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Who becomes an entrepreneur? The role of ability, education, and sector choice

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Abstract: The classical occupational choice model does not explain the simultaneous existence of low and high ability entrepreneurs. In this paper, we study the decision to become an entrepreneur when individuals choose their education level and the economic sector where to operate. We distinguish two sectors: the knowledge and the traditional sector. The knowledge sector requires individuals to invest in education. Under this framework, two results are possible: one where only high ability individuals become entrepreneurs, and one with the coexistence of low and high ability entrepreneurs. This framework provides a rational explanation of the relationship between ability, education, and self-employment. Using PIAAC data, we test the empirical implications of the model. We find that most countries have an equilibrium with low and high ability entrepreneurs.

JEL Codes: J21, J24, L26.

Keywords: Entrepreneurship, human capital entry barrier, occupational choice model, ability, sector choice.

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1 Introduction

When individuals consider whether to become an entrepreneur, they often have in mind a particular type of business, be it a consultancy, a shop, or driving a lorry. The sector choice might depend on their cognitive ability, financial constraints, knowledge of the sector, or their education level, among other factors. In this paper, we revisit the question of who becomes an entrepreneur taking into account the sector choice.

Our paper contributes to the literature on the determinants of entrepreneurship and the literature on sector choice. We provide a framework that unifies both strands by building a conceptual bridge using cognitive ability and education level. Our theoretical framework is consistent with the empirical evidence on the relationship between ability, education, and self-employment.

We develop an occupational choice model with two sectors where one has human capital entry barriers. We denote by 'knowledge sector' the sector that requires having tertiary education credentials to operate in it, while the 'traditional sector' does not have any entry barriers. In this framework, the education and occupation decisions are interrelated and affected by individuals' ability level. Although the model does not have a closed-form solution, we can characterize the equilibria. In any equilibrium, the least able individuals will choose to be workers in the traditional sector while the most able individuals decide to be entrepreneurs. The rest of the individuals decide between being entrepreneurs in the traditional sector or workers in the knowledge sector. This leads to two types of equilibria: one where low and high ability entrepreneurs coexist, and one with only high ability

entrepreneurs.

We test the empirical implications of the model using the Survey of Adult Skills (PIAAC: Programme for the International Assessment of Adult Competencies). We estimate a multinomial logit model with four outcomes: worker in the traditional sector; entrepreneur in the traditional sector; worker in the knowledge sector; and entrepreneur in the knowledge sector. As predicted by the theoretical model, the least able individuals are more likely to work in the traditional sector for the majority of countries in our sample. Results support the co-existence of low and high ability entrepreneurs in most countries. We find the equilibrium with only high ability entrepreneurs in the Eastern European countries, while results are unclear in the Nordic countries.

The literature on the determinants of entrepreneurship has been particularly active in the last two decades achieving common consensus on determinants such as gender, age (Blanchflower 2000, Leoni & Falk 2010), or parental self-employment (Dunn & Holtz-Eakin, 2000; Eren & Sula, 2012), among other factors (see Simoes, Crespo & Moreira, 2016 for a comprehensive review of entrepreneurial determinants). There is, however, no consensus on the effect of education on entrepreneurship. While several studies suggest a positive impact of education on entrepreneurship (Kim, Aldrich & Keister, 2006), others find insignificant or negative results or even a U-shaped relationship (Blanchflower 2000; Poschke 2013). Van Der Sluis et al. (2008) perform a meta-analysis of the literature and conclude that education does not significantly predict the likelihood of self-employment, although it increases entrepreneurship performance. Bates (1995), instead, finds a heterogeneous

effect across industries.

The ambiguous relationship found between education and entrepreneurship is at odds with the implications of the classical models of occupational choice, based on the seminal span-of-control model of Lucas (1978). They predict a positive effect of individual ability on both, the probability of being an entrepreneur and its performance (an exception is Poschke [2013] as discussed below). Since cognitive ability is rarely observable, empirical studies often use education as a proxy for ability, and a positive relationship between education and entrepreneurship is to be expected. The recent emergence of new databases with information on individuals' cognitive ability, measured through test achievement, allows exploring directly its relationship with entrepreneurship. Few studies are available so far. Eren and Sula (2012) find that cognitive ability reduces and non-cognitive ability increases the likelihood of becoming an entrepreneur. Hartog et al (2010) find that technical, mathematical and social ability benefit entrepreneurial incomes more than wages, while verbal and clerical abilities have higher returns in wage employment. Unfortunately, they do not analyze the effect of ability on the entry into self-employment. Levine and Rubinstein (2017) use the NLSY79 database and find that higher ability individuals are more likely to be incorporated self-employed, while ability does not affect the likelihood of being unincorporated self-employed. We contribute to this literature as we are able to disentangle both theoretically and empirically the effect of cognitive ability and education on the individual decision to become an entrepreneur.

This paper also contributes to the literature studying sector choice of the self-employed (Bates 1995; Lofstrom, Bates & Parker 2014). According to

this literature, entry barriers shape not only the decision to become self-employed, but also the sector that potential business owners are likely to enter (Bates 1995). There are mainly two types of barriers affecting the sector choice: financial and human capital barriers. Our paper studies the impact of human capital barriers in one sector. Bates (1995) and Loftstrom et al (2014) show the existence of human capital barriers to enter high-skilled services.

Financial barriers are not considered here. Although many papers found wealth to be a main determinant of entrepreneurship (Evans and Jovanovic, 1989; Evans and Leighton, 1989; Holtz-Eakin et al, 1994; Blanchflower and Oswald, 1998), recent studies find financial constraints to be of a lesser importance for entrepreneurs (Hurst and Lusardi, 2004). Nonetheless, Loftstrom et al (2014) show that when controlling for differences across industries, financial constraints remain important, and Bianchi and Bobba (2013) find that current financial constraints are less relevant than the expected future transfers. In any case, financial barriers are a complementary channel to the mechanism explored in this paper.

Our paper directly relates to several papers. First, it is related to the work of Lofstrom, Bates, and Parker (2014) and Levine and Rubinstein (2017) in that self-employed individuals are treated as a heterogeneous group. Levine and Rubinstein (2017) distinguish between incorporated and unincorporated self-employed individuals. They find that incorporated self-employment involves more non-routine cognitive tasks than unincorporated self-employment. They identify that those individuals with a higher ability and more "illicit" tendencies in their youth are more likely to become in-

corporated entrepreneurs. Lofstrom et al (2014) distinguish between sectors with low and high-entry barriers and study how entry into entrepreneurship is affected by wealth and human capital. In our work, we study human capital entry barriers with an endogenous education decision. Similarly to our paper, Mestieri et al (2017) have endogenous decisions with respect to the investment in education and entrepreneurship. They develop and quantify a heterogeneous-agent model to investigate the importance of credit market imperfections in the joint determination of human capital and entrepreneurial investments in Mexico.

Our model is also closely related to Poschke (2013, 2018). He obtains the co-existence of low and high ability entrepreneurs in equilibrium by assuming that a firm's productivity is uncertain before entry. Since individuals can reject bad projects, searching for new projects has always a positive value. In such a setup, the least able individuals are attracted to entrepreneurship as they have low-value job alternatives. In contrast, our model considers a sector-occupation choice without uncertainty. We obtain that individuals in the second lowest and in the highest ability range engage in entrepreneurship.

The paper is organized as follows. In section 2, we present a model of occupational choice with different sectors. We test the implications of the model in the rest of the paper. In section 3, we present the data and methodology used in the empirical analysis. In section 4, we report the results of the analysis with the PIAAC data. Section 5 concludes.

2 The model

Consider an OLG model with a constant interest rate r and three sectors: a final good sector and two intermediate sectors. We name the two intermediate sectors knowledge and traditional sector. The knowledge sector employs skilled labor, while the traditional sector employs unskilled labor. Think for instance about financial services and education for the knowledge sector, and food and clothes for the traditional sector. The main difference is that to work in the knowledge sector individuals must acquire education. Therefore, we denote by skilled workers those that have been through education and unskilled workers those that have not. All firms operate in a perfect competitive framework. We skip time subscripts since we will study the steady state.

2.1 Final good sector

There is a final good sector that combines the two intermediate goods in a Cobb-Douglas production function $Y = Y_u^{\alpha} Y_s^{1-\alpha}$, where Y_j is the total amount of intermediate good $j \in \{u, s\}$ produced in the economy; u refers to the sector that employs unskilled labor (traditional sector); and s refers to the sector that employs skilled labor (knowledge sector). We set the final good as the numeraire. The final good sector problem is:

$$\max Y_u^{\alpha} Y_s^{1-\alpha} - p_u Y_u - p_s Y_s,$$

and the first order conditions are:

$$\alpha \frac{Y}{Y_u} = p_u, \quad (1)$$

$$(1-\alpha) \frac{Y}{Y_s} = p_s. \quad (2)$$

2.2 Intermediate sectors

There are two intermediate sectors. The knowledge sector hires skilled labor and the traditional sector hires unskilled labor. An initial fixed cost k_j is required to start producing in each sector, $j \in \{u, s\}$. Moreover, only skilled individuals can start a firm in the knowledge sector. The production function in both sectors is increasing and concave in labor, and the productivity of the firm is determined by the entrepreneur's ability x_i (as in Lucas 1978). The production function of the firm of an entrepreneur with ability x_i in sector j is $y_j = x_i l_j^{\beta}$ where $\beta \in (0, 1)$ and l_j is the amount of workers employed in the firm. Profits are:

$$\pi_j (x_i) = p_j x_i l_j^{\beta} - w_j l_j - k_j, \quad (3)$$

where p_j is the price of good from sector j and w_j its wage. The first order conditions of the intermediate sectors are:

$$p_j x_i \beta l_j^{\beta-1} = w_j \text{ for } j \in \{u, s\}. \quad (4)$$

Therefore, labor demand of a firm in sector j is:

$$l_j = \left(\beta \frac{x_i p_j}{w_j}\right)^{\frac{1}{1-\beta}}. \tag{5}$$

Entrepreneurs with higher ability employ more workers. Moreover, profits for sector j are increasing and convex in ability:

$$\pi_j(x_i) = \beta^{\frac{\beta}{1-\beta}}(1-\beta)\left(\frac{p_j x_i}{w_j^{\beta}}\right)^{\frac{1}{1-\beta}} - k_j.$$

Apart from the education requirement in the knowledge sector, there is free-entry.

2.3 Individuals

Suppose an overlapping generations model. Each generation has a measure 1. Individuals live for two periods. They differ in their ability x_i, which ranges between 0 and 1. Let us assume a distribution of ability defined by Γ.

In the first period, individuals decide whether to get education or to work as an unskilled worker. The cost of education is inversely related to their ability $(1/x_i)$.[1] We assume that individuals cannot study and work at the same time. If they decide to work as an unskilled worker, they earn a

[1] Although in reality, the ability to run a firm is not perfectly correlated with the ability to succeed in education, we use a single ability measure in our model. There are two main reasons for that. First, it simplifies the model and, as long as the ability to run a firm and the ability to succeed in education are positively correlated, the main results hold. We provide some evidence of the positive correlation in section 3. Second, we do not have a good measure of entrepreneurial ability, therefore, we prefer to consider a unique ability measure (numerical skills) as a proxy for both types of ability in both the model and the empirical analysis.

wage w_u, which is independent of an individual's ability x_i.

In the second period, individuals choose their occupation given their education level. If they are unskilled, they can choose between working as unskilled for a wage w_u or to create a firm in the traditional sector. If they are skilled, they have three options: working as skilled for a wage w_s, creating a firm in the traditional sector or creating a firm in the knowledge sector.

Individuals consume in the second period only. They get utility from consumption and disutility from the cost of education. $u(c_i, I_e) = c_i - \frac{I_e}{x_i}$, where $I_e \in \{0, 1\}$ indicates whether the individual got education or not. Firms disappear after entrepreneurs die. We solve the individuals' decision using backwards induction.

2.3.1 Occupational choice

In the second period, individuals choose an occupation given their education level. We analyze the choice of the unskilled individual in lemma 1, and the choice of the skilled individual in lemmas 2 and 3.

Lemma 1 *Unskilled individuals with ability level $x_i < \bar{x}_u$ choose to be a worker in the traditional sector, while unskilled individuals with $x_i \geq \bar{x}_u$ choose to be an entrepreneur in the traditional sector, where $\bar{x}_u$ satisfies $\pi_u(\bar{x}_u) = w_u$.*

Proof. Suppose that an individual has no education. Then the individual can only choose between being a salaried worker or an entrepreneur in the traditional sector. The unskilled individual will choose to be an entrepreneur in the traditional sector rather than to work in the traditional sector if

$\pi_u(x_i) > w_u$, that is if:

$$x_i > \frac{(w_u + k_u)^{1-\beta} w_u^{\beta}}{p_u (1-\beta)^{1-\beta} \beta^{\beta}} \equiv \bar{x}_u. \tag{6}$$

Therefore, an unskilled individual will be an entrepreneur in the traditional sector if $x_i > \bar{x}_u$ and will work in the traditional sector if $x_i < \bar{x}_u$. ■

Let's denote by $V_u(x_i)$ the value of being an uneducated individual.

$$V_u(x_i) = \begin{cases} (1+r)w_u + w_u & \text{if } x_i < \bar{x}_u \\ (1+r)\, w_u + \pi_u(x_i) & \text{if } x_i \geq \bar{x}_u \end{cases}. \tag{7}$$

Assumption 1 $\frac{p_s}{p_u} > \left(\frac{w_s}{w_u}\right)^{\beta}$.

Assumption 1 implies that the effect of ability on profits is larger in the knowledge sector than in the traditional sector, as shown in figures 1 and 2. There is no reason why this should be satisfied, so we consider the alternative case as well in lemma 3.

Lemma 2 *Suppose assumption 1 is satisfied. Let $\hat{x}_s$ satisfy $\pi_s(\hat{x}_s) = w_s$, and let $\tilde{x}_s$ satisfy $\pi_s(\tilde{x}_s) = \pi_u(\tilde{x}_s)$. Then,*

1. *If $\hat{x}_s \geq \tilde{x}_s$, that is, if $\frac{p_u w_s^{\beta}}{p_s w_u^{\beta}} \leq \left(1 - \frac{k_s - k_u}{k_s + w_s}\right)^{1-\beta}$, skilled individuals with $x_i < \hat{x}_s$ choose to be workers in the knowledge sector, while those skilled individuals with $x_i \geq \hat{x}_s$ choose to be entrepreneurs in the knowledge sector. See Figure 1.*

2. *If $\hat{x}_s < \tilde{x}_s$, that is, if $\frac{p_u w_s^{\beta}}{p_s w_u^{\beta}} > \left(1 - \frac{k_s - k_u}{k_s + w_s}\right)^{1-\beta}$, skilled individuals with $x_i < \bar{x}_s$ choose to be workers in the knowledge sector, skilled individuals*

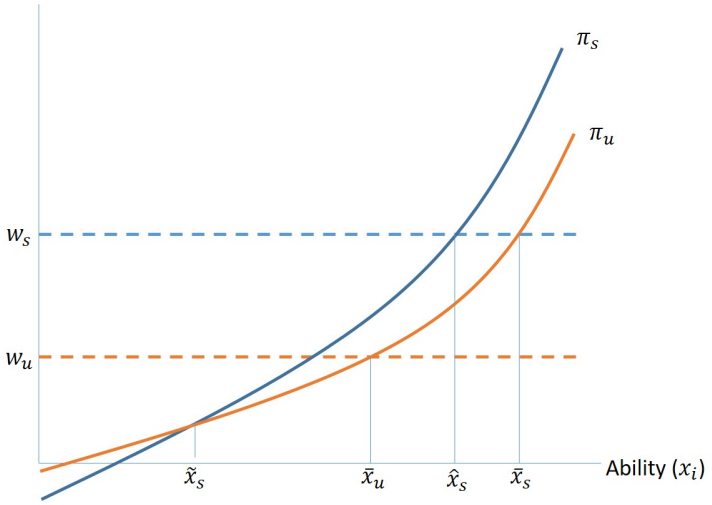

Figure 1: Occupational choice when assumption 1 holds and $\frac{p_u w_s^\beta}{p_s w_u^\beta} \leq \left(1 - \frac{k_s - k_u}{k_s + w_s}\right)^{1-\beta}$.

with $x_i \in (\bar{x}_s, \tilde{x}_s)$ choose to be entrepreneurs in the traditional sector, while those skilled individuals with $x_i \geq \tilde{x}_s$ choose to be entrepreneurs in the knowledge sector, where $\bar{x}_s$ satisfies $\pi_u(\bar{x}_s) = w_s$. See Figure 2.

Proof in Appendix A.

Therefore, under assumption 1, the value of being a skilled individual when $\frac{p_u w_s^\beta}{p_s w_u^\beta} \leq \left(1 - \frac{k_s - k_u}{k_s + w_s}\right)^{1-\beta}$ is:

$$V_s(x_i) = \begin{cases} -1/x_i + w_s & \text{if } x_i < \hat{x}_s \\ -1/x_i + \pi_s(x_i) & \text{if } x_i > \hat{x}_s \end{cases}, \tag{8}$$

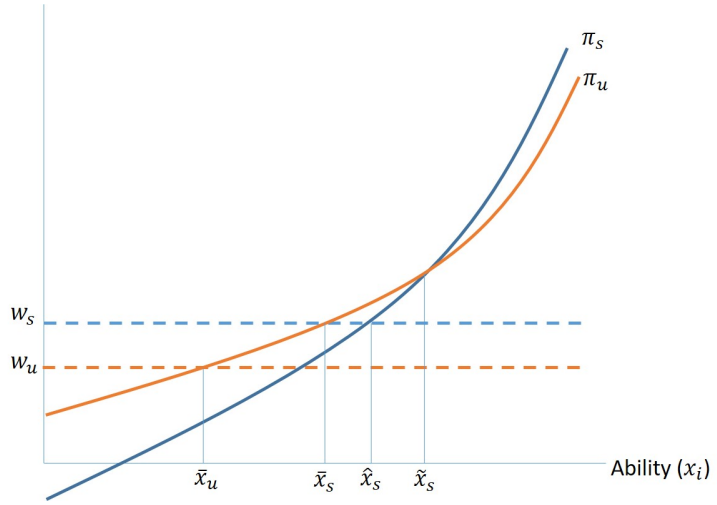

Figure 2: Occupational choice when assumption 1 holds and $\frac{p_u w_s^\beta}{p_s w_u^\beta} > \left(1 - \frac{k_s - k_u}{k_s + w_s}\right)^{1-\beta}$.

and when $\frac{p_u w_s^\beta}{p_s w_u^\beta} > \left(1 - \frac{k_s - k_u}{k_s + w_s}\right)^{1-\beta}$ is:

$$V_s(x_i) = \begin{cases} -1/x_i + w_s & \text{if } x_i < \bar{x}_s \\ -1/x_i + \pi_u(x_i) & \text{if } x_i \in (\bar{x}_s, \tilde{x}_s) \\ -1/x_i + \pi_s(x_i) & \text{if } x_i > \tilde{x}_s \end{cases} . \tag{9}$$

Lemma 3 *Suppose assumption 1 is not satisfied. Let $\hat{x}_s$ satisfy $\pi_s(\hat{x}_s) = w_s$, and let $\tilde{x}_s$ satisfy $\pi_s(\tilde{x}_s) = \pi_u(\tilde{x}_s)$. Then,*

1. *If $\hat{x}_s \geq \tilde{x}_s$, that is, if $\frac{p_u w_s^\beta}{p_s w_u^\beta} \leq \left(1 - \frac{k_s - k_u}{k_s + w_s}\right)^{1-\beta}$, skilled individuals with $x_i < \hat{x}_s$ choose to be workers in the knowledge sector, while those skilled individuals with $x_i \geq \hat{x}_s$ choose to be entrepreneurs in the traditional sector.*

2. *If $\hat{x}_s < \tilde{x}_s$, that is, if $\frac{p_u w_s^\beta}{p_s w_u^\beta} > \left(1 - \frac{k_s - k_u}{k_s + w_s}\right)^{1-\beta}$, skilled individuals with $x_i < \bar{x}_s$ choose to be workers in the knowledge sector, skilled individuals*

with $x_i \in (\bar{x}_s, \tilde{x}_s)$ choose to be entrepreneurs in the knowledge sector, while those skilled individuals with $x_i \geq \tilde{x}_s$ choose to be entrepreneurs in the traditional sector, where $\bar{x}_s$ satisfies $\pi_u(\bar{x}_s) = w_s$.

Proof in Appendix B.

Therefore, when assumption 1 is not satisfied, the value of being a skilled individual when $\frac{p_u w_s^\beta}{p_s w_u^\beta} \leq \left(1 - \frac{k_s - k_u}{k_s + w_s}\right)^{1-\beta}$ would be:

$$V_s(x_i) = \begin{cases} -1/x_i + w_s & \text{if } x_i < \hat{x}_s \\ -1/x_i + \pi_u(x_i) & \text{if } x_i > \hat{x}_s \end{cases}, \tag{10}$$

but this can never happen in equilibrium, since we need some skilled individuals to become entrepreneurs in the knowledge sector. Instead, when assumption 1 does not hold and $\frac{p_u w_s^\beta}{p_s w_u^\beta} > \left(1 - \frac{k_s - k_u}{k_s + w_s}\right)^{1-\beta}$, the value of being a skilled individual is:

$$V_s(x_i) = \begin{cases} -1/x_i + w_s & \text{if } x_i < \bar{x}_s \\ -1/x_i + \pi_s(x_i) & \text{if } x_i \in (\bar{x}_s, \tilde{x}_s) \\ -1/x_i + \pi_u(x_i) & \text{if } x_i > \tilde{x}_s \end{cases}. \tag{11}$$

2.3.2 Education choice

In the first period, individuals choose whether to invest in education. They will do so if their utility is larger being skilled than unskilled.

Let $V(x_i)$ be the value of an individual with ability x_i.

$$V(x_i) = \max\{V_u(x_i), V_s(x_i)\}, \tag{12}$$

where $V_u(x_i)$ is defined in (7) and $V_s(x_i)$ is defined in (8)-(11) depending on the parameter values.

When assumption 1 holds and $\frac{p_u w_s^\beta}{p_s w_u^\beta} \leq \left(1 - \frac{k_s - k_u}{k_s + w_s}\right)^{1-\beta}$, the occupation-sector choice problem can be summarized as follows:

$$V(x_i) = \begin{cases} \max\left\{w_u(2+r), \frac{-1}{x_i} + w_s\right\} & \text{if } 0 < x_i < \bar{x}_u \\ \max\left\{w_u(1+r) + \pi_u(x_i), \frac{-1}{x_i} + w_s\right\} & \text{if } \bar{x}_u < x_i < \hat{x}_s \\ \max\left\{w_u(1+r) + \pi_u(x_i), \frac{-1}{x_i} + \pi_s(x_i)\right\} & \text{if } \hat{x}_s < x_i < 1 \end{cases}. \quad (13)$$

When assumption 1 holds and $\frac{p_u w_s^\beta}{p_s w_u^\beta} > \left(1 - \frac{k_s - k_u}{k_s + w_s}\right)^{1-\beta}$, the occupation-sector choice problem becomes:

$$V(x_i) = \begin{cases} \max\left\{w_u(2+r), \frac{-1}{x_i} + w_s\right\} & \text{if } 0 < x_i < \bar{x}_u \\ \max\left\{w_u(1+r) + \pi_u(x_i), \frac{-1}{x_i} + w_s\right\} & \text{if } \bar{x}_u < x_i < \bar{x}_s \\ \max\left\{w_u(1+r) + \pi_u(x_i), \frac{-1}{x_i} + \pi_u(x_i)\right\} & \text{if } \bar{x}_s < x_i < \tilde{x}_s \\ \max\left\{w_u(1+r) + \pi_u(x_i), \frac{-1}{x_i} + \pi_s(x_i)\right\} & \text{if } \tilde{x}_s < x_i < 1 \end{cases}. \quad (14)$$

When assumption 1 is not satisfied, only the case $\frac{p_u w_s^\beta}{p_s w_u^\beta} > \left(1 - \frac{k_s - k_u}{k_s + w_s}\right)^{1-\beta}$ is relevant to find the equilibrium. In such a case, the occupation-sector choice problem becomes:

$$V(x_i) = \begin{cases} \max\left\{w_u(2+r), \frac{-1}{x_i} + w_s\right\} & \text{if } 0 < x_i < \bar{x}_u \\ \max\left\{w_u(1+r) + \pi_u(x_i), \frac{-1}{x_i} + w_s\right\} & \text{if } \bar{x}_u < x_i < \bar{x}_s \\ \max\left\{w_u(1+r) + \pi_u(x_i), \frac{-1}{x_i} + \pi_s(x_i)\right\} & \text{if } \bar{x}_s < x_i < \tilde{x}_s \\ \max\left\{w_u(1+r) + \pi_u(x_i), \frac{-1}{x_i} + \pi_u(x_i)\right\} & \text{if } \tilde{x}_s < x_i < 1 \end{cases}. \quad (15)$$

Let us denote by $V_{E_j}(x_i)$ and $V_{W_j}(x_i)$ the value functions for being entrepreneur in sector j and for being a worker in sector j, respectively.

$$\begin{aligned} V_{E_s}(x_i) &= -1/x_i + \pi_s(x_i). \\ V_{E_u}(x_i) &= w_u(1+r) + \pi_u(x_i). \\ V_{W_s}(x_i) &= -1/x_i + w_s. \\ V_{W_u}(x_i) &= w_u(2+r). \end{aligned}$$

We next provide the market-clearing conditions of the model before solving the occupation-sector choice.

2.4 Steady-state equilibrium

In this section we present the equations that close the equilibrium. Although it is not possible to find a closed-form solution, we are able to characterize the equilibria.

The market clearing condition of the final good market is (only old individuals consume):

$$\int_0^1 c_i d\Gamma_i = Y - \int k_s de_s - \int k_u de_u, \tag{16}$$

where e_j denotes the distribution of entrepreneurs in sector j.

The market clearing conditions of the intermediate goods markets set the

prices p_s, p_u.

$$Y_s = (1-\alpha)\frac{Y}{p_s} = \int y_{is} de_s. \quad (17)$$

$$Y_u = \alpha\frac{Y}{p_u} = \int y_{iu} de_u. \quad (18)$$

Wages are such that labor markets clear.

$$\int l_s de_s = L_{st} - e_s,$$
$$\int l_u de_u = L_{ut} + L_{ut+1} - e_u,$$

where L_{st} is the amount of individuals born at $t-1$ that got education and $L_{ut} = 1 - L_{st}$.

Given that in any equilibrium there must be some positive amount of individuals in each sector-occupation category, we can characterize the types of equilibrium in this economy.

Proposition 1 *Under assumption 1, there are three types of equilibria. In all of them, the bottom ability individuals choose to be workers in the traditional sector, while the top ability individuals prefer to be entrepreneurs in the knowledge sector. Moreover, the middle range ability individuals decide to become workers in the knowledge sector. The three equilibria differ on which individuals decide to become entrepreneurs in the traditional sector.*

1. *Two groups of individuals may become entrepreneurs in the traditional sector: second bottom and second top ability range individuals (see Fig-*

ure 3).

2. *Only the second bottom ability range individuals choose to be entrepreneurs in the traditional sector (see Figure 4).*

3. *Only the second top ability range individuals decide to be entrepreneurs in the traditional sector (see Figure 5).*

Proof in appendix C.

Proposition 2 *When assumption 1 is not satisfied, there are two types of equilibria. In all of them, the bottom ability individuals choose to be workers in the traditional sector, while the top ability individuals prefer to be entrepreneurs alternating traditional and knowledge sector. Moreover, the middle range ability individuals decide to become workers in the knowledge sector. The two equilibria differ on whether the second bottom ability range individuals decide to become entrepreneurs in the traditional sector (equilibrium 4) or workers in the knowledge sector (equilibrium 5).*

Proof in appendix D.

Propositions 1 and 2 summarize the possible types of equilibria. In equilibria 1 and 2 of Proposition 1 and equilibrium 4 of Proposition 2, low and high ability entrepreneurs coexist. In contrast, in the rest of equilibria, only high ability individuals become entrepreneurs.

Corollary 1 *Let $\bar{x}_e$ satisfy $V_{W_u}(\bar{x}_e) = V_{W_s}(\bar{x}_e)$. When $\bar{x}_e > \bar{x}_u$, that is, when*

$$\frac{1}{w_s - (2+r)\, w_u} > \frac{(w_u + k_u)^{1-\beta}\, w_u^{\beta}}{p_u\, (1-\beta)^{1-\beta}\, \beta^{\beta}},$$

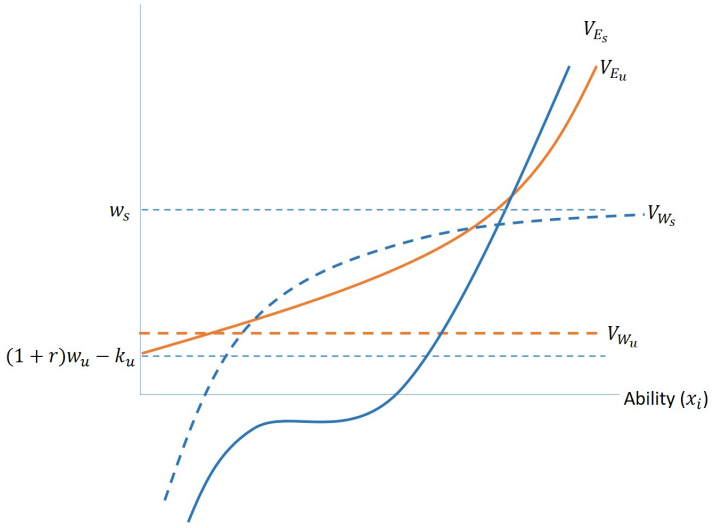

Figure 3: Assumption 1 holds. Case $\bar{x}_e > \bar{x}_u$ and $\tilde{x}_e > \hat{x}_s > \hat{x}_e''$. High and low ability entrepreneurs in the traditional sector.

individuals from the second bottom ability range decide to become entrepreneurs in the traditional sector.

Proof included in the proof of proposition 1 (Appendix C).

The corollary states the condition under which there will be low ability entrepreneurs. These entrepreneurs will operate in the traditional sector. In all equilibria, there are high ability entrepreneurs in the knowledge sector or in both sectors. Therefore, low and high ability entrepreneurs coexist in equilibrium under the condition stated in the corollary. In countries where the returns to education in salaried jobs, unskilled wages and the cost of starting a business in the traditional sector are low, it is more likely to observe low ability entrepreneurs.

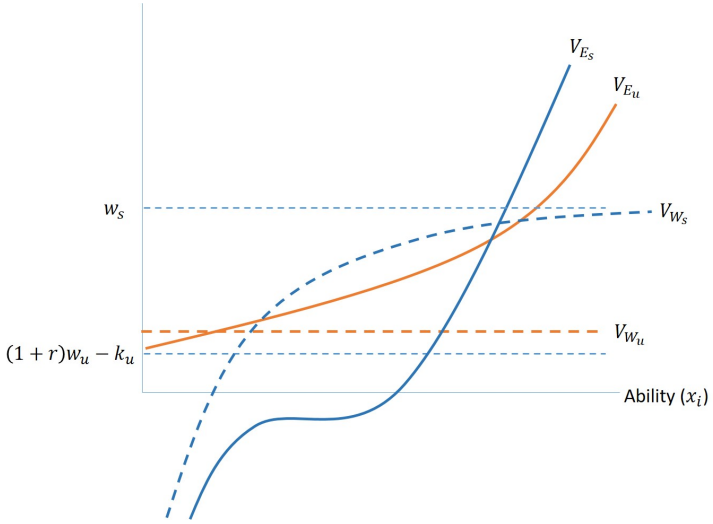

Figure 4: Assumption 1 holds. Case $\bar{x}_e > \bar{x}_u$ and $\tilde{x}_e < \hat{x}_s < \hat{x}_e''$. High ability entrepreneurs in the knowledge sector and low ability entrepreneurs in the traditional sector.

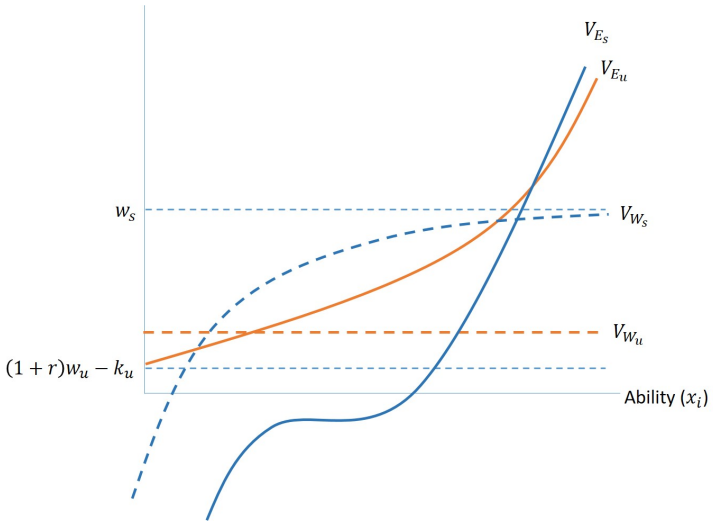

Figure 5: Assumption 1 holds. Case $\bar{x}_e < \bar{x}_u$. High ability entrepreneurs only.

2.5 Empirical implications

The previous model has two main types of equilibria:

1. Low ability entrepreneurs in the traditional sector and high ability entrepreneurs in possibly both sectors (e.g. Figures 3 and 4).

2. High ability entrepreneurs in both the traditional and the knowledge sector (e.g. Figure 5).

The ability distribution and the parameters of the model determine the equilibrium outcome. For instance, countries with low k_u are more likely to be in an equilibrium with low ability entrepreneurs in the traditional sector (see Corollary 1). In our empirical approach, by directly observing the ability level and sector choice of entrepreneurs, we can identify the equilibrium in the country.

There are two main empirical implications of the model:

1. Education does not have a clear relationship with entrepreneurship.

2. Ability and entrepreneurship have a linear relationship exclusively in the case of an equilibrium with only high ability entrepreneurs. Otherwise, the relationship is bimodal: high and low ability entrepreneurs co-exist in equilibrium.

The first implication is consistent with the existing empirical evidence, which does not find a clear relationship between education and entrepreneurship (Van Der Sluis et al, 2008; Simoes, Crespo & Moreira, 2016). In the rest of the paper, we characterize the equilibria of different groups of countries and test the empirical implications of the model.

3 Data and Methodology

We use PIAAC Survey data to test our model. PIAAC is an international survey commissioned by the OECD. The survey was conducted between August 2011 and March 2012 for the first round of countries, and between April 2014 and March 2015 for the second round. PIAAC contains explicit assessment of cognitive ability (numeracy, literacy, and ICT skills). Overall, the survey includes individuals from 32 countries. Each country has a minimum sample size required of 5,000 completed cases.[2] We select 22 countries for our analysis, which we group into five groups according to their education systems and labor market characteristics (see Table I). Group 1 is comprised of the Nordic countries, characterized by high equality (Salverda and Checchi, 2015) and high social mobility (Solon 2002). Education is mostly publicly funded in these countries (OECD 2018a). Group 2 is formed by Austria, Germany, and the Netherlands. They have a dual education system, with a prominent vocational education (Eurydice 2015). They have a strong link between education and the labor market and score high in the employment protection legislation index (Salverda and Checchi, 2015). The third group is formed by the Anglo-Saxon countries. These countries are characterized by large income inequalities, as measured by the Gini index, and liberal policies, which lead to high easiness to create new businesses (World Bank 2018) and low employment protection legislation (Salverda and Checchi, 2015). Belgium, France, Spain, and Italy form the fourth group of countries. They are characterized by low inequality (Salverda and Checchi, 2015), rigid labor

[2]See http://www.oecd.org/skills/piaac/publicdataandanalysis/#d.en.408927 for a detailed description of the survey.

markets, and a large long-term unemployment rate (OECD 2018b). Finally, the Eastern European countries are in group 5. They all went through a transition from communism towards a market economy. They have rather high levels of inequality (Salverda and Checchi, 2015). Additionally, countries in groups 4 and 5 exhibit a rather low index of easiness of doing business in 2012 (World Bank 2018).

[Table I around here]

We restrict our sample to individuals aged between 25 and 65 years old excluding those that could be still in education and those in the retirement age. We delete cases with missing data on any of the explanatory variables. Finally, we also drop all respondents working in the armed forces and extraterritorial bodies.

In our theoretical model, we require individuals to have a tertiary education credential to enter the knowledge sector, while there is no such requirement for the traditional sector. Most occupations in industries such as education or health, for instance, are likely to belong to the knowledge sector. For other industries, such as construction or mining, some occupation levels require higher education while others do not. Think about architects or engineers as opposed to bricklayers, for instance. Therefore, in the empirical part, we classify knowledge and traditional sector taking into account both, industry and occupation. In particular, we consider a job to be in the knowledge sector if 50% of the individuals in the industry or occupation in question have tertiary education[3] (we use the 1-digit classification of ISIC

[3]We use individuals between 25 and 64 years old currently employed to compute the percentage of individuals with tertiary education at the country level. In a robustness exercise, we pool all countries. In a second robustness exercise, we use a 60% threshold

rev 4 for industry and 1-digit ISCO 2008 for occupation).

Unsurprisingly, we find that most jobs in blue-collar or elementary occupations are part of the traditional sector while those that work as professionals are found in the knowledge sector (Table II). Table III shows the distribution of jobs across industries. It reveals that all jobs in the education and scientific industries belong to the knowledge sector as expected. Other industries, such as information and communication, finance and insurance, real estate, public administration, health and social work, and arts and entertainment, have a majority of individuals in the knowledge sector. Instead, most jobs in construction or wholesale and retail pertain to the traditional sector according to our classification.

[Tables II and III around here]

Our sector classification is in some way related to the work in Levine and Rubinstein (2017). They distinguish between incorporated and unincorporated entrepreneurs. They find that education and non-routine analytical skills make an individual more likely to become an incorporated entrepreneur, while non-routine manual skills increase the likelihood to become an unincorporated entrepreneur. In their Table VI, we can observe that industries at the top of non-routine analytical and non-routine direction and control task requirements belong most likely to our knowledge sector (engineering and architectural services, accounting, educational services and the like). Moreover, the top industries in non-routine manual task requirements are likely to belong to our traditional sector (taxicab and trucking services, logging,

instead. The main results of the paper do not change. Robustness results are provided in a supplementary appendix.

etc.).

In our theoretical model, ability affects both, the productivity of the entrepreneur and the probability of succeeding in education. PIAAC data has a good measure of cognitive ability (numeracy skills), which is strongly related to the probability of succeeding in education. Regarding the measure of the productivity of the entrepreneur, one could use the income of self-employed individuals. However, income in the PIAAC survey is self-reported and probably has a large measurement error. Moreover, it is not available for Austria, Canada, Germany, Sweden and the US. In tables IV-VI, we explore whether numeracy skills are a good measure of productivity of the entrepreneur. Table IV reports the regression of the logarithm of the income of the self-employed on numeracy skills and other variables for the countries that provide this information. Numeracy skills clearly increase the income of the self-employed in all groups of countries. Therefore, the assumption of a positive effect of the cognitive ability on the success of the entrepreneurs (higher profits) is satisfied in the PIAAC data. Tables V and VI reinforce the use of numeracy skills instead of literacy skills. Literacy skills have a positive effect on income in all groups of countries except for group 2 (Table V). When both variables are used together, numeracy skills show stronger explanatory power (Table VI). Therefore, we use numeracy skills as a measure of ability for education and entrepreneurship in all the analysis.

[Tables IV to VI around here]

We distinguish four possible professions in our analysis: a salaried worker in the traditional sector, a self-employed individual in the traditional sector, a salaried worker in the knowledge sector, and a self-employed individual

in the knowledge sector. Table VII shows the final sample sizes for each profession in each group of countries.

[Table VII around here]

In a first analysis, we estimate the probability to become self-employed. This allows testing the empirical implications of the model (see Section 2.5).

In the main analysis, we estimate a multinomial logit model assuming the following form:

$$\ln \frac{P_{ij}}{P_{is}} = \beta_{0,j/s} + \sum_{k=2}^{4} \beta_{k,j/s} ability_{ik} + \beta_{x,j/s} X_i. \tag{19}$$

The dependent variable is the log-odds ratio of being in profession j rather in profession s, where P_{ij} stands for the probability that an individual i is in profession j. Ability is the variable of interest. It refers to numeracy skills, which were assessed with an explicit test in the survey. We create dummies indicating the quartile of the ability distribution per country. We control for gender and age bands in all estimations. We add tertiary education controls in subsequent estimations. The complete model includes dummies for the education of the father as well. Fathers education proxies higher family wealth and better social capital. The former positively affects the likelihood of self-employment; the latter can positively affect both, the self-employment as well as the salaried employment. The descriptive statistics of all variables are presented in table VIII.

[Table VIII around here]

The main analysis will let us identify which type of equilibrium holds in each group of countries. According to our model, there are three poten-

tial equilibria. The main difference between them is who becomes an entrepreneur in the traditional sector: individuals in the second lowest ability range, individuals in the second highest ability range, or both. We estimate the model for the different groups of countries.

4 Empirical results

In order to compare our results with previous studies, we first estimate the likelihood of being self-employed without distinguishing between sectors. In Table IX, we test the relationship between education level and self-employment. It becomes evident that education does not have a consistent effect on self-employment across the groups of countries. Having tertiary education decreases the likelihood of self-employment in the Nordic and the Anglo-Saxon countries, while it increases it in the group composed of Austria, Germany, and the Netherlands. In this group, having upper-secondary education decreases the likelihood of self-employment.[4] In contrast, women are less likely to be self-employed in all country groups, and being married has a consistent positive effect. Immigrants are more likely to be self-employed in the Anglo-Saxon countries and less likely in the group 2. There are no differences between immigrants and natives in the rest of the groups.

Table X shows the effect of ability on self-employment. Numeracy skills have a positive or non-significant effect on self-employment. This is consistent with the empirical implications of the model. Results for gender, married and immigrant status do not change.

[4]This might be a product of the dual education system in these countries.

Table XI reports the results when controlling for education, ability, and father's education simultaneously. The results on education remain irregular across groups of countries. Numeracy skills become positive and significant in all groups except in the Nordic countries. Having a father with tertiary education increases the likelihood of self-employment in most groups of countries. Instead, a father with upper-secondary education decreases the likelihood of self-employment in the group with a dual education system and increases it in the group with strong labor market rigidities.

A positive effect of ability would seem to support the equilibrium where all entrepreneurs have high ability. To confirm this result, we estimate the previous equation using quartiles of ability instead of a continuous measure of numeracy skills. Results are presented in Table XII. Only for group 5, the effect of ability on self-employment is really increasing across quartiles, suggesting an equilibrium with only high ability self-employed in these countries. In group 3, the coefficients of quartiles 2 and 4 are larger than the coefficient of quartile 3. This is consistent with the bimodal distribution expected in an equilibrium with low and high ability self-employed. For groups 1, 2 and 4, results are inconclusive. [Tables IX to XII around here]

In what follows we distinguish between traditional and knowledge sectors to further assess the empirical implications of our theoretical model. Tables XIII to XVII report the results of the multinomial estimation based on equation (19) per each group of countries. In all these tables, the first three columns show the results of estimation (1), which controls for age, gender, married and immigrant status only; columns forth to sixth show the results of estimation (2), which adds a control for upper-secondary and tertiary edu-

cation levels of the individual; finally, the last three columns show the results of estimation (3), which adds the father's education level dummies. The base category of the dependent variable is always a worker in the traditional sector. Hence, the coefficients show the effect of each independent variable on each category relative to a worker in the traditional sector.

[Tables XIII to XVII around here]

The probability of being in the knowledge sector, whether as a worker or as a self-employed, as compared to being a worker in the traditional sector increases with the ability quartile in all cases. Coefficients of ability quartile are positive, significant, and increasing with the ability for the salaried worker and the self-employed in the knowledge sector. This is true for all groups of countries and all specifications. However, there are large differences in the coefficients of ability quartiles to explain the choice of being an entrepreneur in the traditional sector (SE-TS). While ability does not explain this choice in the Nordic countries (Table XIII), the effect is significantly different from zero in the other groups. In group 2 (Austria, Germany, and the Netherlands), the three highest quartiles have a positive effect on the probability of self-employment in the traditional sector (Table XIV). Once we control for the educational attainment of the individual, quartile 3 loses some significance level, although it remains significant at the 10%. We conclude that both, low and high ability entrepreneurs co-exist in the traditional sector (as in figure 3). This result holds and is even clearer for the Anglo-Saxon countries (Table XV) where the coefficient of the third quartile is insignificant. For the group of countries with a rigid labor market (Belgium, France, Italy, and Spain), only quartiles 2 and 3 are significant in estimation (1), while quartile

4 becomes also significant once we control for education (Table XVI). Results are compatible with an equilibrium with low and high ability entrepreneurs in the traditional sector, although we do not manage to identify the range of ability where there is the trough. Finally, we obtain an equilibrium with only high ability entrepreneurs for the Eastern European countries (Table XVII). Only quartiles 3 and 4 are positive and significant and increasing with ability quartile for this group of countries.

With respect to the other variables of the estimation, we observe that consistent with existing research women are less likely to be self-employed, although in some cases, women are more likely to be self-employed in the knowledge sector than workers in the traditional sector (groups 3 and 5). Having upper secondary or tertiary education increases the likelihood to be in the knowledge sector by construction. Finally, having a father with tertiary education helps to get into the knowledge sector (either as a worker or self-employed) in all countries. Moreover, in most cases, having a father with secondary education decreases the likelihood of being self-employed in the traditional sector rather than a worker in this sector, while having a father with tertiary education increases this probability.

The coefficients comparing the probability of being self-employed or a worker in the knowledge sector are less clear-cut. We analyze this by re-estimating our models with worker in the knowledge sector as the base category. Results are reported in tables XVIII-XXII. The last column of each estimation reports the probability of self-employment in the knowledge sector relative to being a worker in this sector. Results reveal that ability does not explain the choice of self-employment in the knowledge sector in the groups 1

and 2. For Anglo-Saxon countries (group 3), not being in the first quartile of the ability distribution increases the probability of being self-employed with respect to being a worker in the knowledge sector. For the group comprised of Belgium, France, Italy and Spain, only the second quartile is statistically significant. Its negative sign indicates that these individuals are more likely to be workers than self-employed in the knowledge sector. Finally, in the Eastern European countries, all coefficients are positive and significant, although the effect seems bimodal.

According to the model presented above, we should observe that the probability to be self-employed in the knowledge sector rather than a worker in this sector increases with ability. However, the empirical results are not always consistent with the model. A potential way to accommodate the model to the previous results could be by assuming that the wage in the knowledge sector is increasing with ability. Then, the choice between being a worker or an entrepreneur in the knowledge sector would be less clear, as the empirical results show.

We perform several robustness exercises for these analyses, which are provided in a supplementary appendix. First, we use quintiles of ability instead of quartiles. Then, we change the definition of traditional and knowledge sector, by using a threshold of 60% of individuals with tertiary education instead of 50%, or by using a homogeneous classification of sectors across countries. Finally, we classify all individuals with tertiary education to be in the knowledge sector, independently of their job. The main results do not change in any of these exercises.

5 Conclusions

The empirical literature has so far not found a clear sign on the effect of education and ability on entrepreneurship. Moreover, the observed coexistence of low and high ability entrepreneurs is difficult to explain with the classical occupational choice model. By including the sector choice, which is linked to education investment through human capital entry barriers in one sector, our model allows for the coexistence of low and high ability entrepreneurs. The empirical analysis corroborates the existence of different equilibria. Results are consistent with the existence of low and high ability entrepreneurs in the traditional sector in most groups of countries. In contrast, the results for Eastern European countries suggest an equilibrium with only high ability entrepreneurs. For the Nordic countries, results are unclear.

This paper provides an alternative explanation for the relationship between ability, education, and entrepreneurship. The theoretical model advances our understanding of entrepreneurship in several ways. First, it shows that the inconclusive results on the relationship between education and entrepreneurship come from the bad measurement of ability through education. Using PIAAC survey we are able to show the existence of high and low ability entrepreneurs in several country groups controlling for their education levels. Secondly, we show that ability drives individual decisions whether to start a business, not education. Our setup allows for the existence of low ability entrepreneurs based on rational decisions of individuals. It is an alternative explanation to the out-of-necessity entrepreneurship in the literature.

A Proof of Lemma 2

Let us analyze the occupation choice of an individual who got education in the first period. Given that $w_s > w_u$, the skilled individual will never want to work in the traditional sector. Hence, the choice is among being a worker in the skilled sector, being an entrepreneur in the traditional sector, or being an entrepreneur in the knowledge sector.

- The skilled individual will choose to be an entrepreneur in the traditional sector rather than work in the knowledge sector if $\pi_u(x_i) > w_s$. Denote by $\bar{x}_s$ the ability level that makes the individual indifferent between the two options.

$$\bar{x}_s = \frac{(w_s + k_u)^{1-\beta} w_u^{\beta}}{p_u (1-\beta)^{1-\beta} \beta^{\beta}}.$$

  Since $\pi_u(x_i)$ is increasing with x_i, then individuals with $x_i > \bar{x}_s$ will prefer to create a firm in the traditional sector and those with $x_i < \bar{x}_s$ will prefer to work in the knowledge sector.

- The skilled individual will choose to be an entrepreneur in the knowledge sector rather than work in knowledge sector if $\pi_s(x_i) > w_s$. Denote by $\hat{x}_s$ the ability level of the individual that is indifferent between the two options.

$$\hat{x}_s = \frac{(w_s + k_s)^{1-\beta} w_s^{\beta}}{p_s (1-\beta)^{1-\beta} \beta^{\beta}}.$$

  Since $\pi_s(x_i)$ is increasing in ability, then individuals with $x_i > \hat{x}_s$ will prefer to create a firm in the knowledge sector and those with $x_i < \hat{x}_s$ will prefer to work in the knowledge sector.

- An individual with ability x_i will choose to be an entrepreneur in the knowledge sector rather than in the traditional sector if $\pi_s(x_i) > \pi_u(x_i)$. Let $\tilde{x}_s$ be the ability level that leaves the individual indifferent between the two options.

$$\tilde{x}_s = \frac{(k_s - k_u)^{1-\beta}}{\beta^\beta (1-\beta)^{1-\beta}} \left[\left(\frac{p_s}{w_s^\beta} \right)^{\frac{1}{1-\beta}} - \left(\frac{p_u}{w_u^\beta} \right)^{\frac{1}{1-\beta}} \right]^{\beta-1}.$$

  Under assumption 1 individuals with $x_i > \tilde{x}_s$ will prefer to create a firm in the knowledge sector and those with $x_i < \tilde{x}_s$ will prefer to create a firm in the traditional sector.

Suppose that $\hat{x}_s \geq \tilde{x}_s$. Then, since under assumption 1, $\pi_s(x_i)$ is steeper than $\pi_u(x_i)$, it must be that $\bar{x}_s \geq \hat{x}_s$. In such a case, individuals with ability $x_i < \hat{x}_s$ choose to work in the knowledge sector, while those with $x_i > \hat{x}_s$ choose to be entrepreneurs in the knowledge sector. See Figure 1.

Suppose that $\hat{x}_s < \tilde{x}_s$. Then, since under assumption 1, $\pi_s(x_i)$ is steeper than $\pi_u(x_i)$, it must be that $\bar{x}_s < \hat{x}_s$. In such a case, individuals with ability $x_i < \bar{x}_s$ choose to work in the knowledge sector, those with $x_i \in (\bar{x}_s, \tilde{x}_s)$ choose to be entrepreneurs in the traditional sector, and those with $x_i > \tilde{x}_s$ choose to be entrepreneurs in the knowledge sector. See Figure 2.

B Proof of Lemma 3

In case 1, when $\frac{p_u w_s^\beta}{p_s w_u^\beta} \leq \left(1 - \frac{k_s - k_u}{k_s + w_s}\right)^{1-\beta}$, if assumption 1 were not satisfied, skilled workers with $x_i < \hat{x}_s$ would choose to be workers in the knowledge sector and those with $x_i < \hat{x}_s$ would always prefer to be entrepreneurs in the

traditional sector than in the knowledge sector since $\pi_s(x_i) < \pi_u(x_i)$ for all $x_i > \tilde{x}_s$ and $\tilde{x}_s < \hat{x}_s$.

In case 2, when $\frac{p_u w_s^\beta}{p_s w_u^\beta} > \left(1 - \frac{k_s - k_u}{k_s + w_s}\right)^{1-\beta}$, then there is a possibility to have an equilibrium with top ability individuals being entrepreneurs in the traditional sector and the second top ability individuals being entrepreneurs in the knowledge sector.

The value of being unskilled and skilled is

$$V_u(x_i) = \begin{cases} (2+r)w_u & \text{if } x_i < \bar{x}_u \\ (1+r)\, w_u + \pi_u(x_i) & \text{if } x_i > \bar{x}_u \end{cases}$$

and

$$V_s(x_i) = \begin{cases} -1/x_i + w_s & \text{if } x_i < \bar{x}_s \\ -1/x_i + \pi_s(x_i) & \text{if } x_i \in (\bar{x}_s, \tilde{x}_s) \\ -1/x_i + \pi_u(x_i) & \text{if } x_i > \tilde{x}_s \end{cases},$$

respectively.

C Proof of Proposition 1

In any equilibrium, there must be a positive amount of individuals in each occupation-sector. We first analyze the value functions of each occupation choice to be able to plot them. Second, we prove that all the ability ranges of the value functions (13) and (14) are non-empty. This implies to prove that $\hat{x}_s > \bar{x}_u$ for (13) and that $\bar{x}_s > \bar{x}_u$ for (14). Third, we solve the individual education choice for each case in subsections C.1 and C.2.

- Let us first analyze the value functions $V_{E_j}(x_i)$ and $V_{W_j}(x_i)$, so that we

can plot them.

$V_{E_s}(x_i)$ is increasing, concave until some x_i and convex afterwards. Moreover, $\lim_{x_i \to 0} V_{E_s}(x_i) = -\infty$.

$V_{E_u}(x_i)$ is increasing and convex, with $V_{E_u}(0) = w_u(1+r) - k_u$.

$V_{W_s}(x_i)$ is increasing and concave, with $\lim_{x_i \to 0} V_{W_s}(x_i) = -\infty$ and $\lim_{x_i \to \infty} V_{W_s}(x_i) = w_s$.

Moreover, $V_{E_s}(x_i) - V_{W_s}(x_i) = \pi_s(x_i) - w_s$, which is zero for only one x_i. Hence, $V_{E_s}(x_i)$ and $V_{W_s}(x_i)$ cross only once.

Finally, $V_{W_u}(x_i)$ is a constant.

- Let us now prove that $\bar{x}_u < \hat{x}_s$ in any equilibrium when $\tilde{x}_s < \hat{x}_s$. We do that by contradiction. Suppose that $\bar{x}_u > \hat{x}_s$. Then the occupation-sector choice problem would be represented by:

$$V(x_i) = \begin{cases} \max\left\{w_u(2+r), \frac{-1}{x_i} + w_s\right\} & \text{if } 0 < x_i < \hat{x}_s \\ \max\left\{w_u(2+r), \frac{-1}{x_i} + \pi_s(x_i)\right\} & \text{if } \hat{x}_s < x_i < \bar{x}_u \\ \max\left\{w_u(1+r) + \pi_u(x_i), \frac{-1}{x_i} + \pi_s(x_i)\right\} & \text{if } \bar{x}_u < x_i < 1 \end{cases}.$$

But notice that in equilibrium there must be some individuals in each occupation and sector. Then, it must be that $w_u(1+r) + \pi_u(\bar{x}_u) > \frac{-1}{\bar{x}_u} + \pi_s(\bar{x}_u)$ so that there are entrepreneurs in the traditional sector. This implies that $w_u(2+r) > \frac{-1}{\bar{x}_u} + \pi_s(\bar{x}_u)$ (because $\pi_u(\bar{x}_u) = w_u$). Therefore, all individuals with $\hat{x}_s < x_i < \bar{x}_u$ will choose to be unskilled workers. Then, at $\hat{x}_s$ it is also satisfied that $w_u(2+r) > \frac{-1}{\hat{x}_s} + \pi_s(\hat{x}_s)$, and since $\pi_s(\hat{x}_s) = w_s$, nobody would want to be a skilled worker.

Hence, $\bar{x}_u > \hat{x}_s$ cannot be an equilibrium. Therefore, in equilibrium $\bar{x}_u < \hat{x}_s$ always.

- We now need to prove that $\bar{x}_s > \bar{x}_u$ in any equilibrium when $\tilde{x}_s < \hat{x}_s$. Notice that $\bar{x}_s > \bar{x}_u$ always since in equilibrium $w_s > w_u$ or nobody would have incentives to become a skilled worker.

In the next subsections we analytically solve the education choice in the two cases identified above.

C.1 Case 1: $\frac{p_u w_s^\beta}{p_s w_u^\beta} \leq \left(1 - \frac{k_s - k_u}{k_s + w_s}\right)^{1-\beta}$

Here we solve the choices defined in the value function (13).

- Individuals with $x_i < \bar{x}_u$ either work as unskilled both periods or get educated and work as skilled in the second period. Individuals will get educated as long as:

$$x_i > \frac{1}{w_s - (2+r)\, w_u} = \bar{x}_e,$$

where $\bar{x}_e$ is the ability level that makes individuals indifferent between the two options. In equilibrium it must be that $w_s > (2+r)\, w_u$, so that someone wants to study and work in the knowledge sector in equilibrium. Therefore, $\bar{x}_e > 0$. If $\bar{x}_e > \bar{x}_u$, all individuals with $x_i < \bar{x}_u$ decide to be unskilled workers. If $\bar{x}_e < \bar{x}_u$, individuals with $x_i < \bar{x}_e$ will choose to be unskilled workers and those with $\bar{x}_e < x_i < \bar{x}_u$ will choose to get education and work in the knowledge sector.

- For $\bar{x}_u < x_i < \hat{x}_s$, individuals choose between studying and working in the knowledge sector or being an entrepreneur in the traditional sector. The individual with ability $\hat{x}_e$ is indifferent between the two options.

$$\frac{-1}{\hat{x}_e} + w_s = w_u (1 + r) + \pi_u (\hat{x}_e) .$$

The LHS is an increasing and concave function of $\hat{x}_e$ and the RHS is increasing and convex. They either never cross or do it twice. In the former case, all individuals in this ability range would prefer to be entrepreneurs in the traditional sector than to work as skilled workers. This can only happen in equilibrium if $\bar{x}_e < \bar{x}_u$, otherwise there would be no workers in the knowledge sector.

In order to analyze the case with two solutions, let us denote the two ability levels that leave individuals indifferent between the two options by $\hat{x}'_e$ and $\hat{x}''_e$, such that $\hat{x}'_e < \hat{x}''_e$. Let's see if these ability levels are within the range $\bar{x}_u < x_i < \hat{x}_s$.

As it can be seen in Figures 3 and 4, if $V_{Eu} (\bar{x}_e) > V_{Wu} (\bar{x}_e)$, then $\hat{x}'_e > \bar{x}_u$. Since $V_{Eu} (\bar{x}_e) > V_{Wu} (\bar{x}_e)$ when $\pi_u (\bar{x}_e) > w_u$, $\hat{x}'_e > \bar{x}_u$ if $\bar{x}_e > \bar{x}_u$ and $\hat{x}'_e < \bar{x}_u$ if $\bar{x}_e < \bar{x}_u$.

Then if $\bar{x}_e > \bar{x}_u$ and $\hat{x}_s < \hat{x}''_e$, individuals with a level of ability within the range $\bar{x}_u < x_i < \hat{x}'_e$ will become entrepreneurs in the traditional sector, while those with $\hat{x}'_e < x_i < \hat{x}_s$ become educated and work in the knowledge sector. If $\bar{x}_e < \bar{x}_u$ and $\hat{x}_s < \hat{x}''_e$, individuals with a level of ability within the range $\bar{x}_u < x_i < \hat{x}_s$ will become educated and work in the knowledge sector.

Additionally, if $\hat{x}_s > \hat{x}''_e$, individuals with $\hat{x}''_e < x_i < \hat{x}_s$ will become entrepreneurs in the traditional sector.

- For $x_i > \hat{x}_s$, individuals choose between not studying and being entrepreneurs in the traditional sector or studying and being entrepreneurs in the knowledge sector. Individuals decide to get educated when $x_i > \tilde{x}_e$, where $\tilde{x}_e$ satisfies:

$$\frac{-1}{\tilde{x}_e} + \pi_s(\tilde{x}_e) = w_u(1+r) + \pi_u(\tilde{x}_e).$$

  Then, when $\tilde{x}_e > \hat{x}_s$, those with $x_i < \tilde{x}_e$ will choose not to study and to be entrepreneurs in the traditional sector, while those with $x_i > \tilde{x}_e$ will choose to study and be entrepreneurs in the knowledge sector. If $\tilde{x}_e < \hat{x}_s$, then all individuals with $x_i > \hat{x}_s$ will be entrepreneurs in the knowledge sector. This last case will only be possible if $\bar{x}_e > \bar{x}_u$, otherwise there would not be entrepreneurs in the traditional sector in equilibrium.

  Note that $\hat{x}_s > \hat{x}''_e$ implies that $V_{E_u}(\hat{x}_s) < V_{E_s}(\hat{x}_s)$, therefore, $\tilde{x}_e > \hat{x}_s$, and viceversa.

Summary of the results for case 1 :

- if $\bar{x}_e > \bar{x}_u$ and $\hat{x}''_e > \hat{x}_s > \tilde{x}_e$ (Figure 4):

x_i	Education decision	Occupation decision
$(0, \bar{x}_u)$	no	w_u
$(\bar{x}_u, \hat{x}'_e)$	no	π_u
$(\hat{x}'_e, \hat{x}_s)$	yes	w_s
$(\hat{x}_s, 1)$	yes	π_s

- if $\bar{x}_e > \bar{x}_u$ and $\hat{x}''_e < \hat{x}_s < \tilde{x}_e$ (Figure 3):

x_i	Education decision	Occupation decision
$(0, \bar{x}_u)$	no	w_u
$(\bar{x}_u, \hat{x}'_e)$	no	π_u
$(\hat{x}'_e, \hat{x}''_e)$	yes	w_s
$(\hat{x}''_e, \hat{x}_s)$	no	π_u
$(\hat{x}_s, \tilde{x}_e)$	no	π_u
$(\tilde{x}_e, 1)$	yes	π_s

- if $\bar{x}_e < \bar{x}_u$ and $\hat{x}''_e > \hat{x}_s > \tilde{x}_e$:

x_i	Education decision	Occupation decision
$(0, \bar{x}_e)$	no	w_u
$(\bar{x}_e, \bar{x}_u)$	yes	w_s
$(\bar{x}_u, \hat{x}_s)$	yes	w_s
$(\hat{x}_s, 1)$	yes	π_s

  This case can not be an equilibrium, since there are not any entrepreneurs in the traditional sector.

- if $\bar{x}_e < \bar{x}_u$ and $\hat{x}''_e < \hat{x}_s < \tilde{x}_e$ (Figure 5):

x_i	Education decision	Occupation decision
$(0, \bar{x}_e)$	no	w_u
$(\bar{x}_e, \bar{x}_u)$	yes	w_s
$(\bar{x}_u, \hat{x}''_e)$	yes	w_s
$(\hat{x}''_e, \hat{x}_s)$	no	π_u
$(\hat{x}_s, \tilde{x}_e)$	no	π_u
$(\tilde{x}_e, 1)$	yes	π_s

C.2 Case 2: $\frac{p_u w_s^\beta}{p_s w_u^\beta} > \left(1 - \frac{k_s - k_u}{k_s + w_s}\right)^{1-\beta}$

Here we solve the choices defined in the value function (14).

- For $x_i < \bar{x}_u$, the situation is the same as in case 1.
- For $\bar{x}_u < x_i < \bar{x}_s$, they choose between studying and working in the knowledge sector or being entrepreneurs in the traditional sector. Note that in this range, $w_s > \pi_u(x_i) > w_u$ (by definition of $\bar{x}_u$ and $\bar{x}_s$).

$$\frac{-1}{\hat{x}_e} + w_s = w_u(1 + r) + \pi_u(\hat{x}_e).$$

There are two ability levels that leave individuals indifferent between the two options: $\hat{x}'_e$ and $\hat{x}''_e$. Let's see if they are within the range $\bar{x}_u < x_i < \bar{x}_s$.

If $V_{Eu}(\bar{x}_e) > V_{Ws}(\bar{x}_e) = V_{Wu}(\bar{x}_e)$, that is if $\pi_u(\bar{x}_e) > w_u$, then $\hat{x}'_e > \bar{x}_u$. This is satisfied if $\bar{x}_e > \bar{x}_u$ and not satisfied if $\bar{x}_e < \bar{x}_u$.

Moreover, since $\pi_u(\hat{x}_e) - w_s = -1/\hat{x}_e - w_u(1 + r) < 0$ and $\pi_u(\bar{x}_s) = w_s$, it must be that $\hat{x}''_e < \bar{x}_e$.

Then if $\bar{x}_e > \bar{x}_u$ individuals with level of ability within the range $\bar{x}_u < x_i < \hat{x}'_e$ will become entrepreneurs in the traditional sector, those with $\hat{x}'_e < x_i < \hat{x}''_e$ become educated and work in the knowledge sector, and those with $\hat{x}''_e < x_i < \bar{x}_s$ will become entrepreneurs in the traditional sector.

If $\bar{x}_e < \bar{x}_u$ individuals with level of ability within the range $\bar{x}_u < x_i < \hat{x}''_e$ become educated and work in the knowledge sector, and those with $\hat{x}''_e < x_i < \bar{x}_s$ will become entrepreneurs in the traditional sector.

- For $\bar{x}_s < x_i < \tilde{x}_s$, they choose between not studying and being entrepreneurs in the traditional sector or to study and being entrepreneurs in the same sector. In this case, no one wants to pay the cost of education. So noone gets educated and they all become entrepreneurs in the traditional sector.

$$\frac{-1}{x_i} + \pi_u(x_i) < w_u(1+r) + \pi_u(x_i) \text{ for all } x_i.$$

- For $x_i > \tilde{x}_s$, they choose between not studying and being entrepreneurs in the traditional sector or to study and being entrepreneurs in the knowledge sector. Individuals decide to get educated when $x_i > \tilde{x}_e$, where $\tilde{x}_e$ satisfies:

$$\frac{-1}{\tilde{x}_e} + \pi_s(\tilde{x}_e) = w_u(1+r) + \pi_u(\tilde{x}_e).$$

Notice that $\pi_s(\tilde{x}_e) > \pi_u(\tilde{x}_e)$, therefore, since $\pi_s(\tilde{x}_s) = \pi_u(\tilde{x}_s)$, $\tilde{x}_e > \tilde{x}_s$. Then those with $\tilde{x}_e > x_i > \tilde{x}_s$ will choose not to study and to be

entrepreneurs in the traditional sector, while those with $x_i > \tilde{x}_e$ will choose to study and be entrepreneurs in the knowledge sector.

Summary of the results for case 2 :

- If $\bar{x}_e > \bar{x}_u$ (Figure 3):

x_i	Education decision	Occupation decision
$(0, \bar{x}_u)$	no	w_u
$(\bar{x}_u, \hat{x}'_e)$	no	π_u
$(\hat{x}'_e, \hat{x}''_e)$	yes	w_s
$(\hat{x}''_e, \bar{x}_s)$	no	π_u
$(\bar{x}_s, \tilde{x}_s)$	no	π_u
$(\tilde{x}_s, \tilde{x}_e)$	no	π_u
$(\tilde{x}_e, 1)$	yes	π_s

- If $\bar{x}_e < \bar{x}_u$ (Figure 5):

x_i	Education decision	Occupation decision
$(0, \bar{x}_e)$	no	w_u
$(\bar{x}_e, \bar{x}_u)$	yes	w_s
$(\bar{x}_u, \hat{x}'_e)$	yes	w_s
$(\hat{x}'_e, \bar{x}_s)$	no	π_u
$(\bar{x}_s, \tilde{x}_s)$	no	π_u
$(\tilde{x}_s, \tilde{x}_e)$	no	π_u
$(\tilde{x}_e, 1)$	yes	π_s

D Proof of Proposition 2

In any equilibrium, there must be a positive amount of individuals in each occupation-sector. Therefore, when assumption 1 is not satisfied, only when $\frac{p_u w_s^\beta}{p_s w_u^\beta} > \left(1 - \frac{k_s - k_u}{k_s + w_s}\right)^{1-\beta}$, there is a possibility to have an equilibrium with a positive amount of entrepreneurs in the knowledge sector.

The value of being unskilled and skilled is

$$V_u(x_i) = \begin{cases} (2+r)w_u & \text{if } x_i < \bar{x}_u \\ (1+r)\, w_u + \pi_u(x_i) & \text{if } x_i > \bar{x}_u \end{cases}$$

and

$$V_s(x_i) = \begin{cases} -1/x_i + w_s & \text{if } x_i < \bar{x}_s \\ -1/x_i + \pi_s(x_i) & \text{if } x_i \in (\bar{x}_s, \tilde{x}_s) \\ -1/x_i + \pi_u(x_i) & \text{if } x_i > \tilde{x}_s \end{cases},$$

respectively.

The occupation-sector choice problem is:

$$V(x_i) = \begin{cases} \max\left\{w_u(2+r), \frac{-1}{x_i} + w_s\right\} & \text{if } 0 < x_i < \bar{x}_u \\ \max\left\{w_u(1+r) + \pi_u(x_i), \frac{-1}{x_i} + w_s\right\} & \text{if } \bar{x}_u < x_i < \bar{x}_s \\ \max\left\{w_u(1+r) + \pi_u(x_i), \frac{-1}{x_i} + \pi_s(x_i)\right\} & \text{if } \bar{x}_s < x_i < \tilde{x}_s \\ \max\left\{w_u(1+r) + \pi_u(x_i), \frac{-1}{x_i} + \pi_u(x_i)\right\} & \text{if } \tilde{x}_s < x_i < 1 \end{cases}.$$

The decisions for individuals with $x_i < \bar{x}_s$ is independent of assumption 1. The choice of the top ability individuals ($x_i > \tilde{x}_s$) is now to become entrepreneurs in the traditional sector, obviously without getting education. The main difference occurs for individuals with $\bar{x}_s < x_i < \tilde{x}_s$. They choose

between becoming an entrepreneur in the traditional sector or in the knowledge sector. Let's denote by $\tilde{x}_e$ the ability level that leaves the individual indifferent between the two options. $\tilde{x}_e$ satisfies:

$$\pi_s(\tilde{x}_e) - \pi_u(\tilde{x}_e) = w_u\,(1+r) + \frac{1}{\tilde{x}_e}. \tag{20}$$

The LHS is decreasing and concave when assumption 1 is not satisfied. The RHS is decreasing and convex. Moreover, $LHS(0) = k_u - k_s$ and $\lim_{x_i \to \infty} LHS\,(x_i) = -\infty$ and $RHS(0) = 0$ and $\lim_{x_i \to \infty} RHS\,(x_i) = 0$. Therefore, the only case where there can be some individuals that prefer to become entrepreneurs in the knowledge sector is if the LHS and the RHS cross twice. Let's denote the two solutions by $\tilde{x}'_e$ and $\tilde{x}''_e$, such that $\tilde{x}'_e < \tilde{x}''_e$.

$$\pi_s(\tilde{x}_e) - \pi_u(\tilde{x}_e) = w_u\,(1+r) + \frac{1}{\tilde{x}_e} > 0$$

By definition of $\tilde{x}_s$, $\pi_s(\tilde{x}_s) - \pi_u(\tilde{x}_s) = 0$, and since LHS is decreasing, then it must be that $\tilde{x}''_e < \tilde{x}_s$. Therefore, if there is a solution to equation (20) such that $\tilde{x}''_e > \bar{x}_s$, then some individuals will choose to be entrepreneurs in the knowledge sector.

If $\tilde{x}'_e > \bar{x}_s$, then individuals with ability $\bar{x}_s < x_i < \tilde{x}'_e$ will choose to be entrepreneurs in the traditional sector, those with ability $\tilde{x}'_e < x_i < \tilde{x}''_e$ will choose to be entrepreneurs in the knowledge sector, and those with ability $\tilde{x}''_e < x_i < \tilde{x}_s$ will choose to be entrepreneurs in the traditional sector.

If $\tilde{x}'_e < \bar{x}_s$, then individuals with ability $\bar{x}_s < x_i < \tilde{x}''_e$ will choose to be entrepreneurs in the knowledge sector, and those with ability $\tilde{x}''_e < x_i < \tilde{x}_s$ will choose to be entrepreneurs in the traditional sector.

To sum up, we present all the options below.

- if $\bar{x}_e > \bar{x}_u$ and $\tilde{x}'_e > \bar{x}_s$:

x_i	Education decision	Occupation decision
$(0, \bar{x}_u)$	no	w_u
$(\bar{x}_u, \hat{x}'_e)$	no	π_u
$(\hat{x}'_e, \hat{x}''_e)$	yes	w_s
$(\hat{x}''_e, \bar{x}_s)$	no	π_u
$(\bar{x}_s, \tilde{x}'_e)$	no	π_u
$(\tilde{x}'_e, \tilde{x}''_e)$	yes	π_s
$(\tilde{x}''_e, \tilde{x}_s)$	no	π_u
$(\tilde{x}_s, 1)$	no	π_u

- if $\bar{x}_e > \bar{x}_u$ and $\tilde{x}'_e < \bar{x}_s$:

x_i	Education decision	Occupation decision
$(0, \bar{x}_u)$	no	w_u
$(\bar{x}_u, \hat{x}'_e)$	no	π_u
$(\hat{x}'_e, \hat{x}''_e)$	yes	w_s
$(\hat{x}''_e, \bar{x}_s)$	no	π_u
$(\bar{x}_s, \tilde{x}''_e)$	yes	π_s
$(\tilde{x}''_e, \tilde{x}_s)$	no	π_u
$(\tilde{x}_s, 1)$	no	π_u

- If $\bar{x}_e < \bar{x}_u$ and $\tilde{x}'_e > \bar{x}_s$:

x_i	Education decision	Occupation decision
$(0, \bar{x}_e)$	no	w_u
$(\bar{x}_e, \bar{x}_u)$	yes	w_s
$(\bar{x}_u, \hat{x}'_e)$	yes	w_s
$(\hat{x}'_e, \bar{x}_s)$	no	π_u
$(\bar{x}_s, \tilde{x}'_e)$	no	π_u
$(\tilde{x}'_e, \tilde{x}''_e)$	yes	π_s
$(\tilde{x}''_e, \tilde{x}_s)$	no	π_u
$(\tilde{x}_s, 1)$	no	π_u

- If $\bar{x}_e < \bar{x}_u$ and $\tilde{x}'_e < \bar{x}_s$:

x_i	Education decision	Occupation decision
$(0, \bar{x}_e)$	no	w_u
$(\bar{x}_e, \bar{x}_u)$	yes	w_s
$(\bar{x}_u, \hat{x}'_e)$	yes	w_s
$(\hat{x}'_e, \bar{x}_s)$	no	π_u
$(\bar{x}_s, \tilde{x}''_e)$	yes	π_s
$(\tilde{x}''_e, \tilde{x}_s)$	no	π_u
$(\tilde{x}_s, 1)$	no	π_u

The main difference with the case where assumption 1 is satisfied is that, if assumption 1 is not satisfied, the top ability range individuals will choose to become an entrepreneur in the traditional sector instead of the knowledge sector.

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Tables

Table I: Groups of countries.

Group	Countries
Group 1	Denmark, Finland, Norway and Sweden
Group 2	Austria, Germany and the Netherlands
Group 3	Canada, Ireland, New Zealand, UK and US
Group 4	Belgium, France, Italy and Spain
Group 5	Czech Republic, Estonia, Lithuania, Poland, Slovak Republic and Slovenia

Table II: Distribution of jobs across occupations (ISCO 2008).

ISCO (2008)	Worker traditional sector	Worker knowledge sector	Self-employed traditional sector	Self-employed knowledge sector	Total
Legislators, senior officials and managers	301	5,859	250	1,752	8,162
Professionals	0	16,899	0	2,502	19,401
Technicians and associate professionals	3,719	8,985	428	1,076	14,208
Clerks	4,282	2,887	167	91	7,427
Service workers and shop and market	6,968	3,462	1,293	237	11,960
Skilled agricultural and fishery workers	513	43	1,221	8	1,785
Craft and related trades workers	6,412	367	1,648	63	8,490
Plant and machine operators and assemblers	5,192	171	445	8	5,816
Elementary occupations	3,990	910	299	9	5,208
Total	31,377	39,583	5,751	5,746	82,457

Table III: Distribution of jobs across industries (ISIC).

ISIC (rev 4)	Worker traditional sector	Worker knowledge sector	Self-employed traditional sector	Self-employed knowledge sector	Total
Agriculture, forestry	992	224	1,189	117	2,522
Mining and quarrying , Electricity and gas, utilities	978	785	38	42	1,843
Manufacturing	8,028	3,210	595	332	12,165
Construction	3,213	989	1,125	374	5,701
Wholesale and retail	6,143	2,362	1,054	525	10,084
Transportation and storage	2,997	786	368	87	4,238
Accommodation and food services	1,877	523	256	230	2,886
Information and communication	74	2,362	5	461	2,902
Finance and insurance	384	2,177	87	203	2,851
Real estate	151	435	43	190	819
Scientific	0	3,251	0	1,329	4,580
Administrative services	1,900	534	345	164	2,943
Public administration	1,434	4,643	19	47	6,143
Education	0	7,963	0	352	8,315
Health and social work	2,259	7,831	118	789	10,997
Arts and entertainment	258	879	45	327	1,509
Other services	689	629	464	177	1,959
Total	31,377	39,583	5,751	5,746	82,457

Table IV: OLS regression of ln(income of self-employed) per groups of countries.

	Group 1 ln(income)	Group 2 ln(income)	Group 3 ln(income)	Group 4 ln(income)	Group 5 ln(income)
numsk	0.225*	0.785**	0.494**	0.354**	0.453**
	(0.065)	(0.339)	(0.050)	(0.071)	(0.126)
female	-0.153**	-2.022***	-0.732***	-0.465**	-0.288***
	(0.028)	(0.298)	(0.008)	(0.112)	(0.037)
married	-0.011	-0.456	0.131	0.091	0.291***
	(0.125)	(0.394)	(0.077)	(0.092)	(0.072)
immigrant	-0.322	0.286	-0.134	-0.418**	0.109
	(0.143)	(0.545)	(0.097)	(0.108)	(0.181)
age: 30-34	-0.175	0.035	0.047	-0.115	0.257
	(0.290)	(0.562)	(0.114)	(0.156)	(0.138)
age:35-39	-0.207	-0.317	-0.010	0.023	0.221
	(0.116)	(0.455)	(0.217)	(0.208)	(0.113)
age:40-44	0.247*	0.118	0.008	0.138	0.234
	(0.067)	(0.454)	(0.096)	(0.175)	(0.167)
age: 45-49	0.052	-0.287	0.315	0.117	0.272
	(0.087)	(0.421)	(0.176)	(0.076)	(0.174)
age:50-54	-0.099*	-0.077	0.122*	0.129	0.244
	(0.032)	(0.425)	(0.032)	(0.055)	(0.294)
N	899	328	1435	1045	1396
R^2	0.037	0.147	0.095	0.080	0.057

Standard errors clustered at the country level in parentheses. Country dummies included.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table V: OLS regression of ln(income of self-employed) per groups of countries.

	Group 1 ln(income)	Group 2 ln(income)	Group 3 ln(income)	Group 4 ln(income)	Group 5 ln(income)
litsk	0.259**	0.515	0.378***	0.317**	0.479**
	(0.040)	(0.341)	(0.028)	(0.081)	(0.129)
female	-0.179**	-2.082***	-0.770***	-0.504**	-0.312***
	(0.033)	(0.301)	(0.017)	(0.120)	(0.049)
married	-0.013	-0.440	0.156	0.111	0.307***
	(0.127)	(0.396)	(0.079)	(0.089)	(0.076)
immigrant	-0.307	0.143	-0.141	-0.425**	0.072
	(0.134)	(0.542)	(0.100)	(0.098)	(0.171)
age: 30-34	-0.199	0.134	0.037	-0.109	0.238
	(0.305)	(0.564)	(0.113)	(0.151)	(0.137)
age:35-39	-0.230	-0.245	0.008	0.031	0.193
	(0.107)	(0.458)	(0.207)	(0.218)	(0.107)
age:40-44	0.237*	0.133	0.029	0.136	0.223
	(0.072)	(0.460)	(0.096)	(0.189)	(0.170)
age: 45-49	0.044	-0.223	0.325	0.122	0.287
	(0.096)	(0.422)	(0.182)	(0.081)	(0.173)
age:50-54	-0.099	-0.050	0.129*	0.129	0.257
	(0.040)	(0.427)	(0.032)	(0.058)	(0.289)
N	899	328	1435	1045	1396
R^2	0.038	0.138	0.084	0.075	0.057

Standard errors clustered at the country level in parentheses. Country dummies included.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table VI: OLS regression of ln(income of self-employed) per groups of countries.

	Group 1 ln(income)	Group 2 ln(income)	Group 3 ln(income)	Group 4 ln(income)	Group 5 ln(income)
numsk	0.033	1.216*	0.719**	0.374***	0.238
	(0.139)	(0.631)	(0.101)	(0.061)	(0.131)
litsk	0.229	-0.511	-0.294**	-0.025	0.276*
	(0.113)	(0.631)	(0.064)	(0.084)	(0.133)
female	-0.175**	-1.972***	-0.709***	-0.462**	-0.300***
	(0.021)	(0.305)	(0.012)	(0.117)	(0.039)
married	-0.013	-0.473	0.128	0.090	0.300**
	(0.127)	(0.395)	(0.077)	(0.088)	(0.075)
immigrant	-0.306	0.286	-0.136	-0.419**	0.092
	(0.138)	(0.545)	(0.101)	(0.106)	(0.174)
age: 30-34	-0.198	0.054	0.061	-0.114	0.242
	(0.305)	(0.563)	(0.122)	(0.157)	(0.139)
age:35-39	-0.228	-0.291	-0.004	0.024	0.203
	(0.101)	(0.457)	(0.224)	(0.208)	(0.110)
age:40-44	0.237*	0.170	0.005	0.140	0.224
	(0.072)	(0.459)	(0.092)	(0.177)	(0.172)
age: 45-49	0.044	-0.274	0.321	0.117	0.280
	(0.097)	(0.422)	(0.178)	(0.077)	(0.171)
age:50-54	-0.100	-0.084	0.129*	0.129	0.254
	(0.036)	(0.425)	(0.128)	(0.055)	(0.291)
N	899	328	1435	1045	1396
R^2	0.038	0.148	0.097	0.081	0.058

Standard errors clustered at the country level in parentheses. Country dummies included.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table VII: Final sample size per group of countries

	WO-TS	WO-KS	SE-TS	SE-KS	Total
Group 1	3,895	8,247	766	683	13,591
(DK, FI, NO, SE)	28.66	60.68	5.64	5.03	
Group 2	5,315	2,855	674	587	9,431
(AT, DE, NL)	56.36	30.27	7.15	6.22	
Group 3	7,810	16,637	1,690	2,634	28,771
(CA, IE, UK, US, NZ)	27.15	57.83	5.87	9.16	
Group 4	5,577	4,201	1,144	772	11,694
(BE, FR, IT, ES)	47.69	35.92	9.78	6.60	
Group 5	8,780	7,643	1,477	1,070	18,970
(CZ, EE, LT, PO, SK, SL)	46.28	40.29	7.79	5.64	
Total	31,377	39,583	5,751	5,746	82,457
	38.05	48.00	6.97	6.97	

WO: worker; SE: self-employed; KS: knowledge sector; TS: traditional sector.

Table VIII: Descriptive statistics.

Variable	**Mean**	**Std. Dev**
Ability dummies:		
quartile 1	0.25	0.433
quartile 2	0.25	0.433
quartile 3	0.25	0.433
quartile 4	0.25	0.433
Female	0.50	0.500
Married*	0.72	0.448
Immigrant	0.12	0.330
Higher secondary education	0.43	0.495
Tertiary education	0.45	0.497
Father w/ secondary educ	0.37	0.483
Father w/ tertiary educ	0.20	0.399
Age group dummies:		
25-29	0.12	0.324
30-34	0.13	0.335
35-39	0.14	0.342
40-44	0.14	0.351
45-49	0.15	0.354
50-54	0.14	0.343
55-59	0.12	0.320
60-65	0.07	0.263
Number of observations	82,457	

*Living with spouse or partner.

Table IX: Probit estimation. Effect of education on self-employment.

	Group 1 SE	Group 2 SE	Group 3 SE	Group 4 SE	Group 5 SE
upper secondary	-0.005	-0.010***	-0.003	-0.020	0.032
	(0.013)	(0.002)	(0.005)	(0.025)	(0.028)
tertiary	-0.039**	0.081***	-0.029***	-0.014	-0.009
	(0.015)	(0.016)	(0.005)	(0.020)	(0.053)
female	-0.103***	-0.082***	-0.068***	-0.101***	-0.069***
	(0.010)	(0.001)	(0.008)	(0.004)	(0.004)
married	0.041***	-0.000	0.045***	0.040***	0.019***
	(0.012)	(0.014)	(0.005)	(0.009)	(0.004)
immigrant	0.002	-0.015***	0.017***	-0.010	-0.016
	(0.013)	(0.005)	(0.004)	(0.011)	(0.028)
N	13591	9431	28771	11694	18970
Pseudo R^2	0.042	0.033	0.023	0.038	0.021

SE: self-employed.

Marginal effects; Robust standard errors clustered at the country level in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Additional controls: age groups and country dummies.

Table X: Probit estimation. Effect of numeracy skills on self-employment.

	Group 1 SE	Group 2 SE	Group 3 SE	Group 4 SE	Group 5 SE
numsk	-0.015	0.028***	0.011***	0.019**	-0.003
	(0.014)	(0.003)	(0.004)	(0.008)	(0.014)
female	-0.123***	-0.045***	-0.055***	-0.081***	-0.080***
	(0.010)	(0.003)	(0.010)	(0.007)	(0.003)
married	0.045***	0.002	0.035***	0.033***	0.021***
	(0.015)	(0.007)	(0.003)	(0.010)	(0.004)
immigrant	-0.007	-0.002	0.018***	-0.001	-0.023
	(0.018)	(0.002)	(0.004)	(0.007)	(0.030)
N	13591	9431	28771	11694	18970
Pseudo R^2	0.040	0.022	0.022	0.038	0.019

SE: self-employed.

Marginal effects; Robust standard errors clustered at the country level in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Additional controls: age groups and country dummies.

Table XI: Probit estimation. Effect of education and numeracy skills on self-employment.

	Group 1 SE	Group 2 SE	Group 3 SE	Group 4 SE	Group 5 SE
numsk	-0.001	0.010***	0.024***	0.024***	0.014***
	(0.012)	(0.003)	(0.004)	(0.008)	(0.003)
upper secondary	-0.005	-0.009***	-0.014***	-0.027	0.036**
	(0.013)	(0.001)	(0.002)	(0.022)	(0.018)
tertiary	-0.043***	0.063***	-0.046***	-0.043***	-0.004
	(0.016)	(0.014)	(0.003)	(0.013)	(0.042)
female	-0.105***	-0.077***	-0.048***	-0.077***	-0.063***
	(0.015)	(0.002)	(0.010)	(0.005)	(0.002)
married	0.042**	0.001	0.032***	0.032***	0.016***
	(0.017)	(0.014)	(0.002)	(0.010)	(0.004)
immigrant	-0.000	-0.014***	0.019***	-0.004	-0.019
	(0.015)	(0.004)	(0.003)	(0.006)	(0.027)
father w/ secondary educ	-0.014	-0.027***	0.001	0.018**	-0.041
	(0.009)	(0.006)	(0.004)	(0.008)	(0.026)
father w/ tertiary educ	0.016	0.023**	0.013***	0.060***	-0.013
	(0.010)	(0.011)	(0.003)	(0.004)	(0.013)
N	13591	9431	28771	11694	18970
Pseudo R^2	0.043	0.037	0.025	0.042	0.024

SE: self-employed.

Marginal effects; Robust standard errors clustered at the country level in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Additional controls: age groups and country dummies.

Table XII: Probit estimation. Effect of education and quartiles of numeracy skills on self-employment.

	Group 1 SE	Group 2 SE	Group 3 SE	Group 4 SE	Group 5 SE
quartile 2	-0.002	0.059***	0.047***	0.022**	0.024
	(0.008)	(0.020)	(0.003)	(0.009)	(0.020)
quartile 3	0.010*	0.033**	0.038***	0.044***	0.015***
	(0.005)	(0.015)	(0.004)	(0.011)	(0.003)
quartile 4	-0.006	0.029***	0.050***	0.021	0.037***
	(0.018)	(0.008)	(0.006)	(0.019)	(0.006)
upper secondary	-0.006	-0.016***	-0.018***	-0.031	0.038**
	(0.013)	(0.005)	(0.002)	(0.027)	(0.018)
tertiary	-0.043***	0.058***	-0.056***	-0.045***	-0.010
	(0.014)	(0.011)	(0.004)	(0.016)	(0.047)
female	-0.105***	-0.079***	-0.060***	-0.094***	-0.069***
	(0.010)	(0.001)	(0.007)	(0.001)	(0.004)
married	0.042***	0.001	0.040***	0.039***	0.017***
	(0.014)	(0.014)	(0.004)	(0.010)	(0.004)
immigrant	0.000	-0.011**	0.024***	-0.007	-0.020
	(0.015)	(0.006)	(0.004)	(0.007)	(0.029)
father w/ secondary educ	-0.014**	-0.029***	0.001	0.023**	-0.046*
	(0.007)	(0.007)	(0.004)	(0.011)	(0.028)
father w/ tertiary educ	0.016**	0.022*	0.016***	0.074***	-0.016
	(0.008)	(0.012)	(0.003)	(0.009)	(0.014)
N	13591	9431	28771	11694	18970
Pseudo R^2	0.044	0.040	0.026	0.042	0.025

SE: self-employed.

Marginal effects; Robust standard errors clustered at the country level in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Additional controls: age groups and country dummies.

Table XIII: Group 1. Coefficients of a Multinomial logit. Reference category: worker in the traditional sector.

	(1)			(2)			(3)		
	WO-KS	SE-TS	SE-KS	WO-KS	SE-TS	SE-KS	WO-KS	SE-TS	SE-KS
Ability									
quartile 2	0.532***	0.00947	0.467***	0.200***	-0.0175	0.180*	0.195***	-0.00902	0.170
	(0.051)	(0.111)	(0.100)	(0.026)	(0.118)	(0.107)	(0.030)	(0.116)	(0.107)
quartile 3	1.052***	0.110	1.142***	0.436***	0.0776	0.599**	0.412***	0.0884	0.554**
	(0.078)	(0.186)	(0.216)	(0.069)	(0.173)	(0.262)	(0.070)	(0.182)	(0.271)
quartile 4	1.781***	0.0511	1.745***	0.812***	-0.0232	0.895***	0.771***	-0.00413	0.815***
	(0.029)	(0.192)	(0.253)	(0.046)	(0.190)	(0.255)	(0.043)	(0.194)	(0.275)
female	0.972***	-0.830***	0.113	0.710***	-0.854***	-0.105	0.722***	-0.853***	-0.0789
	(0.212)	(0.172)	(0.327)	(0.229)	(0.174)	(0.322)	(0.226)	(0.172)	(0.322)
married	0.299***	0.582***	0.438***	0.266***	0.581***	0.411***	0.283***	0.574***	0.445***
	(0.040)	(0.139)	(0.085)	(0.056)	(0.133)	(0.106)	(0.064)	(0.137)	(0.121)
immigrant	-0.131	-0.0661	-0.135	-0.557***	-0.107	-0.517**	-0.603***	-0.103	-0.617***
	(0.105)	(0.136)	(0.214)	(0.117)	(0.152)	(0.249)	(0.113)	(0.144)	(0.237)
upper secondary educ				0.360***	-0.139	0.690***	0.336***	-0.127	0.643***
				(0.105)	(0.117)	(0.146)	(0.103)	(0.116)	(0.130)
tertiary educ				2.545***	0.265*	2.516***	2.467***	0.275*	2.366***
				(0.167)	(0.141)	(0.194)	(0.177)	(0.159)	(0.190)
Father w/ secondary educ							-0.0113	-0.208**	-0.0419
							(0.053)	(0.092)	(0.174)
Father w/ tertiary educ							0.405***	-0.00240	0.719***
							(0.038)	(0.107)	(0.116)
N	13591			13591			13591		
Pseudo-R^2	0.0975			0.184			0.186		

WO: worker; SE: self-employed; KS: knowledge sector; TS: traditional sector.

Robust standard errors clustered at the country level in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All estimations include age groups and country dummies as controls.

Table XIV: Group 2. Coefficients of a Multinomial logit. Reference category: worker in the traditional sector.

	(1)			(2)			(3)		
	WO-KS	SE-TS	SE-KS	WO-KS	SE-TS	SE-KS	WO-KS	SE-TS	SE-KS
Ability									
quartile 2	0.976***	0.474***	1.420***	0.690***	0.424**	1.142***	0.664***	0.419**	1.102***
	(0.065)	(0.177)	(0.359)	(0.136)	(0.176)	(0.389)	(0.132)	(0.175)	(0.391)
quartile 3	1.483***	0.378**	1.716***	0.975***	0.246*	1.197***	0.939***	0.239*	1.137***
	(0.067)	(0.158)	(0.412)	(0.132)	(0.128)	(0.410)	(0.125)	(0.124)	(0.403)
quartile 4	2.288***	0.490***	2.517***	1.456***	0.201**	1.666***	1.402***	0.183**	1.576***
	(0.103)	(0.158)	(0.452)	(0.138)	(0.081)	(0.400)	(0.132)	(0.077)	(0.399)
female	0.197***	-0.473***	-0.550***	0.166**	-0.484***	-0.597***	0.151**	-0.490***	-0.626***
	(0.041)	(0.057)	(0.099)	(0.070)	(0.046)	(0.141)	(0.069)	(0.049)	(0.143)
married	0.116***	-0.0331	0.190***	0.0655	-0.0541	0.136	0.0821	-0.0439	0.173
	(0.023)	(0.114)	(0.074)	(0.060)	(0.134)	(0.109)	(0.061)	(0.135)	(0.115)
immigrant	-0.190***	-0.160*	0.0688*	-0.344***	-0.252***	-0.109*	-0.348***	-0.285***	-0.140**
	(0.031)	(0.088)	(0.036)	(0.039)	(0.085)	(0.062)	(0.042)	(0.085)	(0.057)
upper secondary				0.312*	-0.336***	0.226*	0.296*	-0.293***	0.235
				(0.172)	(0.074)	(0.124)	(0.164)	(0.072)	(0.145)
tertiary				2.349***	0.648***	2.324***	2.269***	0.630***	2.212***
				(0.137)	(0.089)	(0.262)	(0.136)	(0.093)	(0.283)
father w/ secondary educ							0.0308	-0.273***	-0.149
							(0.047)	(0.042)	(0.168)
father w/ tertiary educ							0.364***	0.133**	0.549***
							(0.024)	(0.061)	(0.131)
N	9431			9431			9431		
Pseudo R^2	0.0811			0.163			0.166		

WO: worker; SE: self-employed; KS: knowledge sector; TS: traditional sector.

Robust standard errors clustered at the country level in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All estimations include age groups and country dummies as controls.

Table XV: Group 3. Coefficients of a Multinomial logit. Reference category: worker in the traditional sector.

	(1)			(2)			(3)		
	WO-KS	SE-TS	SE-KS	WO-KS	SE-TS	SE-KS	WO-KS	SE-TS	SE-KS
Ability									
quartile 2	0.555***	0.341***	0.903***	0.210***	0.326***	0.660***	0.193***	0.323***	0.625***
	(0.027)	(0.010)	(0.073)	(0.064)	(0.019)	(0.064)	(0.064)	(0.021)	(0.059)
quartile 3	1.322***	0.0548	1.718***	0.697***	0.0476	1.248***	0.673***	0.0602	1.197***
	(0.032)	(0.214)	(0.163)	(0.072)	(0.231)	(0.113)	(0.068)	(0.224)	(0.106)
quartile 4	2.031***	0.518***	2.387***	1.129***	0.510***	1.684***	1.069***	0.492***	1.585***
	(0.023)	(0.053)	(0.132)	(0.098)	(0.028)	(0.071)	(0.098)	(0.030)	(0.060)
female	0.919***	-0.220***	0.381***	0.810***	-0.221***	0.296***	0.811***	-0.224***	0.297***
	(0.023)	(0.083)	(0.023)	(0.044)	(0.081)	(0.032)	(0.043)	(0.079)	(0.031)
married	0.277***	0.471***	0.494***	0.331***	0.466***	0.537***	0.341***	0.470***	0.554***
	(0.014)	(0.016)	(0.079)	(0.016)	(0.015)	(0.085)	(0.014)	(0.013)	(0.085)
immigrant	-0.215***	-0.115***	0.171***	-0.304***	-0.0624*	0.0678	-0.313***	-0.105**	0.0719
	(0.075)	(0.041)	(0.039)	(0.054)	(0.035)	(0.131)	(0.066)	(0.048)	(0.159)
upper secondary ed				0.896***	0.134**	0.248***	0.865***	0.161**	0.156***
				(0.271)	(0.054)	(0.094)	(0.267)	(0.067)	(0.054)
tertiary educ				2.419***	0.0374	1.571***	2.337***	0.0321	1.414***
				(0.363)	(0.102)	(0.130)	(0.360)	(0.119)	(0.091)
Father w/ secondary educ							0.0340	-0.214**	0.238**
							(0.021)	(0.088)	(0.093)
Father w/ tertiary educ							0.324***	0.145***	0.508***
							(0.024)	(0.050)	(0.054)
N	28771			28771			28771		
Pseudo R^2	0.0779			0.128			0.130		

WO: worker; SE: self-employed; KS: knowledge sector; TS: traditional sector.

Robust standard errors clustered at the country level in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All estimations include age groups and country dummies as controls.

Table XVI: Group 4. Coefficients of a Multinomial logit. Reference category: worker in the traditional sector.

	(1)			(2)			(3)		
	WO-KS	SE-TS	SE-KS	WO-KS	SE-TS	SE-KS	WO-KS	SE-TS	SE-KS
Ability									
quartile 2	0.715***	0.191***	0.552***	0.339***	0.228***	0.243***	0.318***	0.221***	0.195***
	(0.084)	(0.039)	(0.052)	(0.067)	(0.066)	(0.027)	(0.064)	(0.067)	(0.024)
quartile 3	1.297***	0.308***	1.284***	0.562***	0.377***	0.634***	0.513***	0.360***	0.545***
	(0.143)	(0.059)	(0.093)	(0.097)	(0.051)	(0.066)	(0.102)	(0.051)	(0.067)
quartile 4	2.026***	0.168	1.840***	0.919***	0.295***	0.805***	0.835***	0.263***	0.660***
	(0.257)	(0.112)	(0.124)	(0.198)	(0.054)	(0.056)	(0.194)	(0.052)	(0.047)
female	0.662***	-0.569***	-0.117	0.390*	-0.536***	-0.398***	0.393*	-0.533***	-0.394***
	(0.198)	(0.090)	(0.080)	(0.222)	(0.111)	(0.142)	(0.222)	(0.112)	(0.139)
married	0.0208	0.366***	0.0367	0.0995	0.345***	0.112	0.123	0.353***	0.150
	(0.076)	(0.060)	(0.132)	(0.117)	(0.074)	(0.132)	(0.124)	(0.076)	(0.147)
immigrant	-0.485**	-0.213***	0.0121	-0.504***	-0.225***	0.0252	-0.555***	-0.235***	-0.0637
	(0.243)	(0.042)	(0.100)	(0.172)	(0.040)	(0.043)	(0.205)	(0.036)	(0.083)
upper secondary				0.828***	-0.217	0.612***	0.783***	-0.238	0.528***
				(0.283)	(0.159)	(0.226)	(0.258)	(0.164)	(0.197)
tertiary				2.570***	-0.332	2.492***	2.400***	-0.414	2.202***
				(0.233)	(0.272)	(0.519)	(0.213)	(0.288)	(0.470)
father w/ secondary educ							0.301	0.120***	0.445**
							(0.186)	(0.043)	(0.198)
father w/ tertiary educ							0.884***	0.467***	1.380***
							(0.160)	(0.126)	(0.071)
N	11694			11694			11694		
Pseudo R^2	0.106			0.176			0.182		

WO: worker; SE: self-employed; KS: knowledge sector; TS: traditional sector.

Robust standard errors clustered at the country level in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All estimations include age groups and country dummies as controls.

Table XVII: Group 5. Coefficients of a Multinomial logit. Reference category: worker in the traditional sector.

	(1)			(2)			(3)		
	WO-KS	SE-TS	SE-KS	WO-KS	SE-TS	SE-KS	WO-KS	SE-TS	SE-KS
Ability									
quartile 2	0.378***	0.0813	0.771***	0.0696	0.0403	0.481*	0.0343	0.0733	0.427
	(0.078)	(0.186)	(0.258)	(0.103)	(0.180)	(0.276)	(0.098)	(0.161)	(0.281)
quartile 3	1.037***	0.155***	1.173***	0.483***	0.108***	0.668***	0.443***	0.151***	0.597***
	(0.069)	(0.012)	(0.014)	(0.058)	(0.013)	(0.030)	(0.069)	(0.029)	(0.030)
quartile 4	1.945***	0.314**	2.250***	0.887***	0.254**	1.277***	0.827***	0.314**	1.178***
	(0.157)	(0.144)	(0.139)	(0.127)	(0.128)	(0.092)	(0.137)	(0.153)	(0.084)
female	1.120***	-0.281	0.579**	0.980***	-0.287	0.463**	0.986***	-0.286	0.474**
	(0.210)	(0.319)	(0.228)	(0.210)	(0.309)	(0.222)	(0.206)	(0.311)	(0.222)
married	0.199***	0.298***	0.0973***	0.224***	0.284***	0.0915	0.242***	0.255***	0.120
	(0.063)	(0.083)	(0.037)	(0.014)	(0.080)	(0.101)	(0.021)	(0.096)	(0.099)
immigrant	-0.135	-0.626***	0.302	-0.485**	-0.602***	-0.0634	-0.501**	-0.642***	-0.0993
	(0.261)	(0.169)	(0.328)	(0.223)	(0.170)	(0.237)	(0.216)	(0.189)	(0.261)
upper secondary ed				0.744***	0.246	0.855***	0.694***	0.330***	0.773***
				(0.108)	(0.177)	(0.106)	(0.112)	(0.128)	(0.107)
tertiary educ				3.368***	0.420***	3.240***	3.209***	0.565***	2.976***
				(0.350)	(0.054)	(0.310)	(0.361)	(0.132)	(0.233)
Father w/ secondary educ							0.178***	-0.392*	0.318***
							(0.058)	(0.201)	(0.082)
Father w/ tertiary educ							0.742***	-0.425*	1.156***
							(0.131)	(0.239)	(0.279)
N	18970			18970			18970		
Pseudo R^2	0.109			0.207			0.212		

WO: worker; SE: self-employed; KS: knowledge sector; TS: traditional sector.

Robust standard errors clustered at the country level in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All estimations include age groups and country dummies as controls.

Table XVIII: Group 1. Coefficients of a Multinomial logit. Reference category: worker in the knowledge sector.

	(1)			(2)			(3)		
	WO-TS	SE-TS	SE-KS	WO-TS	SE-TS	SE-KS	WO-TS	SE-TS	SE-KS
Ability									
quartile 2	-0.532***	-0.523***	-0.0657	-0.200***	-0.218*	-0.0202	-0.195***	-0.205*	-0.0252
	(0.051)	(0.136)	(0.145)	(0.026)	(0.120)	(0.131)	(0.030)	(0.124)	(0.132)
quartile 3	-1.052***	-0.942***	0.0905	-0.436***	-0.358	0.163	-0.412***	-0.324	0.142
	(0.078)	(0.232)	(0.226)	(0.069)	(0.234)	(0.228)	(0.070)	(0.241)	(0.240)
quartile 4	-1.781***	-1.730***	-0.0368	-0.812***	-0.835***	0.0836	-0.771***	-0.776***	0.0434
	(0.029)	(0.168)	(0.239)	(0.046)	(0.201)	(0.221)	(0.043)	(0.206)	(0.242)
female	-0.972***	-1.802***	-0.859***	-0.710***	-1.565***	-0.815***	-0.722***	-1.575***	-0.800***
	(0.212)	(0.063)	(0.170)	(0.229)	(0.067)	(0.172)	(0.226)	(0.069)	(0.178)
married	-0.299***	0.283***	0.138**	-0.266***	0.315***	0.145**	-0.283***	0.291***	0.162**
	(0.040)	(0.099)	(0.062)	(0.056)	(0.084)	(0.063)	(0.064)	(0.079)	(0.071)
immigrant	0.131	0.0652	-0.00398	0.557***	0.450***	0.0400	0.603***	0.500***	-0.0140
	(0.105)	(0.071)	(0.182)	(0.117)	(0.118)	(0.186)	(0.113)	(0.110)	(0.190)
upper secondary				-0.360***	-0.499**	0.330***	-0.336***	-0.463**	0.307***
				(0.105)	(0.221)	(0.068)	(0.103)	(0.218)	(0.062)
tertiary				-2.545***	-2.280***	-0.0294	-2.467***	-2.192***	-0.101
				(0.167)	(0.176)	(0.070)	(0.177)	(0.177)	(0.079)
father w/ secondary educ							0.0113	-0.196**	-0.0306
							(0.053)	(0.098)	(0.133)
father w/ tertiary educ							-0.405***	-0.408***	0.314**
							(0.038)	(0.096)	(0.123)
N	13591			13591			13591		
Pseudo R^2	0.0975			0.184			0.186		

WO: worker; SE: self-employed; KS: knowledge sector; TS: traditional sector.

Robust standard errors clustered at the country level in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All estimations include age groups and country dummies as controls.

Table XIX: Group 2. Coefficients of a Multinomial logit. Reference category: worker in the knowledge sector.

	(1)			(2)			(3)		
	WO-TS	SE-TS	SE-KS	WO-TS	SE-TS	SE-KS	WO-TS	SE-TS	SE-KS
Ability									
quartile 2	-0.976***	-0.501***	0.444	-0.690***	-0.266***	0.452*	-0.664***	-0.245***	0.438*
	(0.065)	(0.117)	(0.294)	(0.136)	(0.053)	(0.253)	(0.132)	(0.053)	(0.258)
quartile 3	-1.483***	-1.105***	0.234	-0.975***	-0.728***	0.222	-0.939***	-0.700***	0.199
	(0.067)	(0.102)	(0.346)	(0.132)	(0.056)	(0.279)	(0.125)	(0.047)	(0.279)
quartile 4	-2.288***	-1.798***	0.229	-1.456***	-1.254***	0.210	-1.402***	-1.219***	0.174
	(0.103)	(0.067)	(0.352)	(0.138)	(0.068)	(0.264)	(0.132)	(0.059)	(0.269)
female	-0.197***	-0.671***	-0.748***	-0.166**	-0.650***	-0.762***	-0.151**	-0.640***	-0.777***
	(0.041)	(0.069)	(0.086)	(0.070)	(0.100)	(0.084)	(0.069)	(0.099)	(0.088)
married	-0.116***	-0.149	0.0741	-0.0655	-0.120	0.0703	-0.0821	-0.126	0.0905
	(0.023)	(0.109)	(0.050)	(0.060)	(0.094)	(0.054)	(0.061)	(0.092)	(0.057)
immigrant	0.190***	0.0302	0.259***	0.344***	0.0922*	0.235***	0.348***	0.0630	0.208***
	(0.031)	(0.118)	(0.030)	(0.039)	(0.053)	(0.031)	(0.042)	(0.052)	(0.027)
upper secondary				-0.312*	-0.648***	-0.0858	-0.296*	-0.588***	-0.0610
				(0.172)	(0.099)	(0.285)	(0.164)	(0.097)	(0.306)
tertiary				-2.349***	-1.701***	-0.0258	-2.269***	-1.639***	-0.0571
				(0.137)	(0.222)	(0.398)	(0.136)	(0.227)	(0.419)
father w/ secondary educ							-0.0308	-0.303***	-0.180
							(0.047)	(0.080)	(0.121)
father w/ tertiary educ							-0.364***	-0.231***	0.185
							(0.024)	(0.078)	(0.119)
N	9431			9431			9431		
Pseudo R^2	0.0811			0.163			0.166		

WO: worker; SE: self-employed; KS: knowledge sector; TS: traditional sector.

Robust standard errors clustered at the country level in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All estimations include age groups and country dummies as controls.

Table XX: Group 3. Coefficients of a Multinomial logit. Reference category: worker in the knowledge sector.

	(1)			(2)			(3)		
	WO-TS	SE-TS	SE-KS	WO-TS	SE-TS	SE-KS	WO-TS	SE-TS	SE-KS
Ability									
quartile 2	-0.555***	-0.214***	0.348***	-0.210***	0.116**	0.449***	-0.193***	0.130***	0.432***
	(0.027)	(0.021)	(0.095)	(0.064)	(0.046)	(0.121)	(0.064)	(0.045)	(0.114)
quartile 3	-1.322***	-1.268***	0.396***	-0.697***	-0.649***	0.551***	-0.673***	-0.613***	0.524***
	(0.032)	(0.240)	(0.143)	(0.072)	(0.166)	(0.184)	(0.068)	(0.162)	(0.174)
quartile 4	-2.031***	-1.513***	0.356***	-1.129***	-0.620***	0.555***	-1.069***	-0.577***	0.516***
	(0.023)	(0.035)	(0.113)	(0.098)	(0.126)	(0.164)	(0.098)	(0.125)	(0.150)
female	-0.919***	-1.140***	-0.539***	-0.810***	-1.031***	-0.514***	-0.811***	-1.036***	-0.515***
	(0.023)	(0.100)	(0.015)	(0.044)	(0.121)	(0.022)	(0.043)	(0.118)	(0.022)
married	-0.277***	0.194***	0.217***	-0.331***	0.134***	0.206***	-0.341***	0.129***	0.213***
	(0.014)	(0.012)	(0.076)	(0.016)	(0.002)	(0.072)	(0.014)	(0.003)	(0.074)
immigrant	0.215***	0.101*	0.386***	0.304***	0.242***	0.372***	0.313***	0.209**	0.385***
	(0.075)	(0.056)	(0.109)	(0.054)	(0.066)	(0.079)	(0.066)	(0.094)	(0.095)
upper secondary				-0.896***	-0.762***	-0.648***	-0.865***	-0.703***	-0.709***
				(0.271)	(0.222)	(0.180)	(0.267)	(0.203)	(0.215)
tertiary				-2.419***	-2.382***	-0.848***	-2.337***	-2.305***	-0.923***
				(0.363)	(0.270)	(0.246)	(0.360)	(0.257)	(0.286)
father w/ secondary educ							-0.0340	-0.248***	0.204**
							(0.021)	(0.075)	(0.085)
father w/ tertiary educ							-0.324***	-0.179***	0.184**
							(0.024)	(0.037)	(0.075)
N	28771			28771			28771		
Pseudo R^2	0.0779			0.128			0.130		

WO: worker; SE: self-employed; KS: knowledge sector; TS: traditional sector.

Robust standard errors clustered at the country level in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All estimations include age groups and country dummies as controls.

Table XXI: Group 4. Coefficients of a Multinomial logit. Reference category: worker in the knowledge sector.

	(1)			(2)			(3)		
	WO-TS	SE-TS	SE-KS	WO-TS	SE-TS	SE-KS	WO-TS	SE-TS	SE-KS
Ability									
quartile 2	-0.715***	-0.524***	-0.163***	-0.339***	-0.111	-0.0960**	-0.318***	-0.0970	-0.123***
	(0.084)	(0.117)	(0.057)	(0.067)	(0.119)	(0.044)	(0.064)	(0.117)	(0.041)
quartile 3	-1.297***	-0.989***	-0.0126	-0.562***	-0.184	0.0724	-0.513***	-0.152	0.0326
	(0.143)	(0.117)	(0.119)	(0.097)	(0.134)	(0.110)	(0.102)	(0.141)	(0.115)
quartile 4	-2.026***	-1.858***	-0.186	-0.919***	-0.624***	-0.115	-0.835***	-0.573**	-0.175
	(0.257)	(0.181)	(0.204)	(0.198)	(0.234)	(0.150)	(0.194)	(0.233)	(0.168)
female	-0.662***	-1.231***	-0.779***	-0.390*	-0.926***	-0.788***	-0.393*	-0.927***	-0.787***
	(0.198)	(0.111)	(0.133)	(0.222)	(0.111)	(0.137)	(0.222)	(0.110)	(0.130)
married	-0.0208	0.345***	0.0159	-0.0995	0.246	0.0127	-0.123	0.230	0.0274
	(0.076)	(0.117)	(0.127)	(0.117)	(0.178)	(0.122)	(0.124)	(0.184)	(0.127)
immigrant	0.485**	0.272	0.497***	0.504***	0.279	0.529***	0.555***	0.320	0.492***
	(0.243)	(0.266)	(0.145)	(0.172)	(0.206)	(0.132)	(0.205)	(0.227)	(0.127)
upper secondary				-0.828***	-1.045**	-0.216	-0.783***	-1.020**	-0.254*
				(0.283)	(0.440)	(0.156)	(0.258)	(0.421)	(0.147)
tertiary				-2.570***	-2.902***	-0.0780	-2.400***	-2.814***	-0.198
				(0.233)	(0.467)	(0.309)	(0.213)	(0.453)	(0.266)
father w/ secondary educ							-0.301	-0.181	0.144
							(0.186)	(0.197)	(0.112)
father w/ tertiary educ							-0.884***	-0.417***	0.496***
							(0.160)	(0.065)	(0.152)
N	11694			11694			11694		
Pseudo R^2	0.106			0.176			0.182		

WO: worker; SE: self-employed; KS: knowledge sector; TS: traditional sector.

Robust standard errors clustered at the country level in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All estimations include age groups and country dummies as controls.

Table XXII: Group 5. Coefficients of a Multinomial logit. Reference category: worker in the knowledge sector.

	(1)			(2)			(3)		
	WO-TS	SE-TS	SE-KS	WO-TS	SE-TS	SE-KS	WO-TS	SE-TS	SE-KS
Ability									
quartile 2	-0.378***	-0.296***	0.393**	-0.0696	-0.0293	0.411**	-0.0343	0.0391	0.393**
	(0.078)	(0.109)	(0.181)	(0.103)	(0.079)	(0.176)	(0.098)	(0.069)	(0.187)
quartile 3	-1.037***	-0.883***	0.136*	-0.483***	-0.375***	0.185**	-0.443***	-0.292***	0.155*
	(0.069)	(0.064)	(0.072)	(0.058)	(0.051)	(0.073)	(0.069)	(0.045)	(0.080)
quartile 4	-1.945***	-1.631***	0.305***	-0.887***	-0.632***	0.390***	-0.827***	-0.512***	0.351***
	(0.157)	(0.073)	(0.028)	(0.127)	(0.051)	(0.044)	(0.137)	(0.043)	(0.066)
female	-1.120***	-1.401***	-0.542***	-0.980***	-1.267***	-0.517***	-0.986***	-1.272***	-0.511***
	(0.210)	(0.109)	(0.043)	(0.210)	(0.103)	(0.042)	(0.206)	(0.108)	(0.040)
married	-0.199***	0.0984**	-0.102	-0.224***	0.0598	-0.133	-0.242***	0.0126	-0.122
	(0.063)	(0.046)	(0.097)	(0.014)	(0.078)	(0.111)	(0.021)	(0.089)	(0.117)
immigrant	0.135	-0.491*	0.437	0.485**	-0.118	0.421	0.501**	-0.141	0.402
	(0.261)	(0.274)	(0.398)	(0.223)	(0.237)	(0.408)	(0.216)	(0.248)	(0.428)
upper secondary				-0.744***	-0.498*	0.111	-0.694***	-0.363*	0.0793
				(0.108)	(0.262)	(0.117)	(0.112)	(0.219)	(0.142)
tertiary				-3.368***	-2.948***	-0.128	-3.209***	-2.644***	-0.233
				(0.350)	(0.311)	(0.085)	(0.361)	(0.239)	(0.142)
father w/ secondary educ							-0.178***	-0.570***	0.140
							(0.058)	(0.177)	(0.120)
father w/ tertiary educ							-0.742***	-1.167***	0.414
							(0.131)	(0.248)	(0.312)
N	18970			18970			18970		
Pseudo R^2	0.109			0.207			0.212		

WO: worker; SE: self-employed; KS: knowledge sector; TS: traditional sector.

Robust standard errors clustered at the country level in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All estimations include age groups and country dummies as controls.