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ABSTRACT

If You Are So Smart, Why Aren't You an Entrepreneur? Returns to Cognitive and Social Ability: Entrepreneurs versus Employees*

How valuable are cognitive and social abilities for entrepreneurs' incomes as compared to employees? We answer three questions: (1) To what extent does a composite measure of ability affect an entrepreneur's earnings relative to employees? (2) Do different cognitive abilities (e.g. math ability, language ability) and social ability affect earnings of entrepreneurs and employees differently?, and (3) Does the balance in these measured ability levels affect an individual's earnings? Our individual fixed-effects estimates of the differential returns to ability for spells in entrepreneurship versus wage employment account for selectivity into entrepreneurial positions as determined by fixed individual characteristics. General ability has a stronger impact on entrepreneurial incomes than on wages. Entrepreneurs and employees benefit from different sets of specific abilities: Language and clerical abilities have a stronger impact on wages, whereas mathematical, social and technical ability affect entrepreneurial incomes more strongly. The balance in the various kinds of ability also generates a higher income, but only for entrepreneurs: This finding supports Lazear's Jack-of-all-Trades theory.

JEL Classification: J23, J24, J31, J44, M13

Keywords: (non-)cognitive abilities, intelligence, earnings, entrepreneur(ship), wage employment, income differentials

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1. Introduction

Starting up and running a business, as any labor market activity, allows an individual to exploit his or her personal characteristics in a particular way. Education, general ability and specific types of ability may all have their value in the complex operations involved in entrepreneurial activities. Many (classic) economists, most notoriously Marshall, have stressed the relevance of general and specific abilities for succeeding as an entrepreneur.[1]

Recently, a literature has revived that measures the effects of cognitive and non-cognitive abilities of individuals on their labor market performance (and other outcome variables).[2] From this literature, it is clear that both cognitive and non-cognitive abilities have a marked effect on labor market performance. However, the evidence is limited to employees, thereby largely ignoring entrepreneurs. There is a separate but less developed literature for entrepreneurs. But seldom the twain have met. Bringing them together is interesting for its own sake, to highlight any differences between distinct but related markets but also of course as a basis for analyzing individuals' choices between entrepreneurship and wage employment. A combined analysis of entrepreneurs and employees enables a comparison of the *relative* value of abilities for the performance of entrepreneurs and employees. The only performance measure available for both groups and thereby allowing such a comparison, albeit with some limitations (Hamilton, 2000), is the individual's income.[3] This paper, therefore, aims at comparing the effects of measured cognitive and non-cognitive abilities on incomes for entrepreneurs versus wage-employees.

In particular, we empirically analyze three questions: (1) To what extent does a composite measure of ability affect incomes for entrepreneurs and salaried employees? (2) Do distinct measures of cognitive abilities (e.g. language ability, mathematical ability, technical ability and administrative ability) and non-cognitive (social) ability affect incomes of entrepreneurs and employees differently?, and (3), inspired by Lazear's Jack-of-all-Trades theory (2005) of entrepreneurship, to what extent does the balance in these measured ability levels affect entrepreneurs' and employees' incomes differently?

To address these novel questions, we incorporate measures of ability into Mincerian income equations using panel data from the National Longitudinal Survey of Youth 1979-2000. This dataset is particularly apt for the task at hand. It includes a number of distinct measures of

[1] Education and ability are usually mentioned in a single breath. The measurement of the returns to education is beyond the scope of this paper, we only focus on abilities. However, as we shall argue, measuring the effect of abilities on incomes requires acknowledging education as a channel for the effect of abilities, and we will do so. Van der Sluis, Van Praag and Van Witteloostuijn (2005) and Van der Sluis and Van Praag (2007) analyze the relative returns to education for entrepreneurs and employees. They show consistently that the returns to education are higher for entrepreneurs than for employees.

[2] See Section 2. Borghans et al. (2008) note that the contrast between cognitive and non-cognitive ability may have intuitive appeal but "creates the potential for much confusion because few aspects of human behavior are devoid of cognition." Nevertheless, the 'contrasting' terms are used widely.

[3] Income is a commonly used performance measure for entrepreneurs, see the meta-analysis by Van der Sluis et al. (2008). The meta-analysis further shows a close correspondence between income and other performance measures for entrepreneurs, such as profit and survival, both in terms of their levels and determinants.

specific abilities administered at early ages (15-23 years old), when they have probably not yet been affected by labor market activities. Moreover, the panel character of the dataset allows estimating the differential returns to abilities in entrepreneurship versus wage employment spells by means of an individual fixed-effects model. Thus, we can account for self-selection based on unobserved individual characteristics that are time-invariant. Finally, survivorship bias is limited thanks to the (bi)annual (panel) data collections about all labor market activities and sources of income in the past period (see Section 3).

However, the dataset also poses some unavoidable challenges. For instance, ability measures administered at different ages and education levels within this age range are incomparable (Heckman et al., 2006). Age affects measured ability, whereas the causality of the relationship between education and measured ability goes both ways: 'schooling causing test scores and test scores causing schooling' (Hansen et al., 2004, p. 40). Therefore, we develop and employ two sets of the measures of ability. Both control for the effect of age at measurement, whereas one does not control for the effect of education at measurement and the other does. The resulting estimates render upper and lower bounds of the returns to true ability, see Section 3. Notably, both sets of ability measures are not exogenous (innate) since they are clearly affected by childhood rearing.

Although we thus believe that our approach has some strengths and certainly has novelty, it is not without limitations. We include few measures of non-cognitive abilities into our analysis.[4] Actually we only use social ability, measured in a particular fashion. Another limitation is that there is no way of ensuring the comparability of the measurement of entrepreneurial and wage incomes (see Fairlie, 2005; Parker, 2004). In this respect, our study is no exception in the empirical literature comparing determinants of entrepreneurial and wage incomes and may be problematic only insofar as the possibly distinct ways of measurement affect the returns to ability. We will return to this issue in detail. Another drawback of our study is that little theory has been developed to guide this empirical analysis measuring the value of abilities for entrepreneurs relative to employees and we do not contribute to a theoretical perspective ourselves.[5] The only exception is the theory developed by Lazear (2005) on the relative value of balanced abilities for entrepreneurs vis-à-vis employees.

The remainder of this article is structured as follows. Section 2 discusses (the measurement of) ability and its previously established –or sometimes just postulated- role for labor market outcomes of wage employees and entrepreneurs. Section 3 discusses the data and how we

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[4] Heckman has recently put a powerful spotlight on non-cognitive abilities (e.g. Heckman et al., 2006). Heckman and his co-authors argue that non-cognitive abilities cannot be ignored when measuring the impact of cognitive abilities.

[5] On the relevance of abilities for economic performance, the most general model is the matching or assignment model, but it does not explicitly distinguish between entrepreneurs and employees (Tinbergen, 1956; Sattinger 1975; Heckman et al, 2006; see the survey in Hartog 2001).

employ them for the analysis. In Section 4 we present the results of the empirical analysis. Section 5 concludes.

2. Abilities

Since the beginning of the measurement of intelligence, the psychological literature has always been divided on the nature of cognitive ability. Alfred Binet, who developed the first instrument to measure differences in child intelligence, assumed that intelligence was essentially unitary, i.e. intelligence is one overriding quality that helps an individual deal with the environment (Binet and Simon, 1911).[6] Thorndike (1904) opposed the idea of one overriding factor; he denied that there was such a thing as general intelligence altogether and acknowledged the existence of specific abilities only. Besides these two extreme view points on the relative roles of general and specific abilities, two early streams acknowledge both. Spearman (1904) concludes that intelligence can be divided into a general factor and specific factors of which one or more have an additional influence on the ability to perform specific activities. Hence, general intelligence is seen as an addition to specific factors of intelligence. Thurstone and Thurstone (1941) and Carrol (1993) represent the second stream by positing that general ability is a (linear) combination of various specific abilities. We take an eclectic approach. Driven by the data, we follow Thurstone and Thurstone (and Carrol) by assuming that general ability is a weighted sum of the individual's scores on specific abilities.

Besides specific cognitive abilities, we analyze the (additional) effect of specific non-cognitive abilites, inspired by a recent stream of research (e.g., Borghans et al., 2008; Heckman and Rubinstein, 2001; Heckman et al., 2006; Mueller and Plug, 2006).

General ability

Economists and psychologists have shown ample evidence that general (cognitive) ability affects economic and social outcomes markedly (e.g., Borghans et al., 2008; Gottfredson, 2002; Heckman et al., 2006; Herrnstein and Murray, 1994;). As noted in the introduction, there is no systematic empirical evidence on the relative role of general ability for the labor market outcomes of entrepreneurs vis-à-vis employees.[7] Even without systematic empirical evidence, classic economists had already put forth that general and specific abilities are required for successful entrepreneurship. Most notably, Marshall claimed, in 1890, that general ability and intelligence 'are required to enable one to attain great success in any pursuit and especially in business'. Marshall defined general ability as:

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[6] This view was later held by Hernstein and Murray (1994).

[7] Van Praag and Cramer (2001) find a significant positive effect of general intelligence on the performance of entrepreneurs (measured by venture size). This study, though, allows no comparison between entrepreneurs and employees. De Wit and Van Winden (1989) estimate an insignificant effect of general intelligence on income for both entrepreneurs and employees. In a related set of studies, we show that the returns to *education* are higher for entrepreneurs than for employees (Van der Sluis et al., 2005; Van Der Sluis and Van Praag, 2007).

To be able to bear in mind many things at a time, to have everything ready when wanted, to act promptly and show resource when anything goes wrong, to accommodate oneself quickly to changes, to be steady and trustworthy, to have always a reserve of force ... Marshall, (1890, 1930, pp. 206–207).

This definition is remarkably similar to the definition of intelligence (or cognitive ability) proposed by an official taskforce of the American Psychological Association: the "ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, to overcome obstacles by taking thought" (Neisser et al. 1996, p. 77 [taken from Borghans et al,, 2008]). We will use our measure of general ability to test Marhall's claim that general ability is required for success, *especially in business.*

Specific abilities

As the assignment literature stresses, jobs are different sets of activities that provide different opportunities for exploiting particular abilities. Setting up and running a business as an entrepreneur forms no exception and will require specific abilities. Among economists, Marshall was the first who stressed the importance of various specialized forms of ability for achieving successful entrepreneurship. Later, the management literature has pursued the idea that certain specific (noncognitive) abilities (e.g. social ability) are relatively important for entrepreneurs as compared to employees (Baron, 2000; Baron and Markman, 2003; Hmieleski and Ensley, 2004). However, little empirical evidence has supported such ideas so far.[8]

From the NLSY79, we extract five specific and distinct abilities, see Section 3: (i) Verbal ability; the knowledge to understand and process written material; (ii) Mathematical ability; the knowledge to perform mathematical calculations and logical thinking; (iii) Technical ability; the ability to understand physical and mechanical principles; (iv) Clerical ability or coding speed; the ability to process information quickly; and, finally (v) Social ability; the ability to form social contacts. The effects of all these abilities have been studied in various contexts (but not in their relative value for entrepreneurs and employees):

To date, the results on *verbal* ability have been ambiguous. Verbal ability is reported to have no value (Paglin and Rufolo, 1990; Dougherty, 2000), a negative impact (Bishop, 1991), and sometimes a positive effect on labor market outcomes (Hause, 1972). Non-linearities may be at play here (Dougherty, 2000; McIntosh and Vignoles, 2001). *Mathematical* ability has received most attention from researchers. The returns to math ability are mostly found to be significantly positive (Taubman and Wales, 1974; Willis and Rosen, 1979; Paglin and Rufolo, 1990; Murnane et al., 1995; McIntosh and Vignoles, 2001). A minority of (some older) studies reports an insignificant or even negative return to math ability (Hause, 1972; Bishop, 1991). Evidence on a

[8] One reason for this is probably the lack of data. Most representative data sets do not include any measures of specific abilities and there are few data sets that include both entrepreneurs and employees as well as comparable measures of their labor market performance.

positive impact of *technical* ability on performance comes from Blackburn and Neumark (1993), but only for employees. *Clerical* ability (coding speed, i.e., the ability to process information quickly) has almost entirely been neglected. Exceptions are Bishop (1991) and Murnane et al., (2001) who used the NLSY79 to find that clerical ability enhances employees' performance. The last type of ability we consider is a non-cognitive one, i.e., *social* ability. As Heckman and Rubinstein (2001) claim: "No single factor has yet emerged to date in the literature on noncognitive skills, and it is unlikely that one will ever be found, given the diversity of traits subsumed under the category of noncognitive skills." We pick social ability as it is receiving increasing attention in entrepreneurship research. Various studies have shown that the ability to disentangle patterns of social relationships and deal with social relationships accordingly have a positive influence on entrepreneurs' performance (Baron, 2000; Wong and Law, 2002; Baron and Markman, 2003).[9] Baron and Markman (2003) suggest that social ability is more important for the performance of entrepreneurs than of employees because entrepreneurs must interact with many different persons inside and outside the firm in environments that are often unstructured and uncertain. They find indeed that social perception, adaptability and expressiveness are important determinants of entrepreneurial performance. Their analysis excludes employees.

Balanced abilities

Recently, Lazear (2005) has developed a theory based on the idea that individuals with a set of balanced competencies across different fields, i.e. 'Jacks-of-All-Trades' (JATs), are more apt for entrepreneurship than those who have unbalanced sets of competencies, i.e. specialists: An employee may work in a specific job needing a specific skill, but entrepreneurs are assumed to need all competencies themselves and they are as strong as the level of their weakest skill.[10] Employees are the pawns in the division of labor, employers organize this division.

Empirical evidence supporting this theory has been provided by Lazear himself (2005), Wagner (2003) and Silva (2007).[11] They find that JATs have a higher probability of becoming an entrepreneur. The measure used for the extent of 'JATness' is based on an individual's schooling curriculum and the number of different job roles individuals have had. Of course, curriculum and job variety may be endogenous to the decision to become an entrepreneur.

We modify Lazear's test in three dimensions. First, we use an alternative measure of JAT. We use the balance in an individual's scores across the five measures of specific abilities, measured at a relatively young age. This measure is probably not influenced by the anticipated decision to become an entrepreneur or by the anticipated relative earnings as such, and thereby does not suffer from endogeneity and unclear causality.[12] Second, we do not focus on the *selection* into

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[9] Hartog (1980) concluded for employees that the standardised price for social ability is lower than for intellectual ability but higher than for manual ability.

[10] Team entrepreneurship is an exception.

[11] Astebro and Thompson (2007) test the theory on inventors and report no support.

[12] Silva (2007)discusses the issue of the source of being a JAT, i.e., 'nature vs. nature'.

entrepreneurship, but rather on the *performance* of entrepreneurs relative to employees. The JAT theory claims that JATs have a comparative advantage over others to become an entrepreneur. A relevant way of testing this is measuring whether being a JAT has a more positive effect on the performance of entrepreneurs than of employees. Third, most of the studies that examine the effect of being a JAT on entrepreneurship focus on only a particular part of the schooling distribution like university -or even top MBA- graduates (Lazear, 2005; Silva, 2007). We study the relationship between being a JAT and performance across the entire schooling distribution.

3. Data and Methodology

Empirical answers to our central questions are obtained by incorporating measures of ability into Mincerian income equations using panel data from the (representative part of) the National Longitudinal Survey of Youth (NLSY) 1979-2000. The nationally representative part of the NLSY consists of 6,111 individuals aged between 14 and 22 years in 1979.[13] They have been interviewed annually up to 1994, and since then on a bi-annual basis. Thus, the maximum number of observations per individual is 19. Within each observed year, our sample selection includes all persons who are entrepreneurs or employees (defined below), while excluding students and people who are unemployed or otherwise not working. Given this selection criterion and omitting missing person-year observations, the resulting sample includes, on average and per annum, 4,500 entrepreneurs/employees, leading to a total number of person-year observations of almost 50,000. Hence the average number of year-observations per individual is 11. In what follows, we first define the key variables, i.e., our measures of ability levels and dispersion, occupational status, and incomes. We present the descriptive statistics of both the key and control variables and discuss the empirical methodology.

Abilities measured

The NLSY contains information on cognitive test scores derived from the Armed Services Vocational Aptitude Battery (ASVAB).[14] All of these have been administered in 1980 at age 15-23. Our analysis of measured abilities uses four of the ten measures of cognitive abilities included in the ASVAB: (i) language ability as measured by 'paragraph comprehension'; (ii) mathematical ability as measured by 'mathematical knowledge'; (iii) technical ability as measured by 'mechanical comprehension'; and (iv) clerical ability as measured by 'coding speed'.[15] Aiming at including a varied set of abilities into the analysis, these four measures have been selected out of the ten

[13] The original NLSY sample consists of 12,686 individuals. From this sample we exclude the supplementary military sample and the supplementary minority sample.

[14] The ASVAB is a test developed by the U.S. Department of Defense in the 1960s and used for recruiting purposes. In 1980 the ASVAB intelligence test was added to the NLSY questionnaire with the purpose of generating a benchmark intelligence measure representative of the total USA population. It correlates strongly with other intelligence tests that are frequently used, such as the Otis-Lennon Mental Ability test and the Lorge-Thorndike Intelligence Test (Frey and Detterman, 2003).

[15] Other measured abilities in the ASVAB are: (v) general science, (vi) arithmetic reasoning, (vii) word knowledge, (viii) numerical operations, (ix) auto and shop information, and (x) electronic information.

available measures such that a reasonable number of measures can be used with minimal correlation levels between each of them. The resulting upper limit on correlation is 0.60 (see Appendix Table A1 for a correlation matrix).

As motivated before, a relevant non-cognitive ability for entrepreneurship that is discussed in the literature is social ability. Since the ASVAB only includes measures of cognitive ability, we use a measure of extravertedness as a six-years old child included in the NLSY, which has been administered in 1980. This leaves us with five specific ability measures in total.

As was discussed in the introduction, ability measures taken at different ages and education levels within this age range are incomparable (Heckman et al., 2006). Age affects measured ability, whereas the causality of the relationship between education and measured ability is joint: 'schooling causing test scores and test scores causing schooling' (Hansen et al., 2004, p. 40). Therefore, we develop two sets of the ability measures. The first set is calculated as the residual when regressing each measure on a set of age dummies in 1980. The second set is formed by the residuals when regressing each measure on a set of age and education dummies in the year 1980 (cf. Blackburn and Neumark, 1993). Both sets of (corrected) ability measures are not exogenous (innate) since they are clearly affected by childhood rearing. But they are unlikely to be affected by future entrepreneurship status or prospects. The correlation levels between these five used measures are shown in Table 1, both without (Panel A) and with (Panel B) correction for education.

A composite score of general ability is constructed from the (corrected) ASVAB sections including social ability by means of factor analysis. Again, two scores are calculated, one based on the first set of corrected ability measures and the other on the second set. Table 1 shows the correlation between these composite measure of general ability and the specific ability measures. The correlation with social ability is low and explains why the results from our analyses remain the same when excluding social ability from the composite measure.[16] The composite score approximates the standard Armed Forces Qualifications Test (AFQT) score that is included in the NLSY. The results obtained in this paper are the same when using that score.[17]

To test Lazear's JAT theory, a measure of the balance in the specific measured ability levels is required. The spread across the five corrected ability scores as measured by the coefficient of variation of the individual scores on the five corrected measures of specific ability will serve as an inverse measure of balance.[18] Unlike Lazear, we do not use the variance as a measure of spread

[16] These results are not shown and can be obtained from the authors.

[17] "The AFQT is a general measure of trainability and a primary criterion of eligibility for service in the armed forces. It has been used extensively as a measure of cognitive skills in the literature" (Heckman et al., 2006, p. 415). The results obtained when replacing our ASVAB based measure of general ability with the AFQT score can be obtained from the authors.

[18] The balance in abilities is possibly also (negatively) affected by an individual's age and education the time of the test. However, based on insignificant correlation coefficients between the measure of spread and respondents' ages and education levels at the time of the test, we assume no correction is required.

since it is a function of the means of the specific ability measures. Table 1 shows indeed that the correlation between the measure of spread and all ability scores is low.

<< Insert Table 1>>

Finally, to facilitate interpretation of the regression coefficients, we have standardized all ability variables (including the coefficient of variation): we subtracted the mean and divided by the standard deviation. Panel A of Table 2 shows the descriptive statistics of the two sets of standardized ability measures, separately for spells in entrepreneurship and paid employment. The different average scores of the two groups will be discussed below where we will set out the empirical methodology, including the issue of selectivity.

<< Insert Table 2>>

Occupational status measured

We define entrepreneurs conventionally as labor market participants whose main occupation is in self-employment or who are owner-director of an incorporated business.[19] As usual, farmers are excluded from the sample of entrepreneurs. Furthermore, in line with common practice (Fairlie, 2005), we exclude 'hobby' entrepreneurs from the sample by using a lower boundary of 300 hours per year worked as an entrepreneur.[20] An employee is defined as a person whose main occupation is a salaried job.

An important feature of the panel is that it includes both entrepreneurial and employee spells for a subset of the individuals who have changed occupational status during the observed period 1979-2000, thus allowing to control for fixed traits of individuals. Moreover, as occupational positions are administered at each interview, also over the past period, all entrepreneurship spells of at least six months are recorded. (However, they are not always counted as such dependent on what the main labor market activity of the respondent was.) Therefore, our subsample of entrepreneurs does not much suffer from survivorship bias as is the case in single cross-section samples: our returns to ability will not pertain to surviving entrepreneurs only. In cross-sections, the likelihood of encountering an individual as entrepreneur is higher, the longer the individual remains an entrepreneur. Hence, the estimated effects for entrepreneurs disproportionately apply to surviving, i.e. successful entrepreneurs.

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[19] This is different from Lazear (2005), who defines entrepreneurs as "founders: among those who initially started the business". Entrepreneurs in our sample are not necessarily founders, they may as well have bought an existing business. We presume that the majority will be founders, however. Parker and Van Praag (2007) distinguish between takeover and new venture start-up. In their Dutch representative dataset of entrepreneurs, 83 percent have started up a firm whereas only 17% acquired their entrepreneurial positions through takeover of a (family) firm.

[20] We tested whether the results in Section 4 are sensitive to increasing this number. We find that the results do not change substantially.

Table 2 shows that we observe 3,000 entrepreneur spells in a total of 50,000 spells. On average, at any moment, six percent of the sample is an entrepreneur.[21] Moreover, 942 individuals are observed in both entrepreneurship and in paid employment spells. Among their 15,749 spells, a quarter has been in entrepreneurship. These numbers will be relevant for the fixed effects analysis, that will effectively use only these 'mixed' observations.

Incomes measured

We measure labor market performance by means of incomes, the only performance measure which is (to some extent) comparable for entrepreneurs and employees; measures like company growth or supervisor ratings cannot be used. Gross hourly income is used as the performance measure for both groups and is constructed as the average annual total earnings (from wage and business income, see Fairlie (2005)), divided by the number of hours worked in that year. The second panel of Table 2 shows the income statistics of entrepreneurs and employees separately. The mean, median and standard deviation of the distribution of hourly incomes are higher for entrepreneurs than for employees, in line with Fairlie (2005).[22]

Parker (2004) documents many reasons limiting the comparability of entrepreneurs' incomes to those of employees. For instance, the self-employed have more opportunity to underreport (tax) income (Levitt and Dubner, 2006, p 237); a failure to deal properly with negative incomes and 'top-coding', ignoring employee fringe benefits that are unavailable for entrepreneurs and the fact that entrepreneurs' incomes may include returns to capital besides returns to labor. For all these reasons, the income levels of entrepreneurs may only be compared with these of employees with great caution.

However, the extent to which all such biases affect the marginal returns to regressors, such as measured ability is probably limited. In an earlier study, Van der Sluis et al. (2005) explicitly evaluate the presence and effect of several of the potential problems of the income measure for entrepreneurs mentioned by Parker (2004) and Fairly (2005). They conclude that, based on the NLSY79, the returns to education for entrepreneurs (relative to employees) are robust under corrections for possible differential underreporting of income, for entrepreneurs erroneously including capital income, for possible risk premiums included in entrepreneurs' incomes and for differences in the incidence of part-time work. Moreover, Van der Sluis and Van Praag (2007), analyze the relative returns to education upon the inclusion and exclusion of negative incomes.

Based on this, we are rather confident about the comparability of regression coefficients pertaining to the main variables of interest, i.e., the ability measures. Any comparison of the income levels of entrepreneurs versus employees will be interpreted with great caution.

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[21] The percentage is below the national average as we study a relatively young cohort (see Fairlie, 2005).

[22] As will become clear when discussing the regression results in Section 4, the income premium for entrepreneurs turns negative when controlling for individual characteristics such as education and abilities, cohort effects, age effects and macroeconomic circumstances. This is a common finding for the US (Parker, 2004).

Control variables

Panel C of Table 2 shows the statistics of the control variables included in the analyses. Schooling is measured as the number of completed years of education (with a topcode of 20 years of schooling). Parental education levels are measured in the same fashion. Furthermore, dummies are included for gender, marital status, geographic location in the US, health conditions and race. Moreover, each income equation includes a set of transformed year, birth year and age dummies according to the method proposed by Deaton (2000).[23] In this manner, the estimates are obtained while controlling for cohort effects, age effects and macroeconomic circumstances.

One more remark about education levels is in order. Education levels are strongly correlated with the corrected test scores, albeit expectedly less so for the second set than for the first set of corrected measures, see Table 1. As was noted, the causality of this relationship might be joint. Therefore, we shall derive all results without and with education controls in the income equations.[24] Hence, four income equations are estimated in all cases: (i) Where the ability measures are corrected for age, but not for education at the time the test was taken and the income equation does not control for the current education level; (ii) Where the ability measures are corrected for age and education at the time the test was taken and the income equation does not control for the current education level; (iii) Where the ability measures are corrected for age, but not for education at the time the test was taken and the income equation controls for the current education level; (iv) Where the ability measures are corrected for age and education at the time the test was taken and the income equation does control for the current education level. Under (i) we will obtain overestimates of the true effects of ability, whereas under (iv) we will obtain underestimates.

Empirical methodology

To estimate the returns to general ability, specific abilities and ability spread for entrepreneurs relative to employees, we first estimate income equations by means of a random effects (RE) model. In the baseline specification, the dependent variable is the log of hourly income, as defined above, whereas the independent variables are the ability measures, occupational status and the control variables discussed. The second specification includes the same variables and controls but adds interacted variables of the occupational status dummy and the ability measures. The coefficient pertaining to the interaction between measured ability and occupational status will be of prime interest as it indicates the differential return to the various measures of ability for entrepreneurs vis-à-vis employees. The measure of general ability and the measures of specific

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[23] This method transforms the year dummies, age dummies and birth year dummies so that the year effects add to zero, and are orthogonal to a time trend.

[24] Although schooling is generally recognized to be endogenous in an earnings equation we do not attempt any correction as in this paper we are not interested in the returns to education per se. In Van der Sluis et al. (2007), education is instrumented using the same data to establish that the returns to education are higher for entrepreneurs than for employees.

abilities are not included simultaneously into one equation, since general ability is a linear combination of the specific abilities. Ability measures are just entered linearly, for practical reasons.[25]

A potential problem when estimating these specifications is that the choice between entrepreneurship and salaried employment might be endogenous. Individuals might decide to become entrepreneurs because their ability and some of their unobserved characteristics have higher value as an entrepreneur than as an employee. Table 2 shows indeed that some of the ability measures have different average values for entrepreneurs than for employees. Moreover, Table A2 in the Appendix shows the determinants of occupational choice in a probit framework, including the control variables discussed. The first panel shows the estimates from a random effects probit model. The second panel shows the estimates from a probit model where the dependent variable is a dummy variable equal to 1 if an individual has ever been an entrepreneur and 0 if not.[26] General, language and clerical ability have no effect on occupational choice, technical and social ability have a positive effect on the choice for entrepreneurship and mathematical ability a negative effect. This is only partially in line with the relative returns we estimate below.

To address the issue of selectivity, the second specification is also estimated by means of an individual fixed effects model.[27] This controls for unobserved individual characteristics that do not change over time, without imposing zero correlation between the individual effect and the other explanatory variables. It eliminates the bias originating in permanent disposition, inclination and aptness for entrepreneurial activity. It will not eliminate bias from favorable unobservable circumstances that stimulate an individual to seize an opportunity at a particular point in time.

4. Results

In this section, we first present the results from estimating income equations where the only ability measure included is general ability (Table 3). Next, general ability is replaced by the five specific ability measures (Table 4). Then, we show the estimates for the returns to an individual's spread in abilities, where the levels of general ability and the five specific abilities are included respectively as additional controls (Table 5). All of these specifications have been estimated without distinguishing between entrepreneurs and employees (Panel A), with a distinction between the two in a random effects model (Panel B) and a fixed effects model (Panel C). All

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[25] In an earlier version of this paper, we experimented with non-linearities and interactions, but we saw insufficient gain above the linear specification, whereas the interpretation of results became cumbersome. Heckman et al. (2006) estimate linear earnings functions for given education levels and impose linear separability of cognitive and non-cognitive ability across occupations.

[26] Time varying covariates have been omitted from this last specification.

[27] Obviously, the ability measures as stand alone variables are omitted from this third specification; they do not vary over time as they have been obtained in 1980 only. The model is identified because we only estimate the *difference* in returns to ability between entrepreneurial and employee status. There are 942 individuals who are observed to change status at least once.

panels include four columns that differ with respect to whether current education is included as a control variable and whether the ability measures are purged from the effect of education at the test. When estimating the effect of ability spread, a total number of eight columns results (four columns where general ability is included as a control and four columns where the specific abilities are included as controls).

Returns to general ability

Table 3 presents the estimation results for the income equation confined to the effect of general abilty. Equation IV shows that hourly income goes up by 11% with an increase of general ability by one standard deviation. If we would not control for education, in the income regression nor in measured ability, the effect would be almost 20%. The second panel shows that the return to general ability is 30% higher for entrepreneurs than for employee. Comparing the four columns in this panel shows that measured additional returns are barely sensitive to the corrections for education. Including education in the income regression has a small negative effect on the additional returns to ability as an entrepreneur, as part of the ability effect is taken over by the schooling effect.[28] The third panel shows that our results are not biased by unobserved permanent individual factors: the fixed effects estimates tell the same tale. Thus we find clear support for Marshall's claim that general ability, while obviously relevant for economic success, is particularly relevant for entrepreneurs.

<< Insert Table 3>>

Figure 1 shows suggestive evidence about the implications of the different returns between employee and entrepreneurial status for their resulting income levels based on the four sets of estimates presented in Panel C (fixed effects).[29] The figure shows the percentage (points) premium earned as an entrepreneur versus a wage employee (on the vertical axis), dependent on where a person is located on the distribution of general ability measured in standard deviations (horizontal axis, where '0' comes down to the average level of general ability). It should be noted here that, on average and ceteris paribus, entrepreneurs earn nine to 11 percent lower incomes than employees (see also Hamilton, 2000), i.e., the coefficient pertaining to occupational status varies from a significant -0.09 to -0.11 in the equations. Thus the premium earned in entrepreneurship vis-à-vis wage employment is negative for average values of the regressors.

The differences between the lines are very small and they all bring out the same message: The returns to general ability are higher for entrepreneurs than for employees (indicated by the

[28] The interacted effect of education and entrepreneur status is positive and significant in all income equations (not shown). This is consistent with earlier findings that the returns to education are higher for entrepreneurs than for employees (Van der Sluis et al., 2007; Van der Sluis et al., 2008). However, as was noted, in this case, education has been entered into the equations as such, without using any kind of instrumentation.

[29] The discussion in Section 3 about the limited comparability of income levels for entrepreneurs and employees motivates why we refer to 'suggestive evidence'.

positive slope), whereas this leads to higher incomes as an entrepreneur than as an employee for the top of the ability distribution only. The minimum level of general ability at which earnings are higher for entrepreneurs than for employees is between 1.74 and 1.92 standard deviations above the mean. This implies that earnings are higher as an entrepreneur than as an employee for the upper 7.8% and 7.3% of the distribution of general ability, respectively.

<< Insert Figure 1>>

Returns to specific abilities

Table 4 shows the results for the returns to specific abilities. The structure of the table is similar to Table 3. For the pooled data, ignoring possibly differential returns, language ability does not pay off, technical ability is barely significant, and the other three abilities significantly boost earnings. Mathematical ability pays most, a common finding in the literature. An extra standard devation raises earnings by 6 %. As before, estimated coefficients are sensitive to controlling for education. The results generally fit in with the literature. Insignificance for language ability conforms to the ambiguous results we found in our survey (Section 2), whereas strong positive effects for mathematical ability are a common result.

Considering differential returns by occupational status (panel B), we see a substantial positive effect of technical ability in entrepreneurial status and a substantial positive effect of clerical abilty in employee status. Social ability has higher returns when entrepreneur, language ability pays better when employee. The former result corroborates the anticipation formulated in Section 2, although the effect is not large. The differences are barely affected by controls for education and are robust when applying a fixed effects estimation (Panel C). With earnings differences up to 10% for a standard deviation difference in technical or clerical abilty, these effects are economically not negligible.[30]

<< Insert Table 4>>

Figure 2 shows (again suggestive evidence about) the earnings advantage in entrepreneurial status for the three abilities that affect entrepreneurial incomes relative to employee incomes positively.[31] The lines within the figures only differ visibly for technical ability, but they all bring again the same message as before: To realize an earnings gain from entrepreneurial status seems

[30] One might suspect that the (differences in) returns to specific abilities are related to differences in earnings across industries. This turned out not to be the case. We added 12 industry dummies to our regression equations, but this did not affect our results. While industry effects were substantial (some 50% difference between the highest and the lowest paying industry), signs and significance levels of the parameters of interest were unaffected and the effects on magnitudes of coefficients were very small.

[31] Please note that upon variation in the levels of the other measured abilities, i.e., clerical and language ability, the incomes pertaining to spells in entrepreneurship can never attain higher levels than in employment spells: This is due to the combination of a negative coefficient of the occupational position of entrepreneur (the intercept in the figures) and the negative coefficient of the relative return to these abilities in entrepreneurship (the slope in the figures).

to require top levels of abilities. The only exception is technical ability: The threshold is between 1.04 and 1.43 standard deviations, corresponding to the upper 18.6-29.6% of the technical ability distribution. For mathematical and social ability, only individuals positioned in the very top of the distribution are financially better off as entrepreneurs. Earnings are higher as an entrepreneur than as an employee for the upper 3.9% of the distribution of math ability and for the upper 3.4% of the social ability distribution.

Returns to being a Jack-of-all-Trades

Table 5 shows the results from testing the Jack-of-all-Trades theory of entrepreneurship (Lazear, 2005). As Panel A indicates, an individual's spread in measured ability levels is irrelevant for earnings if we do not distinguish between employee and entrepreneur status, irrespective of the inclusion of controls for education or ability levels into the equation.

The second panel is partly supportive of the Jack-of-all-Trades hypothesis. While earnings as an employee are unaffected by ability dispersion, the impact for entrepreneurs is significant and negative, thereby supporting the positive effect of being a Jack-of-all-Trades. An increase by a standard deviation of variability reduces eannings in entrepreneurial status by 3 %. This estimate is also independent of controls for education and abilities. Once again the results are not biased by permanent unobserved personal effects; the fixed-effects estimate (Panel C) is virtually identical to the random-effects estimate (Panel C).

<< Insert Table 5>>

Lazear's theory predicts that entrepreneurs benefit from being Jacks-of-all-Trades, whereas employees would benefit from being specialists. We find significant support for the first prediction. Lazear's theory, therefore, does not only hold when analyzing the choice for entrepreneurship (Lazear, 2005; Silva, 2007; Wagner, 2003), but also when analyzing returns. The latter might even be a more direct way of establishing that Jacks-of-all-Trades have the comparative advantage in entrepreneurship that Lazear's theory predicts. Furthermore, Lazear's own empirical analysis does not make a clear distinction between the effect of endowed ability dispersion and ability dispersion generated by investment (in schooling and labor market positions). Our results indicate that being a Jack-of-all-Trades by endowment (due to innate abilities and childhood rearing) affects one's income when being an entrepreneur, but not when being an employee. This result is supportive of Silva (2007). He establishes that endowments play a role, whereas investments do not (although our study does not test the effect of investing in being a Jack-of-all-Trades).

Figure 3 shows that once again, the earnings advantage as an entrepreneur only holds for the top of the distribution: Earnings are higher as an entrepreneur than as an employee for the upper 4.0 to 4.5% of the distribution of ability dispersion.

5. Conclusion

On average, ten percent of the labor force in any developed country are entrepreneurs, i.e., business owners (either self-employed or owner-managers of incorporated businesses, see Parker, 2004). Moreover, successful entrepreneurship has a profound effect on economic growth, labor demand, and innovation (see the survey by Van Praag and Versloot, 2008). Therefore, knowledge about the determinants of entrepreneurs' performance is relevant.

In Van der Sluis, Van Praag and Van Witteloostuijn (2005) and Van der Sluis and Van Praag (2007) we analyzed the relative returns to education for entrepreneurs and employees employing methods to deal with the endogenous nature of education (in an income equation) and self-selection of individuals into entrepreneurship versus wage employment. These studies show consistently that the returns to education are higher for entrepreneurs than for employees.

In this paper, we extend the search for determinants of successful entrepreneurship to cognitive and non-cognitive abilities. Our results indicate strongly that general ability pays off better in entrepreneurship. The same individual has a 30% higher return to general ability when active as an entrepreneur than when working as an employee. Nevertheless, the resulting earnings are higher as an entrepreneur than as an employee only for the upper echelon of the general ability distribution. This suggests that, if the choice for entrepreneurship hinges on expected earnings, only the smartest people become entrepreneurs. However, as indicated by the results in Table A2 of the Appendix, general ability is not a factor that affects people's occupational choice. In fact, there is some negative effect of general ability but it is not significant.

Since the measure of general ability is a weighted average of measured specific abilities, it is interesting to assess which specific measures of ability render the returns in an entrepreneurial spell higher than in a spell in wage employment. As it turns out, it is, in particular, the science-oriented part of the set of abilities that generates higher returns. Especially technical and, to a lesser extent, mathematical ability are more lucrative in entrepreneurship than in wage employment. One standard deviation increase in technical ability pays 12% more when active as an entrepreneur. In addition, social ability benefits entrepreneurial incomes more than wages. The other measured abilities, i.e., language ability and, in particular, clerical ability pay off better as an employee: Increasing one's measured level of clerical ability by one standard deviation increases the income premium in wage employment relative to entrepreneurship by 8 to 10%. The differential returns to measured specific abilities do not reflect industry effects.

These results suggest that, again if occupational choices are based on expected earnings differentials, people with high levels of math, technical and social abilities become entrepreneurs, whereas people with relatively high levels of clerical and language abilities become wage employees. The indicated effects of measured specific abilities on occupational choice are partly borne out by the data. Table A2 in the Appendix shows that, indeed, higher measured levels of social and technical ability favor the choice for entrepreneurship. However, higher levels of mathematical ability do not favor the choice for entrepreneurship (on the contrary), and clerical and language ability have no effect on occupational choice.

The third analysis in this paper assesses the validity of Lazear's Jack-of-all-Trades theory. In support of this, we find that more dispersion in individual ability levels hurts earnings as an entrepreneur. However, it leaves earnings as an employee unaffected. Table A2 shows that people's occupational choices are not affected by this JAT characteristic.

Our results are generally quite robust. All our conclusions are insensitive to including or excluding education in the regression equation or in the correction of ability scores. Furthermore, all our conclusions are unaffected if we estimate an individual fixed-effects model rather than a random effects model. The fixed-effects model can be estimated only for the differential returns to ability for entrepreneurship spells vis-à-vis wage employment spells, since our ability measures are time-invariant.

Some limitations pertain to our study. As the earnings intercept for entrepreneurial status is negative, we concluded that higher returns to ability only lead to higher hourly earnings as an entrepreneur if that characteristic surpasses quite high threshold values. This conclusion is only valid if two underlying assumptions hold. First, that the relationships between earnings and measured ability levels and dispersion are linear and second, that the income measures for employees and entrepreneurs are comparable in absolute levels. The first assumption seems to hold. When we include abilities into the equations in quadratic form, their coefficients are almost all insignificant (available from the authors) and the conclusions are not upset. However, there is little proof of the validity of the second assumption (although researchers commonly assume this comparability). Therefore, we interpret the results based on comparisons of income *levels* with great caution.

Assuming that the social benefits of successful entrepreneurship are at least as high as the social benefits of successful wage employees (Van Praag and Versloot, 2008), considering that spells in entrepreneurship give higher levels of job satisfaction than spells in wage employment (Benz and Frey, 2003), given incomes, and considering that the returns to education are higher for entrepreneurs than for employees (Van der Sluis et al., 2005; Van der Sluis and Van Praag, 2007), our results suggest underemployment in entrepreneurship. The elite of the workforce, especially in terms of science oriented and social abilities (and education), should, ceteris paribus, be stimulated to become entrepreneurs. Given the estimated choice equations in the Appendix, this is not yet common knowledge or practice.

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Table 1: Correlations between the used measures for general ability, specific abilities, spread in abilities and education

Panel A Ability measures without controls for education level at the time of the test (1980)								
Correlation coefficients	**1.**	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**
1. General ability	1.000							
2. Language ability	0.856	1.000						
3. Math ability	0.861	0.664	1.000					
4. Technical ability	0.748	0.554	0.607	1.000				
5. Clerical ability	0.683	0.559	0.523	0.336	1.000			
6. Social ability	0.154	0.086	0.064	0.052	0.057	1.000		
7. Spread in abilities	0.022	0.021	0.004	0.021	0.028	0.002	1.000	
8. Education	0.582	0.487	0.616	0.349	0.382	0.085	0.000	1.000
Panel B Ability measures with controls for education level at the time of the test (1980)								
Correlation coefficients	**1.**	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**
1. General ability	1.000							
2. Language ability	0.839	1.000						
3. Math ability	0.857	0.643	1.000					
4. Technical ability	0.702	0.494	0.557	1.000				
5. Clerical ability	0.633	0.506	0.487	0.235	1.000			
6. Social ability	0.151	0.081	0.056	0.053	0.047	1.000		
7. Spread in abilities	0.016	-0.001	0.016	0.011	0.035	-0.041	1.000	
8. Education	0.420	0.331	0.470	0.267	0.212	0.084	0.005	1.000

The correlation levels have been calculated while using one year of observations.

Table 2: Descriptive statistics of the key and control variables by occupational status

Panel A Standardized and corrected ability measures								
	Ability measures without education controls				**Ability measures with education controls**			
	Entr=1 (n=3,052)		**Entr=0 (n=46,713)**		**Entr=1 (n=3,026)**		**Entr=0 (n=46,272)**	
	Mean	**Std Dev**	**Mean**	**Std Dev**	**Mean**	**Std Dev**	**Mean**	**Std Dev**
1. General ability	.0665	.9595	-.0043	1.0024	.0385	.9447	-.0025	1.0034
2. Language ability	-.0024	.9994	.0002	1.0001	-.0241	.9983	.0016	1.0001
3. Math ability	-.0268	.9902	.0018	1.0006	-.0533	.9546	.0035	1.0028
4. Technical ability	.2241	.9914	-.0146	.9988	.2025	.9789	-.0132	.9999
5. Clerical ability	-.0358	.9429	.0023	1.0036	-.0519	.9420	.0034	1.0036
6. Social ability	.1174	.9991	-.0077	.9996	.1192	1.0006	-.0078	.9995
7. Spread in abilities	-.0049	.8007	.0003	1.01166	-.0226	1.0405	.0015	.9973
Panel B Income measures								
	Entr=1 (n=3,025)		**Entr=0 (n=46,272)**		**Entr=1 (n=3,025)**		**Entr=0 (n=46,272)**	
	Mean	**Std Dev**	**Mean**	**Std Dev**	**Median**		**Median**	
1. Hourly income	14.6580	29.7422	10.4819	15.6709	9.61		8.07	
2. Log(hourly income)	2.1651	1.0135	2.1092	.6458	2.2628		2.0882	
Panel C Control variables								
	Entr=1 (n=3,026)		**Entr=0 (n=46,272)**					
	Mean	**Std Dev**	**Mean**	**Std Dev**				
1. Education (in years)	13.1261	2.4355	13.0714	2.3369				
2. Education father (in years)	12.3249	3.2070	11.8252	3.3421				
3. Education mother (in years)	12.1226	2.2579	11.7020	2.4358				
4. Male (dummy)	.6342		.5090					
5. Married (dummy)	.6395		.5144					
6. Live in the South of the US (dummy)	.2637		.3143					
7. Live outside big city (SMSA) (dummy)	.2217		.2318					
8. Limited health condition (dummy)	.0324		.0238					
9. Hispanic (dummy)	.0278		.0434					
10. Black (dummy)	.0377		.0937					

Table 3: The effect of general ability on income

Panel A Base line model (GLS-Random Effects)				
	I.	II.	III.	IV.
General Ability	0.1935 (.0068)***	0.1572 (.0069)***	0.1314 (.0074)***	0.1095 (.0069)***
Ability regr include education controls	No	Yes	No	Yes
Income regr includes education controls	No	No	Yes	Yes
R-sq overall	.4362	.4212	.4489	.4458
# Observations	49,764	49,297	49,764	49,297
# Individuals	4,472	4,423	4,472	4,423
Panel B Distinguishing entrepreneurs (GLS-Random Effects)				
General Ability	0.1911 (.0068)***	0.1546 (.0070)***	0.1300 (.0074)***	0.1076 (.0069)***
General Ability*Entrepreneur	0.0359 (.0100)***	0.0416 (.0101)***	0.0236 (.0120)**	0.0330 (.0106)***
Ability regr include education controls	No	Yes	No	Yes
Income regr includes education controls	No	No	Yes	Yes
R-sq overall	.4360	.4211	.4487	.4457
# Observations	49,764	49,297	49,764	49,297
# Individuals	4,472	4,423	4,472	4,423
Panel C Distinguishing entrepreneurial spells (Fixed Effects)				
General Ability*Entrepreneur	0.0432 (.0104)***	0.0458 (.0105)***	0.0282 (.0125)**	0.0347 (.0110)***
Ability regr include education controls	No	Yes	No	Yes
Income regr includes education controls	No	No	Yes	Yes
R-sq overall	.3027	.3027	.3512	.3516
# Observations	49,764	49,297	49,764	49,297
# Individuals	4,472	4,423	4,472	4,423

Significance levels: * 10%; ** 5%; *** 1%. All regressions include the control variables discussed in Section 3, see also Table 2.

Table 4: The effect of specific abilities on income

Panel A Base line model (GLS-Random Effects)				
Language ability	0.0310 (.0083)***	0.0135 (.0080)*	0.0175 (.0081)**	0.0094 (.0076)
Math ability	0.1170 (.0079)***	0.1098 (.0078)***	0.0688 (.0081)***	0.0611 (.0077)***
Technical ability	0.0081 (.0080)	0.0129 (.0079)	0.0126 (.0078)	0.0146 (.0075)*
Clerical ability	0.0525 (.0070)***	0.0391 (.0070)***	0.0451 (.0068)***	0.0402 (.0066)***
Social ability	0.0181 (.0053)***	0.0179 (.0054)***	0.0168 (.0051)***	0.0161 (.0052)***
Ability regr include education controls	No	Yes	No	Yes
Income regr includes education controls	No	No	Yes	Yes
R-sq overall	.4364	.4231	.4486	.4459
# Observations	49,764	49,297	49,764	49,297
# Individuals	4,472	4,423	4,472	4,423
Panel B Distinguishing entrepreneurs (GLS-Random Effects)				
Language ability	0.0335 (.0083)***	0.0154 (.0081)*	0.0203 (.0081)**	0.0114 (.0077)
Math ability	0.1150 (.0079)***	0.1081 (.0078)***	0.0683 (.0081)***	0.0602 (.0078)***
Technical ability	-0.0001 (.0080)	0.0057 (.0080)	0.0043 (.0078)	0.0072 (.0076)
Clerical ability	0.0586 (.0070)***	0.0442 (.0070)***	0.0514 (.0068)***	0.0452 (.0067)***
Social ability	0.0163 (.0053)***	0.0162 (.0055)***	0.0150 (.0052)***	0.0144 (.0052)***
Language ability*Entrepreneur	-0.0341 (.0137)**	-0.0260 (.0131)**	-0.0375 (.0137)***	-0.0250 (.0131)*
Math ability*Entrepreneur	0.0389 (.0138)***	0.0332 (.0136)***	0.0100 (.0155)	0.0203 (.0145)
Technical ability*Entrepreneur	0.1147 (.0119)***	0.1056 (.0116)***	0.1205 (.0119)***	0.1072 (.0116)***
Clerical ability*Entrepreneur	-0.1051 (.0125)***	-0.0850 (.0119)***	-0.1081 (.0124)***	-0.0840 (.0119)***
Social ability*Entrepreneur	0.0318 (.0092)***	0.0278 (.0093)***	0.0311 (.0092)***	0.0270 (.0092)***
Ability regr include education controls	No	Yes	No	Yes
Income regr includes education controls	No	No	Yes	Yes
R-sq overall	.4379	.4244	.4501	.4471
# Observations	49,764	49,297	49,764	49,297
# Individuals	4,472	4,423	4,472	4,423
Panel C Distinguishing entrepreneurial spells (Fixed Effects)				
Language ability*Entrepreneur	-0.0414 (.0143)***	-0.0333 (.0137)**	-0.0468 (.0144)***	-0.0342 (.0137)**
Math ability*Entrepreneur	0.0474 (.0143)***	0.0388 (.0142)***	0.0188 (.0162)	0.0257 (.0151)*
Technical ability*Entrepreneur	0.1232 (.0124)***	0.1137 (.0121)***	0.1290 (.0125)***	0.1156 (.0121)***
Clerical ability*Entrepreneur	-0.1036 (.0130)***	-0.0841 (.0124)***	-0.1067 (.0130)***	-0.0832 (.0124)***
Social ability*Entrepreneur Ability regr include education controls	0.0287 (.0096)*** No	0.0254 (.0096)*** Yes	0.0279 (.0096)*** No	0.0243 (.0096)** Yes
Income regr includes education controls	No	No	Yes	No
R-sq overall	.3059	.3058	.3550	.3552
# Observations	49,764	49,297	49,764	49,297
# Individuals	4,472	4,423	4,472	4,423

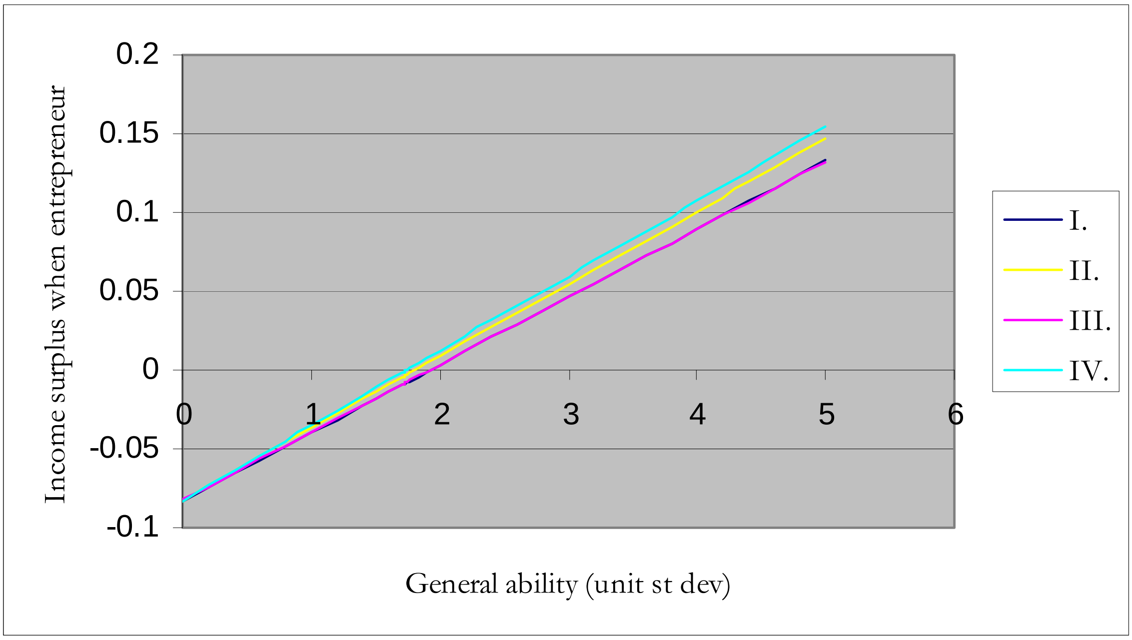
Significance levels: * 10%; ** 5%; *** 1%. All regressions include the control variables discussed in Section 3, see also Table 2.

Table 5: The effect of individual variation in abilities on income

Panel A Base line model (GLS-Random Effects)								
Variation in Abilities Measure	0.0014 (.0048)	-0.0009 (.0056)	0.0015 (.0046)	0.0011 (.0053)	0.0021 (.0048)	0.0001 (.0056)	0.0019 (.0046)	0.0014 (.0053)
Ability regr include education controls	No	Yes	No	Yes	No	Yes	No	Yes
Income regr includes education controls	No	No	Yes	Yes	No	No	Yes	Yes
Income regr controls for general ability	Yes	Yes	Yes	Yes	No	No	No	No
Income regr controls for specific abilities	No	No	No	No	Yes	Yes	Yes	Yes
R-sq overall	.4362	.4212	.4489	.4459	.4364	.4231	.4486	.4459
# Observations	49,764	49,297	49,764	49,297	49,764	49,297	49,764	49,297
# Individuals	4,472	4,423	4,472	4,423	4,472	4,423	4,472	4,423
Panel B Distinguishing entrepreneurs (GLS-Random Effects)								
Variation in Abilities Measure	0.0025 (.0048)	0.0006 (.0056)	0.0026 (.0046)	.00247 (.0053)	0.0030 (.0048)	0.0012 (.0056)	0.0028 (.0046)	0.0024 (.0053)
Variation in Abilities*Entrepreneur	-0.0296 (.0086)***	-0.0252 (.0088)***	-0.0287 (.0086)***	-0.0239 (.0088)***	-0.0227 (.0086)***	-0.0286 (.0088)***	-0.0213 (.0086)**	-0.0274 (.0088)***
Ability regr include education controls	No	Yes	No	Yes	No	Yes	No	Yes
Income regr includes education controls	No	No	Yes	Yes	No	No	Yes	Yes
Income regr controls for general ability	Yes	Yes	Yes	Yes	No	No	No	No
Income regr controls for specific abilities	No	No	No	No	Yes	Yes	Yes	Yes
R-sq overall	.4361	.4212	.4488	.4458	.4380	.4245	.4502	.4473
# Observations	49,764	49,297	49,764	49,297	49,764	49,297	49,764	49,297
# Individuals	4,472	4,423	4,472	4,423	4,472	4,423	4,472	4,423
Panel C Distinguishing entrepreneurial spells (Fixed Effects)								
Variation in Abilities*Entrepreneur	-0.0297 (.0086)***	-0.0221 (.0089)**	-0.0291 (.0086)***	-0.0208 (.0089)**	-0.0226 (.0086)***	-0.0259 (.0090)***	-0.0213 (.0086)**	-0.0246 (.0090)***
Ability regr include education controls	No	Yes	No	Yes	No	Yes	No	Yes
Income regr includes education controls	No	No	Yes	Yes	No	No	Yes	Yes
Income regr controls for general ability	Yes	Yes	Yes	Yes	No	No	No	No
Income regr controls for specific abilities	No	No	No	No	Yes	Yes	Yes	Yes
R-sq overall	.3028	.3028	.3513	.3517	.3060	.3060	.3550	.3553
# Observations	49,764	49,297	49,764	49,297	49,764	49,297	49,764	49,297
# Individuals	4,472	4,423	4,472	4,423	4,472	4,423	4,472	4,423

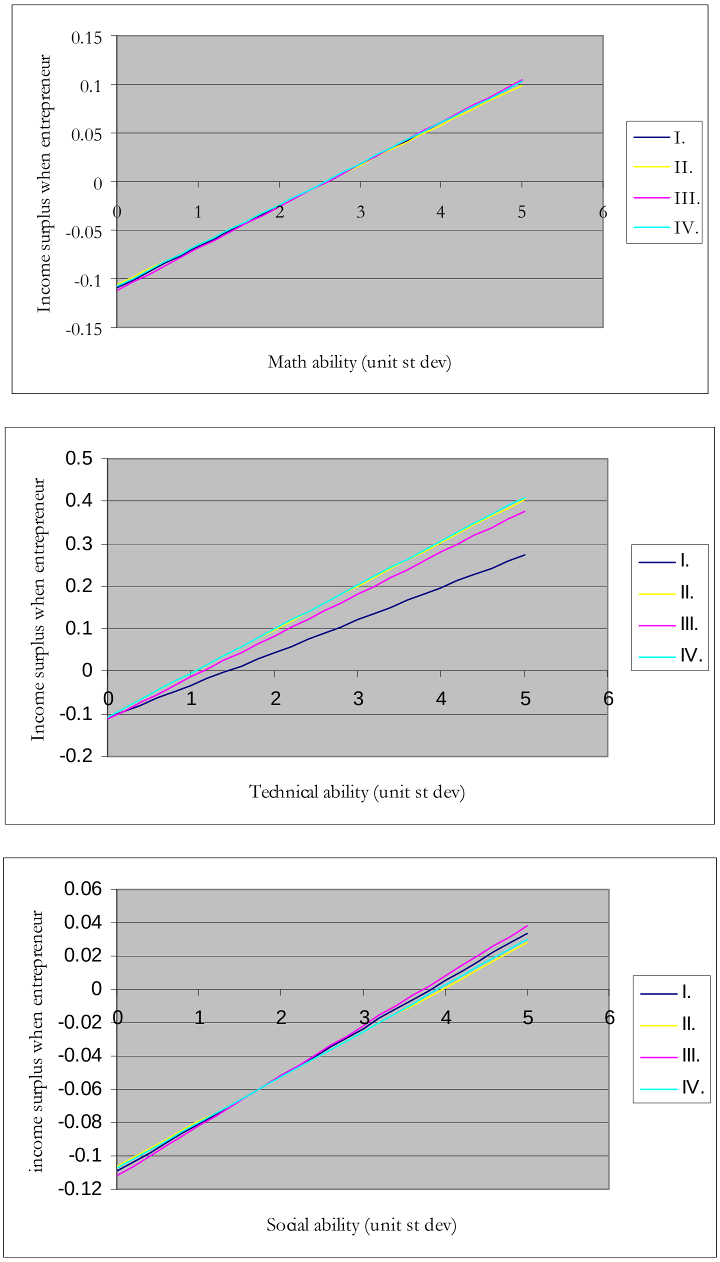
Significance levels: * 10%; ** 5%; *** 1%. All regressions include the control variables discussed in Section 3, see also Table 2.

Figure 1: Surplus income in entrepreneurial spells given general ability levels



The graph is based on the estimates of Panel C (fixed effects) of Table 3. When calculating the lines based on Columns III and IV, where education is included as a control variable, the individual's education level varies with the level of general ability corresponding with the correlation between general ability and education. To be precise, whenever general ability is increased by x standard deviations, education is increased by x times corr(general ability, education) times sd(education).

Figure 2: Surplus income in entrepreneurial spells given specific ability levels



The graphs are based on the estimates of Panel C (fixed effects) of Table 4; lines correspond to columns. Along any line, levels of other specific abilities and education co-vary according to correlations. The effect of a change in a specific ability is not calculated at fixed values for the other abilities, but they vary according to the correlation with the depicted ability. Whenever the depicted ability is increased by x standard deviations, the other specific ability measures and education are increased by x times corr(depicted ability, other ability). The same holds for education.

Figure 3: Surplus income in entrepreneurial spells given ability dispersion

The graph is based on the estimates in Columns 1-4 of Panel C (fixed effects), Table 5; the lines correspond to the first four columns. Along a line, the individual's general ability level (all lines) and education level (lines III and IV only) co-vary according to correlations (see text).

Table A1: Correlations between the ten ASVAB measures in the used sample

Correlation coefficients of the ten ASVAB scores	**1.**	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**
1. Science ability	1.000									
2. Arithmetic ability	0.7085	1.000								
3. Word knowledge	0.7820	0.6981	1.000							
4. Paragraph comprehension	0.6598	0.6750	0.7760	1.0000						
5. Numerical operations	0.4813	0.5952	0.5750	0.5934	1.0000					
6. Coding speed	0.3916	0.4786	0.5077	0.5252	0.6774	1.0000				
7. Auto and shop information	0.6180	0.5124	0.4975	0.3859	0.2508	0.1747	1.0000			
8. Mathematical knowledge	0.6760	0.8207	0.6697	0.5899	0.5985	0.4887	0.3856	1.0000		
9. Mechanical comprehension	0.6815	0.6708	0.5785	0.5057	0.3633	0.2934	0.7209	0.5816	1.0000	
10. Electronic information	0.7347	0.6409	0.6596	0.5443	0.3614	0.2781	0.7214	0.5625	0.7260	1.0000

The correlation levels have been calculated while using one year of observations.

Table A2: The effect of abilities on entrepreneurship selection

Panel A Random Effects Probit model (GEE Population Averaged Model)								
General ability	-0.0622 (.0231)***	-0.0491 (.0231)**	-0.0278 (.0264)	-0.0251 (.0244)				
Language ability					-0.0084 (.0282)	0.0036 (.0269)	-0.0058 (.0284)	0.0043 (.0269)
Math ability					-0.164 (.0267)***	-0.1592 (.0259)***	-0.1517 (.0285)***	-0.1426 (.0271)***
Technical ability					0.1313 (.0272)***	0.1156 (.0264)***	0.1301 (.0273)***	0.1151 (.0264)***
Clerical ability					-0.0037 (.0240)	0.0057 (.0234)	-0.0028 (.0241)	0.0046 (.0234)
Social ability					0.0518 (.0181)***	0.0527 (.0182)***	0.0536 (.0182)***	0.0539 (.0183)***
Variation in abilities	0.0034 (.0159)	-0.0125 (.0178)	0.0031 (.0161)	-0.0132 (.0179)	0.0033 (.0156)	-0.0121 (.0175)	0.0033 (.0157)	-0.0125 (.0176)
Ability regr incl. education controls	No	Yes	No	Yes	No	Yes	No	Yes
Income regr incl. education controls	No	No	Yes	Yes	No	No	Yes	Yes
Wald Chi-square	627.9	623.0	639.6	638.7	678.7	671.5	681.0	678.7
# Observations	50,215	49,627	50,094	49,627	50,215	49,627	50,094	49,627
# Individuals	4,508	4,452	4,501	4,452	4,508	4,452	4,501	4,452
Panel B Probit, dependent variable = ever been entrepreneur in sample period, independent variables do not vary over time, derivative effects estimated								
General ability	-0.0144 (.0084)*	-0.0117 (.0079)	0.0079 (.0095)	0.0009 (.0083)				
Language ability					-0.0055 (.0112)	0.0018 (.0106)	-0.0020 (.0112)	0.0011 (.0105)
Math ability					-0.0562 (.0110)***	-0.0518 (.0105)***	-0.0388 (.0118)***	-0.0376 (.0110)***
Technical ability					0.0463 (.0110)***	0.0352 (.0104)***	0.0427 (.0110)***	0.0352 (.0104)***
Clerical ability					0.0038 (.0094)	0.0105 (.0091)	0.0049 (.0095)	0.0091 (.0091)
Social ability					0.0198 (.0075)***	0.0198 (.0075)***	0.0209 (.0075)***	0.0210 (.0075)***
Variation in abilities	0.0024 (.0064)	-0.0129 (.0090)	0.0018 (.0063)	-0.0138 (.0094)	0.0014 (.0065)	-0.0123 (.0090)	0.0013 (.0064)	-0.0130 (.0093)
Ability regr incl. education controls	No	Yes	No	Yes	No	Yes	No	Yes
Income regr incl. education controls	No	No	Yes	Yes	No	No	Yes	Yes
Wald Chi-square	32.0	34.9	52.8	55.3	71.9	68.4	81.0	81.8
# Observations	3,333	3,294	3,326	3,294	3,333	3,294	3,326	3,294

Significance levels: * 10%; ** 5%; *** 1%. All regressions include the control variables discussed in Section 3, see also Table 2. The estimates in Panel B have been obtained when omitting regressors that vary over time.