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Compulsory Education and Jack-of-all-trades Entrepreneurs

Robin Douhan

Research Institute of Industrial Economics
P.O. Box 55665
SE-102 15 Stockholm, Sweden
info@ifn.se
www.ifn.se

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Robin Douhan
Research Institute of Industrial Economics (IFN)
and Uppsala University

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Abstract

Can educational institutions explain occupational choice between wage employment and entrepreneurship? This paper follows Lazear's (2005) Jack-of-all-trades hypothesis according to which an individual with a more balanced set of abilities is more likely to enter into entrepreneurship. In the theoretical model proposed, abilities are an outcome of talent and educational institutions. Institutions, in turn, differ with respect to mandatory time in school and the scope of the curriculum. Implications of the theory are tested using Swedish data for a school reform. Empirical results support the main theoretical predictions.

JEL: J24, I21, L26

Keywords: human capital, occupational choice, entrepreneurship, education institutions

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1 Introduction

Recent economic research has approached human capital as a multifaceted phenomenon. The importance of non-cognitive abilities has been emphasized in works by Heckman, Stixrud and Urzua (2006) and Borghans *et al.* (2008). Non-cognitive dimensions such as motivation, socioemotional regulation, time preferences and personality traits have a high predictive value for a range of labor market and behavioral outcomes. In view of these findings, Heckman (2008) makes a strong claim that the traditional bias toward cognitive skills in research and policy should be reduced. According to him, particular attention should be given to the multiplicity of human abilities.

Lazear (2004; 2005) showed that the multiplicity of human capital is also relevant for the study of self-employment and entrepreneurship.[1] He proposed the hypothesis that entrepreneurs are, in contrast to wage employees, generalists, or jacks-of-all-trades (henceforth, JAT). For the small scale entrepreneur internal division of labor is not a feasible option, and hiring competent outside specialists is often prohibitively costly. Hence, success depends on the entrepreneur's ability to undertake a wide range of different tasks in addition to his or her core competency, e.g., marketing, accounting, customer relations, *et cetera*. For larger scale entrepreneurs, both of these constraints are relaxed. However, Lazear still argues that high competence in a broad set of skills is important: the entrepreneur should be sufficiently "well-versed in a variety of fields to judge the quality of applicants" (Lazear 2005, p.650).[2]

In a formal analysis of the JAT theory, the entrepreneur is better able to gain from complementarities between different skills, but is also more vulnerable to any weak link in the chain of abilities required. Moreover, if wage work is

[1] Following prior literature we will talk about entrepreneurs rather than self-employed, although the latter are the ones we can identify in the data. The former is often taken to refer to a particular kind of person whereas the later denotes occupational status (Iversen *et al.* 2008).

[2] One could add a third argument that builds on the role of the entrepreneur as an innovator. Research on creativity and innovativeness has stressed the importance of combinations (e.g. Ward 2004). From this point of view, innovations are often a result of novel combinations of knowledge pertaining to different fields of expertise. This implies that the entrepreneur as an innovator must be highly skilled in a broad set of abilities. Whereas the discussion in Lazear (2005) pertains to the entrepreneur as an organizer, this argument suggests that the JAT-hypothesis is also valid when applied to the entrepreneur as an innovator.

perfectly specialized, the opportunity cost of entrepreneurship is closely related to the strongest ability. Taken together, these facts suggest that the probability of becoming an entrepreneur decreases with the variation across different skill levels in the (multidimensional) set of human capital. The JAT theory has previously been tested using generality of the entrepreneur's field of education (Lazear 2005), diversity in prior labor market experience (Wagner 2003; Astebro and Thompson 2007; Silva 2007) and variation in aptitude tests (Hartog, van der Sluis and van Praag 2008).

This paper expands the JAT literature in two directions. First, we use a large set of individual level data containing information about talents in early adolescence to test the basic JAT hypothesis. The results are indicative of the expected effect. More importantly, we proceed to test the interaction between educational institutions, talents in adolescence and occupational choice.

Education is modeled as a one-period event that individuals enter with a vector of talents and exit with a vector of abilities. Institutions that prescribe a longer time in compulsory education are shown to reduce entry into entrepreneurship for individuals who exhibit high variation in their set of talents. This is due to effects of so-called dynamic complementarity – a skill begets skill effect – which strengthens differences in skill levels and hence increases variation across skills.

We also show that probability of entry depends on the initial endowments of skills that are unaffected by education. The likelihood of entering into entrepreneurship is more positively affected by a longer time in school for individuals with a high talent for the relevant skills. These individuals gain the most from schooling by developing abilities that are complementary to their initial skills.

This implies that changing the scope of the curriculum by either excluding or including a particular skill will also affect entry decisions. In particular, if the curriculum is expanded by integrating more skills, this has the strongest negative effect on entry for individuals with high talents for abilities excluded in the old regime. These individuals lose the complementary effect of education in the new regime.

We test the propositions using a reform in compulsory education in Sweden dating back to the 1960s. At the time of the reform, two random samples, each consisting of about 10 percent of all individuals in a cohort, were surveyed, and data on their test results, interests and school performance together with background information were collected. Individuals from these two cohorts are matched to recent labor market data. The data allow for a difference-in-difference approach similar to Meghir and Palme (2005). In accordance with the theoretical predictions, the reform decreased entry into entrepreneurship for individuals with a high variation across skills. Moreover, the change to a more comprehensive curriculum reduced entry for those who scored high on an ability that was excluded in the old system.

The result that the returns on education for entrepreneurs depend on abilities unaffected by education (e.g., sociability, charisma) may be seen as a contribution to the literature on entrepreneurship and human capital (Iyigun and Owen 1998). It also relates to the issue of differential returns on education for entrepreneurs and wage workers (Van der Sluis, van Praag and Vijverberg 2008; 2005; Van Praag and van der Sluis 2007). This paper is also, to the best of our knowledge, the first to put the production function approach to education (suggested by, e.g., Cunha and Heckman 2007) into an occupational choice framework.

To put the issue discussed in this paper into a broader context, it is worth noting the importance for economic growth that is often attached to the entrepreneur (see, e.g., van Praag and Versloot 2007). A better understanding of the interaction between education and occupational choice therefore implicitly relates to the effect of education on growth.[3] Moreover, the analysis in this paper can shed some light on, and bind together, three trends that are pertinent in the twentieth century economic history. During this time, the scope and extent of compulsory education was heavily expanded in most developed countries. For instance, Boli, Ramirez and Meyer (1985) discuss the rise of mass education and the striking similarities of the newly built institutions. In tandem with this, the demise of entrepreneurship was predicted in an influential work by Joseph Schumpeter (1942). It has since been documented, notably by Loveman and Sengenberger (1991), that small scale businesses – often assumed to be the natural habitat for entrepreneurs – in fact

[3]Research on the relation between education and growth has been dominated by two theoretical approaches (see Krueger and Lindahl 2001). Following Nelson and Phelps (1966), research has stressed the role of education and human capital in adopting new technologies. Second, in endogenous growth theories accumulation of human capital sustains long run growth (Lucas 1988; Romer 1990).

decreased in importance in the post-war development of major economies. Big companies run on Fordist managerial principles with a high degree of specialization were seen as the main drivers of economic growth (Galbraith 1967). A third trend, which is consistent with the second, is the increased role of division of labor in economic development (Smith 1965 [reprinted]; Becker and Murphy 1992).

If increased schooling makes individuals more apt for specialized tasks, the three tendencies sketched above fit neatly together. One story that can be told is that educational institutions evolved to better fit the needs of a specialized workforce in big Fordist companies. The same institutions have endowed individuals with human capital less conducive to JAT entrepreneurship.

2 Theory

2.1 Human capital formation

Assume that human capital can be described as a vector of ability levels for n different types of abilities (or synonymously, skills), denoted θ. Each element $\theta_j \in \theta$ corresponds to a certain type of skill j.

Cunha and Heckman (2007) suggested that the skill level at time $t+1$ can be described in the following way:

$$\theta_{t+1} = f_t\left(h, \theta_t, I_t\right), \tag{1}$$

where h is parental characteristics and I_t investments at time t. Including present skill level θ_t allows for what they call self-productivity, i.e. a positive effect of past skills on future skills. We simplify the recursive structure and consider only two time periods. Let $\bar{\theta}$ denote the vector of abilities before education and θ after. We will refer to the former as talents and the latter as skills or abilities. The analysis is further simplified by abstracting from parental characteristics.[4]

Investments in eq (1) correspond to characteristics of the educational system in our setting. These are modeled using a vector S of length n where each element $s_j \geq 0$ corresponds to one ability $\theta_j \in \theta$. The interpretation of $s_j = 0$ is that the

[4] In the empirical part some controls for characteristics of the parents are included.

curriculum pays no attention at all to ability j. The higher s_j the more (quality adjusted) time is spent on ability j. A larger S will be somewhat loosely called a more extensive or longer education. We thus picture education in the following way:

$$\theta = f\left(\bar{\theta}, S\right). \tag{2}$$

Next, we impose some restrictions. A first assumption that is natural to make is that ability is increasing over the extent of education

$$\frac{\partial f\left(\bar{\theta}, S\right)}{\partial S} > 0. \tag{3}$$

Although education has a positive effect on the transformation from talent to (productive) abilities, it is plausible that some of the talent would be retained even outside of school. The second assumption is similar to what Cunha and Heckman (2007) call self-productivity. The higher the level of talent is for a specific ability, the higher the ability produced by the education technology will be:

$$\frac{\partial f\left(\bar{\theta}, S\right)}{\partial \bar{\theta}} > 0. \tag{4}$$

Now, we simplify the analysis considerably by assuming that education in a specific skill only affects this skill type. In other words, we preclude spillovers from education in one ability to other abilities. Similarly, we assume that self-productivity is only effective within a particular skill type. With a slight abuse of notation we may thus write

$$\theta_j = f\left(\bar{\theta}_j, s_j\right).$$

A final assumption is related to dynamic complementarity in Cunha and Heckman (2007). Dynamic complementarity means that investments in abilities are more productive when the prior talent is higher. This is captured by assuming that the cross derivative of eq (2) with respect to its two arguments is positive. For our purposes it is more helpful to first define the elasticity of education:

$$\sigma_j = \frac{\partial f\left(\bar{\theta}_j, s_j\right)}{\partial s_j} \frac{s_j}{f\left(\bar{\theta}_j, s_j\right)},$$

and then define dynamic complementarity as

$$\frac{\partial \sigma_j}{\partial \bar{\theta}_j} > 0. \tag{5}$$

In relation to compulsory education we also propose a slightly different interpretation. We will say that the system is more elitist the larger the value of (5). Such a system is focused on strengthening those who have a high talent level. A more egalitarian system would instead spend resources on supporting weak students.

2.2 Occupational choice

Lazear (2005) models a situation where an individual faces job market opportunities in the form of two different kinds of wage employment and self-employment. He considers a vector of abilities $\theta = \{\theta_A, \theta_B\}$. As an employee, the individual can specialize in one of the two abilities. Hence, the two are perfect substitutes, and the individual earns the higher of θ_A and θ_B. In entrepreneurship, the individual must rely on both abilities, which are perfect complements, and the profit is determined by the lower of the two. In making the occupational choice, he or she solves the problem:

$$\max \{\max (\theta_A, \theta_B), \lambda \min (\theta_A, \theta_B)\}.$$

Abilities are expressed in terms of their market value and should be interpreted as measures of productivity. For the setting to be interesting it must be assumed that $\lambda > 1$. In effect, this parameter embodies relative compensation levels, where wages have been normalized to 1. One intuition for $\lambda > 1$ is the possibility of earning higher returns from using one's abilities as complements in entrepreneurship.[5] For a distribution of ability vectors θ, we can write a binary condition for

[5] Lazear (2005), and Astebro and Thompson (2007) show that the parameter can be derived from a more fundamental production function where the entrepreneur employs the workers. λ will then summarize the relation between profit and wages. They do so assuming an exogenously given demand for entrepreneurs which is perfectly inelastic.

entry into entrepreneurship as:

$$\lambda \min(\theta) \geq \max(\theta), \tag{6}$$

where the vector of abilities is given by eq (2).

The analysis here will be restricted to just one vector, θ (generated by a draw of $\bar{\theta}$ from some arbitrary distribution). Stochastics is introduced in the model by letting λ_i be a draw from a probability distribution, $\lambda_i \sim G(\lambda)$. We have the property of probability distribution functions that $G' > 0$, and for simplicity we will assume that $G''(x) < 0$ for $x > 1$.[6] We can write the probability of becoming an entrepreneur for a given θ as:

$$P(entry) = 1 - G\left(\frac{\max(\theta)}{\min(\theta)}\right). \tag{7}$$

To facilitate the comparative statics exercise, it is assumed that elements in S take either some specific uniform value s or 0. In other words, all ability types that are part of the curriculum are treated similarly (at a given talent level). This assumption drastically simplifies the analysis by, among other things, implying that the order between different types of skills with $s_j = s$ is preserved. Comparative statics are conducted either by increasing s or shifting s_j for some ability type from 0 to s.

2.3 Comparative statics

To simplify the analysis we let $\bar{\theta}^+$ (θ^+) represent the most highly valued talent (ability) in the vector of talents and $\bar{\theta}^-$ (θ^-) the lowest. Moreover, assume that all talents are parts of the curriculum, i.e. that $s_j = s$ for all j. We then have:

$$P(entry) = 1 - G\left(\frac{\theta^+}{\theta^-}\right) = 1 - G\left(\frac{f(\bar{\theta}^+, s)}{f(\bar{\theta}^-, s)}\right). \tag{8}$$

[6] A specific case where this assumption holds is for $G = N(\mu, \sigma)$ with $\mu = 1$.

Differentiating with respect to s yields

$$\begin{aligned}\frac{\partial P}{\partial s} &= -G'\left[\frac{f_S(\bar{\theta}^+, s)}{\theta^-} - \frac{f_S(\bar{\theta}^-, s)\theta^+}{(\theta^-)^2}\right] \\ &= -G'\left[\frac{\theta^+}{\theta^-}\frac{1}{s}\left(f_S(\bar{\theta}^+, s)\frac{s}{\theta^+} - f_S(\bar{\theta}^-, s)\frac{s}{\theta^-}\right)\right] < 0\end{aligned}$$

where the inequality follows from the assumption in (5) and the properties of a probability distribution function. Although a more extensive system yields higher abilities for both high and low talent, the high talent ability is furthered the most. This is an effect of dynamic complementarity. Ability types that are already high when entering schooling are the ones that gain the most. Education thus has the effect of increasing the divergence among different skills and hence the variance in human capital. It is easily realized that this effect is stronger the larger the distance is between θ^- and θ^+; for individuals with a perfectly balanced set of talents, $\theta^- = \theta^+$, the effect on probability of entry is nil. Moreover, a more elitist system, i.e., institutions with a larger inequality in (5), also yields a stronger negative effect on entry.

Proposition 1 *Longer education reduces the probability of entry due to the effect of dynamic complementarity. The effect is increasing in the distance between the highest and the lowest valued talents (and zero if these are equal).*

Corollary 1 *The cross effect of longer education and variance of talents is stronger the more elitist the system is.*

Next, consider the case when $s_j = 0$ for one ability type (now letting $\bar{\theta}^+$ and $\bar{\theta}^-$ denote the highest and lowest abilities for which $s_j = s$). The level of talent for this type of ability is denoted $\bar{\theta}^0$, and the skill level is thus $\theta^0 = \alpha\bar{\theta}^0$. What is the effect of increasing s? The interesting cases are when $\theta^0 < f(\bar{\theta}^-, s)$ or $\theta^0 > f(\bar{\theta}^+, s)$. We then have

$$P(entry) = \begin{cases} 1 - G\left(\frac{f(\bar{\theta}^+,s)}{\theta^0}\right) & \text{if } \theta^0 < f(\bar{\theta}^-, s) \\ \\ 1 - G\left(\frac{\theta^0}{f(\bar{\theta}^-,s)}\right) & \text{if } \theta^0 > f(\bar{\theta}^+, s) \end{cases}$$

and consequently the following effects of an increase in s.

$$\frac{\partial P}{\partial s}=\begin{cases} -G'\left[\frac{f_S(\bar{\theta}^+,s)}{\theta^0}\right] & <0 \quad \text{if } \theta^0<f(\bar{\theta}^-,s) \\ -G'\left[-f_S(\bar{\theta}^-,s)\frac{\theta^0}{(\theta^-)^2}\right] & >0 \quad \text{if } \theta^0>f(\bar{\theta}^+,s) \end{cases}. \tag{9}$$

For the intermediate case where $f(\bar{\theta}^+,s)>\theta^0>f(\bar{\theta}^-,s)$ the probability in eq (8) is not affected by leaving one ability out of the curriculum. Also note that the probability function has kinks where the level of the ability left out equals the high or low ability. *Figure 1* demonstrates the effect for a continuum of values of s and $\theta^0>f(\bar{\theta}^+,0)$. For low $s<s^*$, return to employment and entrepreneurship is determined by θ^0 and θ^-, respectively. Return to employment is therefore constant up to s^*, whereas return to entrepreneurship is increasing. In the region $s^*<s<s^{**}$, proposition 1 holds, and probability of entry decreases. For $s>s^{**}$, the return to entrepreneurship is bounded by θ^0, whereas return to employment increases. The probability of becoming an entrepreneur consequently decreases.

The intuition for the result in (9) is that entrepreneurs gain from complementarity effects when the talent for the ability left out of the curriculum is high. For instance, an individual with high sociability may use this skill as an entrepreneur together with abilities acquired in school.

[Figure1: The effect of education when one ability is excluded from the curriculum]

From (9) we know that the effect of education will be altered if θ^0 either substitutes the highest or the lowest of the abilities that are developed in school. A high θ^0 will tend to substitute the highest talent developed in school, which implies that increasing s has a positive impact on entry into entrepreneurship. To complete the analysis, we must evaluate the effect of a higher θ^0 inside the regions in (9). Hence, we study the cross-derivative:

$$\frac{\partial^2 P}{\partial s \partial \theta^0} = \begin{cases} -G'' \left[\frac{f_S(\bar{\theta}^+,s)}{\theta^0}\right]^2 - G' \left[-\frac{f_S(\bar{\theta}^+,s)}{(\theta^0)^2}\right] & > 0 \quad \text{if } \theta^0 < f(\bar{\theta}^-, s) \\ -G'' \left[-f_S(\bar{\theta}^-, s)\frac{\theta^0}{(\theta^-)^2}\right]^2 - G' \left[-f_S(\bar{\theta}^-, s)\frac{1}{(\theta^-)^2}\right] & > 0 \quad \text{if } \theta^0 > f(\bar{\theta}^+, s) \end{cases} . \tag{10}$$

The positive signs follow from the assumption that $G''(x) < 0$ if the argument x is larger than 1. Since the argument is the maximum over the minimum value, this requirement holds. We summarize the results in the following proposition.

Proposition 2 *Longer education (weakly) increases the probability of entry more the higher the endowment value of an ability excluded from the curriculum.*

Now consider what happens when the ability j for which $s_j = 0$ is moved into the curriculum by setting $s_j = s$. An individual with a high value of $\bar{\theta}_j = \bar{\theta}^0$ was, by proposition 2, the one for whom longer education increased probability of entry the most. It is then intuitive that this individual will see the largest decline in probability of entry following an expansion of the curriculum. An exception is when θ^0 is very low so that $f(\bar{\theta}^0, s) < f(\bar{\theta}^-, s)$. In this case, entry will increase following a regime shift in which $\bar{\theta}^0$ becomes part of the curriculum.

Proposition 3 *A reform that incorporates a new skill type into the curriculum has more negative effects on the probability of entry the higher the level of the previously excluded ability (if the ability type excluded is not the lowest valued talent).*

Proof. See the Appendix. ■

Finally, we note that all effects discussed are cross-effects. We are not able to say anything about the direct effect of a reform (longer education or greater scope of curriculum) since these effects are in general dependent on the initial extent of education (s).

We now turn to the empirical part of this study. A reform in the compulsory schooling system is used to study the effects on entry into entrepreneurship later in life. Using this reform we are able to get results related to proposition 1 and 3.

3 Empirical evidence

3.1 The reform

A reform in the Swedish compulsory education dating back to the 1950s/60s was used to test the theoretical implications. Meghir and Palme (2005) study the effects of the same reform on final educational attainment and earnings; a detailed description of the reform can be found in Meghir and Palme (2003).

Before the reform, basic education in Sweden consisted of two parts: A basic compulsory school (*folkskola*) and a junior secondary school (*realskola*). Junior secondary school was a prerequisite for higher education, and selection into it was based on performance after the sixth year in school. Those who were not selected into junior secondary school continued for one or two more years (depending on municipality) in the basic compulsory school. Those who qualified for junior secondary school spent an additional three years in school before possibly moving on to higher tiers of education. After the reform, all students were educated for nine years in the same system.

The reform of compulsory education was the first step of a comprehensive reform that merged what had previously been three types of secondary schools. The political will was to break social injustices perceived to be created by early selection into tracks with academic or vocational biases (Erikson and Johnsson 1993). The new system was intended to break labor market segregation between academic and vocational occupations by raising the level of education in theoretical subjects among blue-collar workers (Heidenheimer 1978; Husén 1965).

Several changes were implemented in the curriculum concurrent with the reform. Embodied in the new curriculum was a new agenda with a broader and more encompassing notion of education (Dahllöf 1990; Richardson 2004). In particular, the new curriculum gave more room to aesthetics and practical subjects such as woodworking and home economics.

3.2 Presentation of the data

As part of a conscious strategy to calm political opposition, the reform was implemented so as to facilitate evaluation (Heidenheimer 1974). The new comprehensive system was introduced step-wise between 1949 and 1962, and two major evaluations were conducted in 1961 and 1966. On these occasions, samples consisting of about 10 percent of all students belonging to cohorts born in 1948 and 1953 were surveyed (at age 13). The data from these surveys contain detailed information on background variables, grades and test scores for about $20,000$ individuals.

From this survey data, we have information on intelligence test scores, school grades and questions related to the students' spare time activities. The intelligence test includes scores for three dimensions: ability to inductively continue numerical series (inductive ability), to identify the opposite of a given word (linguistic ability) and to recognize versions of figures folded in different ways (spatial ability). By using information about spare time activities, we can construct proxy variables for interest in three dimensions. The first is interest for social activities (sociability). The proxy used is the frequency of interaction with friends in spare time. Based on measures of the frequency of reading books and newspapers, we construct a variable for interest in general knowledge. The third proxy is interest for technical and mechanical activities (mechanical). Finally, we construct a variable for scholastic motivation that reflects grades obtained when controlling away the effect of intelligence.[7]

The available background data include information about the parents' level of educational attainment and their occupations. Using the latter, we constructed a dummy variable indicating whether or not the father was an entrepreneur. Importantly, we also have information about the municipality where an individual attended compulsory schooling.

The theory gives us little guidance as how to define the ability set. To alleviate some concerns about *ad hoc* definitions of ability sets, we will use two different sets of abilities throughout. The narrow set of abilities consists of the three IQ

[7] The model we estimate is: $Grade_i = \alpha + \beta \times IQ_i + \varepsilon_i$. Residuals ε are obtained as proxies for motivation. This is a stylized way of obtaining proxies for motivation where we abstract from the effects from parental influence, school characteristics and other non-cognitive skills. Moreover, the IQ measures are obtained as test scores which are also plausibly affected by motivation.

measures. In addition to these, the broad set includes measures of sociability, interest for general knowledge and scholastic motivation. The variables in each set are first re-scaled from 0 to 100. For each individual, the variance is then obtained as the variance across his values on the skills included in the set. The variable of mechanical interest is used separately in an attempt to capture one skill that was excluded from the curriculum prior to the reform but included in the post-reform system.

The survey data is combined with more recent register data for the years 2001–06. From register data we have access to information on annual wage income and income from self-employment and final educational attainment. Moreover, an indicator allows us to distinguish between unincorporated and incorporated self-employed individuals.[8] An individual is coded as one of the two types of entrepreneurs if she had this occupational status for at least three of the six years covered.

Summary statistics for all variables involved are reported in the Appendix, *Table A1.* In *Table 1*, we present some summary statistics divided into three groups: employees and unincorporated and incorporated entrepreneurs.

[Table 1. Summary statistics by occupational status]

Both types of entrepreneurs have lower final educational attainment levels than employees. This is consistent with lower scholastic motivation at adolescence and a lower interest in general knowledge. Those who became entrepreneurs, on the other hand, scored higher on the intelligence test administered at adolescence.

Whereas having a father who is an entrepreneur increases the likelihood of becoming an incorporated entrepreneur, it appears to have less effect on entry as an unincorporated entrepreneur. Moreover, incorporated entrepreneurs tend to have higher scores on the intelligence tests and score higher on sociability than

[8] The majority of unincorporated businesses are run as sole proprietorship. In contrast to an incorporated business these are not juridical subjects. An individual is categorized as (unincorporated) self-employed if more than half of his income pertains to income from self-employment. Income from self-employment is scaled by a factor 1.6 to allow for underreporting of earnings from self-employment mainly due to tax-evasion motives. On average about 75 percent of total income in the group of (unincorporated) self-employed is income from self-employment.

unincorporated ones. Finally, we note that incorporated as well as unincorporated entrepreneurs tend to have a lower variance than employees in both the narrow and the broad sets of abilities.

Unincorporated self-employed individuals comprise 4.6 percent of the sample and incorporated 4.1 percent.[9] Unincorporated businesses are, from an occupational choice-theory point of view, more problematic than incorporated firms. Most importantly, the latter requires an equity stake, whereas all it takes to start an unincorporated firm is registration at the tax authority. Starting an incorporated firm is therefore likely to be a more elaborate decision. Moreover, many firms are likely to change organizational form to becoming incorporated when they grow. To some extent, this implies that incorporated firms are more successful and therefore arguably run by entrepreneurs who made – from a theory point of view – a correct choice. These concerns, together with the differences shown in *Table 1*, suggest that it is useful to separate the two types in the empirical analysis.

3.3 Methodology and predictions

The sequential implementation of the reform allows for an evaluation that controls for cohort effects. The experiment was largely introduced on a municipality level (at that time, Sweden consisted of about 2,500 municipalities). Some municipalities were assigned to the experiment in 1966, when the second wave of the survey was conducted, but not at the time of the first wave, 1961. This feature of the reform allows for control of municipality-specific effects. The effect of the reform can be identified for individuals within a municipality where the reform status changed from 1961 to 1966. The methodology applied here follows Meghir and Palme (2005) closely: the basic regression model is:[10]

$$\begin{aligned} P(Ent_{idm}) &= \alpha_0 + \alpha_1 SchoolSystem_{idm} + \boldsymbol{\beta}_1 \mathbf{G}(Ability_{idm}) + \\ &\quad \boldsymbol{\beta}_2 SchoolSystem_{idm} \times \mathbf{G}(Ability_{idm}) + \alpha_2 m_i + \alpha_3 d_i + \boldsymbol{\delta} \mathbf{X}_{idm} + \varepsilon_{idm}. \end{aligned}$$

[9] Individuals with no occupational status (i.e. neither self-employed nor wage employed) were dropped from the sample, in order to match the binary occupational choice modelled.

[10] More generally it is in the tradition of Angrist and Kreuger (1991), Harmon and Walker (1995), and Acemoglu and Angrist (2000).

Sub indices i, d and m indicate individual, cohort and municipality, respectively. Coefficients α_0 to α_3 are scalars and $\boldsymbol{\beta}_1$, $\boldsymbol{\beta}_2$ and $\boldsymbol{\delta}$ are vectors of coefficients. $\mathbf{G}(Ability)$ is a vector of functions that depend on different abilities, $SchoolSystem$ is a dummy that indicates whether the individual was assigned to the new comprehensive system, and X is a vector of controls. The outcome variable Ent is a dummy taking value 1 if the individual is an entrepreneur (of either type).

In this empirical design, the treatment group consists of individuals assigned to the new compulsory school system. Who, then, are the affected individuals within this group (Angrist 2004; Oreopoulos 2006)? As described, the new system had two main effects: prescribing longer compulsory time in school and changing the scope of the curriculum. Only individuals who would have quit after seven years (i.e., the ones ending up in the *folkskola*) were impacted by the first effect. The second effect impacted everyone assigned to the new system. Meghir and Palme (2003) report that around 60 percent of a cohort quit after seven (or eight) years before the reform (i.e., approximately 40 percent progressed to the *realskola*). This indicates that it is important to identify the individuals actually affected by spending a longer time in school.

We use two strategies to isolate the treatment effect. First, we note that the educational attainment of the father is a good predictor of which school (*folkskola* or *realskola*) the individual went into prior to the reform (Meghir and Palme 2005; 2003). Second, we follow Oreopoulos (2006) and look at final educational attainment. The argument is that individuals with higher attainment have higher scholastic aptitude and are therefore the most likely to have been assigned to the longer compulsory track (*realskola*) before the reform. To proxy the (counterfactual) assignment, we divide the sample using an indicator for high (above compulsory level) paternal education and high (above upper secondary high school) final educational attainment.[11]

We test propositions 1 and 3.[12] The prediction from proposition 1 is that indi-

[11] Since the average education level has increased, it is reasonable that the educational level that is required for an individual to count as highly educated is higher than for his father. Results are robust to other divisions.

[12] Due to the nature of the reform Proposition 2 is hard to test. Arguably the broader and more encompassing notion of education that was embodied in the new curriculum also had effects on the development of for instance social skills.

viduals with a high variation across talents decrease their probability of becoming entrepreneurs if assigned to the new school system. Proposition 3 predicts that individuals with a high talent for an ability excluded (here: interest for mechanical activities) decrease their probability of being self-employed the most when assigned to the new school system. We expect the first effect to pertain mainly to individuals who either have a low final educational attainment themselves or who have a father with low educational attainment.

3.4 Results

We first test the JAT proposition that low variance across abilities increases the probability of becoming an entrepreneur. *Table 2* shows the results for the variance across the narrow and broad sets of abilities. The first column reports estimates without any control for elements in the ability set. The effects are negative, and estimates are statistically significant at conventional levels, although weakly for the narrow set. An increase of one standard deviation in the variance in the broad (narrow) set implies a decreased probability of entry of 1 (0.4) percentage points. This corresponds to a 12 (5) percent decrease in entry probability.

To control for level effects, the second column for each set includes the sum of the elements in the set. The estimate for the narrow set drops below conventional significance levels, whereas the broad set remains highly significant. In the third column, we include controls for each element of the ability set. The broad index is still significant at the 10 percent level, and a one-unit change in standard deviation changes the probability of entry about 0.6 percentage points.[13]

We also note from *Table 2* that spatial intelligence is a good predictor of becoming an entrepreneur. The effect is strongly significant and a change of one standard deviation implies a change in probability of entry of 1 percentage point.

[Table 2. Testing the JAT-hypothesis on talents in adolescence]

[13]Note that by including the elements of the sets we are including variables that are collinear to the variance measures (which are by construction functions of the elements). This explains some of the reduction in significance levels.

Next, we add the new school system variable. We also include two interaction variables reflecting the interactions between the new school system and the variance across the set of skills and between the new school system and mechanical ability. *Table 3* reports results for the aggregate and for incorporated and unincorporated entrepreneurs separately. Estimates for the narrow and broad sets are reported in separate columns. Note first that the variance measure is not significant in any of the specifications, and neither is the main effect of the new school system.

The first panel reports estimates for the probability of becoming either an unincorporated or an incorporated entrepreneur. The cross effect between the new school system and the variance of the narrow set of abilities is negative and significant in all specifications. The coefficients for the cross effects between educational system and the broad set of abilities are negative but below significance levels when looking at the aggregate of the two types.

Turning to the second panel, we find negative and significant estimates for the cross effect of school system and variance. These results are robust to inclusion of the sum of components in the second column. For the narrow set, the estimates drop below statistical significance levels when including controls for each ability type separately in the third column.[14] The size of the average effects is similar for the narrow and broad sets. We can compare two individuals who only differ in their variance across abilities. One individual has a variance that is one standard deviation higher than the other. If both attended the new school system instead of the old, the one with the higher variation would experience a drop in probability of becoming an entrepreneur of 0.75 percentage points (18 percent) relative to the one with lower variation.

Finally, turning to the unincorporated entrepreneurs, we find little evidence of a cross effect between school system and variation. The estimated coefficients are even positive (but insignificant) for the broad set of abilities. However, the interaction effect between mechanical skills and school system is now negative, and

[14]When controlling for the elements of the sets separately or as a sum, the specification also includes an interaction term between these variables and the school system. This implies that we allow education to have an independent effect on each element (or the sum of them). Again, this means that we are including variables that are collinear to the ones of main interest, which explains part of the reduced significance.

the estimates are statistically significant. Again, compare two individuals with a difference in mechanical skills of one standard deviation. Relative to the one with lower ability, the other one experiences a reduction in probability of entry by 0.95 percentage points (21 percent) when the two attend the new school system instead of the old.

[Table 3. Interaction effect between talents and the school system.]

Next, we split the sample depending on the individuals' own and their fathers' final educational attainment. *Table 4* shows the results for the narrow and broad sets of abilities and the two types of entrepreneurs reported in separate panels.

The two first columns report results for incorporated entrepreneurs. The cross effects for variance and school system show the expected pattern both when the sample is split according to the father's education and the individual's own educational attainment. Those who have a father with low educational attainment or who themselves have themselves low educational attainment are the most likely to experience a large treatment effect from the reform. These are also the individuals for whom the cross-effect between variation and school system is negative and significant. The estimated effects are somewhat larger when the sample is split according to own educational attainment. The largest estimated effect is for the broad set of abilities and individuals with low educational attainment. Again, performing the thought experiment with two individuals distanced one standard deviation apart in variation across skills yields a reduction of 1.75 percentage points (40 percent) in probability of entry.

Turning to the unincorporated entrepreneurs in the two lower panels, we obtain a statistically significant negative cross effect between variation and school system in only one case. This is for the narrow set of abilities when the sample is split according to the father's education. However, when split in the same way, the estimated parameter is positive (but insignificant) for the broad set of abilities. With respect to the unincorporated entrepreneurs, we also see that the negative cross effect between mechanical ability and school system pertains to those who are most likely to be affected. We can also note that the same cross effect tends to be positive for incorporated entrepreneurs in the two upper panels.

[Table 4. Interaction effect between talents and the school system for different treatment groups.]

4 Discussion

This study has approached human capital as a multifaceted phenomenon. It has been argued that not only the level of abilities but also the variance across abilities matters. For an analysis of educational institutions this implies that it is not sufficient to take duration, even if it is quality adjusted, into account. Features such as the scope of curriculum and complementarities with non-cognitive skills must be a part of the analysis.

As highlighted by recent research, the occupational choice between entrepreneurship and employment is one issue where multiplicity of abilities matter. Lazear (2005) is the most recent proponent of the jack-of-all-trades approach to entrepreneurship. The entrepreneur is, in contrast to the employee, pictured as a generalist. As a generalist, the entrepreneur is able to draw on complementarities between skills, but at the same time is vulnerable to weaknesses in his or her set of abilities.

Using a reform in the compulsory education system, we have investigated the interaction between education and occupational choice. Variation across talents was found to significantly affect the probability of entering entrepreneurship. This is consistent with prior empirical work on the JAT hypothesis. When controlling for differences in education, the effects of variation in talents disappear. In a production function approach to human capital formation, this underscores the importance of acknowledging features of educational institutions.

Individuals with a high degree of variation across abilities were found to be less likely to enter (incorporated) entrepreneurship if they were assigned to the new school system. An interpretation suggested by the theory developed here is that the new, more extensive, school system was more efficient in transforming talents into abilities. Under the assumption of dynamic complementarities – i.e., that skill begets skill – this implies a more divergent set of abilities for higher initial variation across talents. This results in a lower probability of becoming a JAT entrepreneur. Empirically, the effect is stronger for those who had a father with low educational attainment or who themselves had low educational attainment. Individuals in this group had the highest probability of quitting school after seven years and hence are most likely to be affected by longer (nine years) compulsory education.

The empirical study also yielded results pertaining to interest in technical and mechanical work. The probability of becoming an entrepreneur is lower for an individual with a high score on interest for mechanical work if that individual attended the new comprehensive school. The new school system was built on a broader curriculum, where practical work (e.g., classes related to mechanical and technical skills) was included. The theory predicts that such reform should decrease entry the most for individuals who are highly talented in skills previously excluded. The intuition is that, prior to the reform, these individuals had the most to gain from complementarities between the skill excluded and the abilities learnt in school. Hence, the theoretical proposition is supported empirically.

A human capital vector of multiple dimensions increases the complexity of the analysis. A major concern is the overlap between different skills, and connected to this, the problem of defining abilities at the same level of abstraction. Theoretically, we simplified the analysis by assuming non-overlapping skills and abstracting from cross effects of developing one skill on other skills.

Empirically, we constructed two sets of talents, each of which arguably covers a broad set of abilities. To some extent this mitigates concerns that the JAT theory rests on the assumption that the same type of abilities is used in employment and entrepreneurship. Since technological as well as organizational constraints are likely to segment the labor market, this is arguably problematic. For instance, services that require practical skills may be more efficiently organized as small-scale businesses, whereas more analytical skills are better coordinated in large organizations.

The broad conclusion that emerges from this study is that educational institutions matter for occupational choice into wage employment or entrepreneurship. Moreover, the result strengthens the case for analyzing the occupational choice decision in a setting where human capital is formed by multiple abilities. In the context of entrepreneurship, this has some policy implications. By acknowledging the multiplicity of human capital, a narrow-minded educational policy could be a system in which attention is paid to each individual's most promising talents. One reason for such a recommendation is that in specialized employment, investment in a broad set of abilities implies a waste of resources. However, if entrepreneurs are jacks-of-all-trades, and if we believe that entrepreneurship (which one could define broadly as creative and innovative economic activities) is important, the policy prescriptions are different. An educational policy with the goal of promoting entrepreneurship would focus on developing skills which are complementary to the ability in which an individual is endowed with the highest talents.

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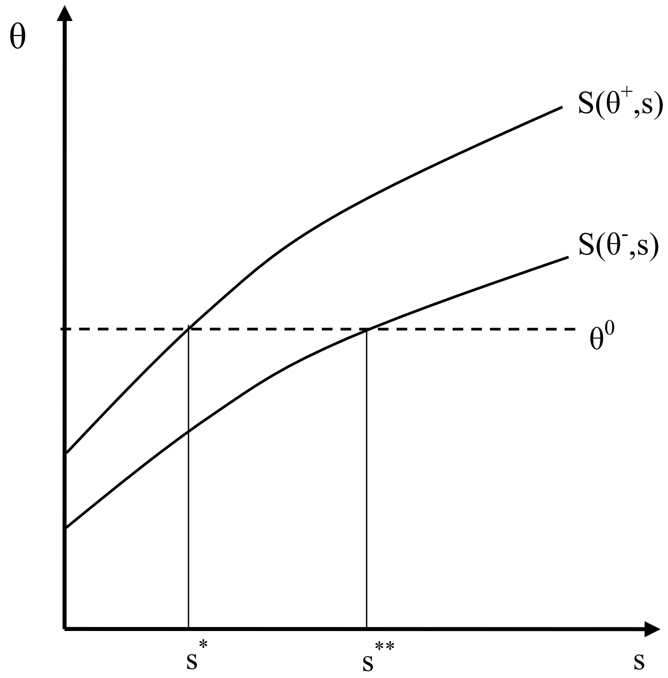

Figure 1. Effects increasing extent of school when one ability is excluded from curriculum.

Table 1
Summary statistics by occupational status

	Employees		Incorporated Entrepreneurs		Unincorporated Entrepreneurs	
Final educational attainment	2.81	1.55	2.53	1.51	2.37	1.50
High father education	0.17		0.19	-	0.17	-
Father entrepreneur	0.06		0.13	-	0.08	-
IQ inductive	49.80	20.09	52.23	18.81	50.43	19.36
IQ spatial	53.58	18.24	57.08	18.31	55.62	17.86
IQ linguistic	57.16	17.44	58.10	15.62	56.44	16.97
Scholastic motivation	46.26	10.68	44.66	10.59	44.94	10.92
Sociability	76.02	27.12	78.66	25.87	73.82	27.62
General knowledge	70.86	25.91	66.50	26.41	67.32	26.88
Mechanical skill	51.06	24.00	61.35	22.26	59.86	24.47
Variance (narrow ability set)	12.44	6.48	12.37	6.42	11.96	6.30
Variance (broad ability set)	22.33	6.14	21.67	5.80	21.63	6.12
Observations	18128		818		912	

Note: Final educational attainment takes values 1–6, where 1 is the lowest attainment (corresponding to the old *folkskola*) and 6 is the highest (PhD degree). Father's education is a dummy taking value 1 if the educational attainment of the father has education above compulsory schooling. Father entrepreneur is a dummy variable taking value 1 if the occupational status of the father (codes 14, 52 and 62–64). The narrow index consists of three IQ measures, and the broad index of the same three IQ measures, a measure of scholastic motivation, general knowledge and sociability.

Table 2

Testing the JAT-hypothesis on talents in adolescence

	Narrow ability set			Broad ability set		
Dependent variable: Entry into self-employment						
Variance	-0.064 (0.037)*	-0.059 (0.037)	-0.037 (0.041)	-0.170 (0.044)***	-0.174 (0.044)***	-0.094 (0.052)*
IQ inductive			0.012 (0.019)			0.028 (0.017)
IQ spatial			0.057 (0.020)***			0.053 (0.020)***
IQ linguistic			-0.031 (0.020)			-0.029 (0.021)
Scholastic motivation						0.003 (0.026)
Sociability						-0.013 (0.011)
General knowledge						-0.027 (0.011)**
Sum of components		0.013 (0.006)**			-0.004 (0.004)	
Observations	14610	14610	14610	13590	13590	13590

Note: Standard errors clustered on home municipality reported. Standard errors are reported in parentheses – *** indicates p-value <0.01, ** p-value<0.05, and * p-value<0.1. Coefficients and standard errors have been scaled by a factor 10^2.

All regressions include a constant term and controls for sex, cohort, mother's and father's education and a dummy taking value 1 if the father was an entrepreneur. The narrow index consists of three IQ measures, and the broad index of the same three IQ measures, a measure of scholastic motivation, general knowledge and sociability.

Table 3
Interaction effect between talents and the school system

	Narrow ability set			Broad ability set		
Dependent variable: Self-employment in incorporated and unincorporated firm						
School system	0.119	-2.236	-2.086	0.138	-4.223	-0.204
	(0.614)	(1.746)	(1.942)	(0.589)	(3.203)	(3.978)
Variance	0.044	0.044	0.084	-0.107	-0.121	0.007
	(0.061)	(0.061)	(0.065)	(0.073)	(0.074)	(0.090)
Mechanical skills	0.050	0.049	0.041	0.055	0.058	0.059
	(0.022)**	(0.022)**	(0.022)*	(0.023)**	(0.023)**	(0.024)**
Variance x School system	-0.170	-0.159	-0.175	-0.065	-0.053	-0.135
	(0.079)**	(0.079)**	(0.085)**	(0.085)	(0.086)	(0.103)
Mechanical skills x School system	-0.010	-0.012	-0.007	-0.013	-0.016	-0.025
	(0.022)	(0.023)	(0.023)	(0.023)	(0.023)	(0.025)
Observations	14262	14262	14262	13274	13274	13274
Dependent variable: Self-employment in incorporated firm						
School system	0.744	-0.927	-0.255	0.541	-1.258	-0.805
	(0.475)	(1.300)	(1.321)	(0.471)	(2.324)	(2.949)
Variance	0.065	0.066	0.076	-0.002	-0.003	0.033
	(0.045)	(0.045)	(0.048)	(0.045)	(0.046)	(0.058)
Mechanical skills	0.006	0.004	0.001	0.015	0.013	0.011
	(0.018)	(0.018)	(0.018)	(0.019)	(0.019)	(0.020)
Variance x School system	-0.128	-0.119	-0.104	-0.127	-0.120	-0.139
	(0.059)**	(0.060)**	(0.066)	(0.059)**	(0.060)**	(0.076)*
Mechanical skills x School system	0.024	0.022	0.025	0.018	0.018	0.020
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.020)
Observations	13481	13481	13481	12549	12549	12549
Dependent variable: Self-employment in un incorporated firm						
School system	-0.508	-1.716	-1.993	-0.541	-3.350	-0.360
	(0.450)	(1.570)	(1.717)	(0.451)	(2.677)	(3.054)
Variance	-0.010	-0.012	0.022	-0.100	-0.117	-0.012
	(0.050)	(0.050)	(0.055)	(0.059)	(0.060)	(0.074)
Mechanical skills	0.054	0.056	0.051	0.053	0.058	0.062
	(0.018)***	(0.019)***	(0.019)***	(0.019)***	(0.020)***	(0.021)***
Variance x School system	-0.052	-0.049	-0.078	0.058	0.065	0.004
	(0.060)	(0.060)	(0.064)	(0.068)	(0.069)	(0.084)
Mechanical skills x School system	-0.038	-0.039	-0.037	-0.037	-0.040	-0.051
	(0.017)**	(0.017)**	(0.017)**	(0.018)**	(0.018)**	(0.019)***
Observations	13539	13539	13539	12593	12593	12593
Control for sum of component	No	Yes	No	No	Yes	No
Controls for components	No	No	Yes	No	No	Yes

Note: Regressions include controls for home municipality and the standard errors clustered on home municipality reported. Standard errors are reported in parentheses – *** indicates p-value <0.01, ** p-value<0.05, and * p-value<0.1. Coefficients and standard errors have been scaled by a factor 10^3.

All regressions include a constant term and controls for sex, cohort, mother's and father's education and a dummy taking value 1 if the father was an entrepreneur. The narrow index consists of three IQ measures, and the broad index of the same three IQ measures, a measure of scholastic motivation, general knowledge and sociability. When controlling for the sum of the index components or the individual components separately, an interaction term with the new school system is also included.

Table 4

Interaction effect between talents and the school system for different treatment groups

	Full sample	Low father education	High father education	Full sample	Low educational attainment	High educational attainment
Dependent variable: Self-employment in incorporated firm. Variance in narrow index						
School system	-0.273	-0.475	-0.391	-0.273	-0.714	-0.128
	(1.290)	(1.453)	(4.456)	(1.290)	(1.762)	(2.836)
Variance x school system	-0.105	-0.139	-0.043	-0.105	-0.154	-0.050
	(0.066)	(0.071)**	(0.153)	(0.066)	(0.085)*	(0.096)
Mechanical skills x school system	0.025	0.037	-0.040	0.025	0.036	-0.007
	(0.019)	(0.019)**	(0.045)	(0.019)	(0.021)*	(0.033)
Observations	13483	11037	2446	13483	8591	4892
Dependent variable: Self-employment in incorporated firm Variance in broad Index						
School system	-1.002	-1.010	-11.630	-1.002	-0.964	-6.843
	(2.915)	(3.315)	(8.415)	(2.916)	(3.983)	(5.663)
Variance x school system	-0.140	-0.176	-0.017	-0.140	-0.285	0.070
	(0.076)*	(0.088)**	(0.145)	(0.091)	(0.108)***	(0.091)
Mechanical skills x school system	0.020	0.025	-0.019	0.020	0.031	-0.006
	(0.020)	(0.021)	(0.050)	(0.020)	(0.024)	(0.031)
Observations	12551	10277	2274	12551	7989	4562
Dependent variable: Self-employment in unincorporated firm Variance in narrow index						
School system	-1.855	-1.515	-3.075	-1.855	-1.739	-2.354
	(1.651)	(1.623)	(5.940)	(1.651)	(2.159)	(2.573)
Variance x school system	-0.077	-0.132	0.119	-0.077	-0.102	0.081
	(0.064)	(0.071)*	(0.156)	(0.064)	(0.086)	(0.094)
Mechanical skills x school system	-0.036	-0.039	0.004	-0.037	-0.064	0.008
	(0.017)**	(0.019)**	(0.039)	(0.017)**	(0.023)***	(0.024)
Observations	13541	11100	2441	13541	8642	4899
Dependent variable: Self-employment in unincorporated firm Variance in broad Index						
School system	0.227	2.246	-9.568	0.237	1.551	-3.270
	(3.055)	(3.366)	(9.555)	(3.055)	(4.239)	(4.718)
Variance x school system	0.003	0.014	-0.055	0.003	-0.029	0.054
	(0.084)	(0.091)	(0.183)	(0.084)	(0.121)	(0.126)
Mechanical skills x school system	-0.050	-0.057	-0.010	-0.050	-0.086	0.020
	(0.019)***	(0.021)***	(0.045)	(0.019)***	(0.025)***	(0.027)
Observations	12595	10327	2268	12595	8029	4566

Note: Regressions include controls for home municipality and the standard errors clustered on home municipality reported. Standard errors are reported in parentheses – *** indicates p-value <0.01, ** p-value<0.05, and * p-value<0.1. Coefficients and standard errors have been scaled by a factor 10^3.

All regressions include a constant term and controls for sex, cohort, mother's and father's education and a dummy taking value 1 if the father was an entrepreneur. In addition to this, the regressions contain controls for the individual parts of the indices and interaction terms between these and the school system. The narrow index consists of three IQ measures, and the broad index of the same three IQ measures, a measure of scholastic motivation, general knowledge and sociability.

APPENDIX

Proof of proposition 3

We have six different cases for a given length of education s. We evalute the change in probability of entry ΔP (difference between after and before θ^0 is included in curriculum) due to the regime shift and the cross-effect with the value of θ^0 inside each region. The following properties and assumptions are used in each case

$$\begin{aligned} G(x_1) &> G(x_2) \text{ if } x_1 > x_2 \\ G'(x_1) &> G'(x_2) \text{ if } 1 < x_1 < x_2 \end{aligned}$$

- Case 1: $f(\bar{\theta}^0, 0) > f(\bar{\theta}^+, s)$ $(> f(\bar{\theta}^+, 0))$ and $f(\bar{\theta}^0, s) > f(\bar{\theta}^+, s)$

$$\begin{aligned} \Delta P &= 1 - G\left(\frac{f(\bar{\theta}^0, s)}{f(\bar{\theta}^-, s)}\right) - \left(1 - G\left(\frac{f(\bar{\theta}^0, 0)}{f(\bar{\theta}^-, s)}\right)\right) < 0 \\ \frac{\partial \Delta P}{\partial \bar{\theta}^0} &= G'\left[\frac{f_\theta(\bar{\theta}^0, 0)}{f(\bar{\theta}^-, s)}\right] - G'\left[\frac{f_\theta(\bar{\theta}^0, s)}{f(\bar{\theta}^-, s)}\right] < 0 \end{aligned}$$

- Case 2: $f(\bar{\theta}^0, 0) \leq f(\bar{\theta}^+, s)$ and $f(\bar{\theta}^0, s) > f(\bar{\theta}^+, s)$

$$\begin{aligned} \Delta P &= 1 - G\left(\frac{f(\bar{\theta}^0, s)}{f(\bar{\theta}^-, s)}\right) - \left(1 - G\left(\frac{f(\bar{\theta}^+, 0)}{f(\bar{\theta}^-, s)}\right)\right) < 0 \\ \frac{\partial \Delta P}{\partial \bar{\theta}^0} &= -G'\left[\frac{f_\theta(\bar{\theta}^0, 0)}{f(\bar{\theta}^-, s)}\right] < 0 \end{aligned}$$

- Case 3: $f(\bar{\theta}^0, 0) > f(\bar{\theta}^-, s)$ and $f(\bar{\theta}^0, s) < f(\bar{\theta}^+, s)$

$$\begin{aligned} \Delta P &= 1 - G\left(\frac{f(\bar{\theta}^+, s)}{f(\bar{\theta}^-, s)}\right) - \left(1 - G\left(\frac{f(\bar{\theta}^+, s)}{f(\bar{\theta}^-, s)}\right)\right) = 0 \\ \frac{\partial \Delta P}{\partial \bar{\theta}^0} &= 0 \end{aligned}$$

- Case 4: $f(\bar{\theta}^0, 0) \leq f(\bar{\theta}^-, s)$ and $f(\bar{\theta}^0, s) > f(\bar{\theta}^-, s)$

$$\begin{aligned} \Delta P &= 1 - G\left(\frac{f(\bar{\theta}^+, s)}{f(\bar{\theta}^-, s)}\right) - \left(1 - G\left(\frac{f(\bar{\theta}^+, s)}{f(\bar{\theta}^0, 0)}\right)\right) > 0 \\ \frac{\partial \Delta P}{\partial \bar{\theta}^0} &= G'\left[-f_\theta(\bar{\theta}^0, 0)\frac{f(\bar{\theta}^+, s)}{\left(f(\bar{\theta}^0, 0)\right)^2}\right] < 0 \end{aligned}$$

- Case 5: $f(\bar{\theta}^0, 0) < f(\bar{\theta}^-, s)$ and $f(\bar{\theta}^0, s) < f(\bar{\theta}^-, s)$

$$\begin{aligned}
\Delta P &= 1 - G\left(\frac{f(\bar{\theta}^+, s)}{f(\bar{\theta}^0, s)}\right) - \left(1 - G\left(\frac{f(\bar{\theta}^+, s)}{f(\bar{\theta}^0, 0)}\right)\right) > 0 \\
\frac{\partial \Delta P}{\partial \bar{\theta}^0} &= G'\left[-f_\theta(\bar{\theta}^0, 0)\frac{f(\bar{\theta}^+, s)}{\left(f(\bar{\theta}^0, 0)\right)^2}\right] - G'\left[-f_\theta(\bar{\theta}^0, s)\frac{f(\bar{\theta}^+, s)}{\left(f(\bar{\theta}^0, s)\right)^2}\right] \\
&> G'\left[\frac{f(\bar{\theta}^+, s)}{\left(f(\bar{\theta}^0, 0)\right)^2}\right] - G'\left[\frac{f(\bar{\theta}^+, s)}{\left(f(\bar{\theta}^0, s)\right)^2}\right] \lesseqgtr 0
\end{aligned}$$

Table A1

Descriptive statistics

	Observations	Mean	Standard deviation
Entrepreneur	19858	0.087	-
Incorporated entrepreneur	19858	0.041	-
Unincorporated entrepreneur	19858	0.046	-
School system	21127	0.572	-
Sex	21127	0.491	-
Father high education	21127	0.174	-
Father entrepreneur	20139	0.072	-
High educational attainment	21127	0.353	-
IQ inductive	19306	56.37	
IQ spatial	19306	53.12	18.47
IQ linguistic	19285	48.73	20.23
Scholastic motivation	18061	45.70	10.74
Sociability	19143	76.01	27.35
General knowledge	19178	70.63	25.97
Mechanical skill	18773	0	23.97
Narrow index	19285	0	6.47
Broad index	17872	0	6.13

Note: Incorporated entrepreneurs are owners of an incorporated firm from which they earn wage income. Unincorporated entrepreneurs is sole proprietorship. An individual is coded as an unincorporated entrepreneur if 1.6 times income from self-employment is the largest source of income.

Father's education is a dummy taking value 1 if the educational attainment of the father has education above compulsory schooling. Father entrepreneur is a dummy variable taking value 1 if the occupational status of the father (codes 14, 52 and 62–64). Final educational attainment takes values 1–6, where 1 is the lowest attainment (corresponding to the old *folkskola*) and 6 is the highest (PhD degree). High educational attainment is a dummy taking value 1 if educational attainment is 4 or above corresponding to education above upper secondary high school).

The narrow index consists of three IQ measures, and the broad index of the same three IQ measures, a measure of scholastic motivation, general knowledge and sociability.

Data for income, occupational status and final educational attainment are register data from the so called LOUISE database. Data on school system, test scores and parental background are from the UGU dataset.