B1: Summary Statistics - Full Sample

	Full Sample	Paid Employment	Self Employment	Δ (Self−Paid)	p-values
Earnings in 2004	$71,597.50	$72,126.53	$92,908.23	$20,781.70	0.003
Assets in 1995	$124,509.20	$95,436.44	$210,178.60	$114,742.16	0.000
High school degree	0.21	0.20	0.20	0.00	0.621
Some college	0.26	0.27	0.24	-0.03	0.426
College graduate	0.24	0.25	0.26	0.01	0.487
Married	0.78	0.78	0.80	0.02	0.523
Number of children	2.25	2.19	2.27	0.08	0.894
Spouse's education (years)	14.38	14.46	14.30	-0.15	0.600
Spouse employed in 1995	0.57	0.56	0.63	0.07	0.044
Fluid Cognitive Ability	0.25	0.33	0.31	-0.02	0.391
Agreeableness (1995)	3.31	3.29	3.32	0.03	0.757
Agreeableness (2004)	3.26	3.24	3.28	0.04	0.599
Extraversion (1995)	3.14	3.12	3.23	0.11	0.009
Extraversion (2004)	3.05	3.03	3.13	0.10	0.014
Neuroticism (1995)	2.17	2.20	2.10	-0.09	0.089
Neuroticism (2004)	2.05	2.06	2.00	-0.06	0.232
Conscientiousness (1995)	3.39	3.39	3.42	0.04	0.291
Conscientiousness (2004)	3.45	3.45	3.46	0.00	0.774
Openness (1995)	3.06	3.05	3.12	0.06	0.048
Openness (2004)	2.96	2.95	3.05	0.10	0.004

Summary statistics for all working age men (25-64) who are observed in the second wave of MIDUS data collection (MIDUS II).