DISCUSSION PAPER SERIES

IZA DP No. 4628

# Returns for Entrepreneurs vs. Employees: The Effect of Education and Personal Control on the Relative Performance of Entrepreneurs vs. Wage Employees

Mirjam van Praag
Arjen van Witteloostuijn
Justin van der Sluis

December 2009

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

# Returns for Entrepreneurs vs. Employees: The Effect of Education and Personal Control on the Relative Performance of Entrepreneurs vs. Wage Employees

**Mirjam van Praag**
*University of Amsterdam, Tinbergen Institute, Max Planck Institute of Economics and IZA*

**Arjen van Witteloostuijn**
*University of Antwerp and Utrecht University*

**Justin van der Sluis**
*University of Amsterdam*

Discussion Paper No. 4628
December 2009

IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

IZA Discussion Paper No. 4628
December 2009

# ABSTRACT

## Returns for Entrepreneurs vs. Employees: The Effect of Education and Personal Control on the Relative Performance of Entrepreneurs vs. Wage Employees*

How valuable is education for entrepreneurs' performance as compared to employees'? What might explain any differences? And does education affect peoples' occupational choices accordingly? We answer these questions based on a large panel of US labor force participants. We show that education affects peoples' decisions to become an entrepreneur negatively. We show furthermore that entrepreneurs have higher returns to education than employees (in terms of the comparable performance measure 'income'). This is the case even when estimating individual fixed effects of the differential returns to education for spells in entrepreneurship versus wage employment, thereby accounting for selectivity into entrepreneurial positions based on fixed individual characteristics. We find these results irrespective of whether we control for general ability and/or whether we use instrumental variables to cope with the endogenous nature of education in income equations. Finally, we find (indirect) support for the argument that the higher returns to education for entrepreneurs is due to fewer (organizational) constraints faced by entrepreneurs when optimizing the profitable employment of their education. Entrepreneurs have more personal control over the profitable employment of their human capital than wage employees.

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

Keywords: entrepreneurship, self-employment, returns to education, performance, personal control, locus of control, human capital, wages, incomes

Corresponding author:

Mirjam van Praag
Amsterdam Center for Entrepreneurship
Faculty of Economics and Business
University of Amsterdam
Roetersstraat 11
1018 WB Amsterdam
The Netherlands
E-mail: C.M.vanPraag@uva.nl

* A very early version of this paper circulated entitled: "Why are the returns to education higher for entrepreneurs than for employees?" We are grateful to Robert Fairlie and Rob Alessie for their excellent comments. The usual disclaimer applies.

## 1. INTRODUCTION

Entrepreneurship is a multidisciplinary field with a wide topical coverage. Shane and Venkataraman took stock of the entrepreneurship literature in a note in the *Academy of Management Review* of 2000. They defined the field "as the scholarly examination of how, by whom, and with what effects opportunities to create future goods and services are discovered, evaluated and exploited" (Shane and Venkataraman, 2000: 218). Indeed, by and large, the entrepreneurship literature revolves around these three key issues. First, the "how" question deals with entrepreneurship strategies such as firm entry and product innovation (e.g., Wu and Knott, 2006). Second, the "who" question relates to the examination of what makes an entrepreneur different from a non-entrepreneur, varying from family background to genetic heritage (e.g., Nicolaou, Shane, Cherkas, Hunkin and Spector, 2008). Third, the "what" question focuses on entrepreneurial performance, searching for the drivers of performance heterogeneity (e.g., Zott and Amit, 2007). The "what" question has received most scholarly attention, to date (Ireland, Reutzel and Webb, 2005).

The first question addressed in the current paper primarily relates to the "what" question, too. We study the effect of one particular source of human capital, i.e., education, on the relative performance of entrepreneurs *vis-à-vis* employees. How is formal education related to entrepreneurial performance? Any insight in the "what" question may have important implications. As demonstrated by a recent literature review (Van Praag and Versloot, 2007), there is hard evidence supporting the important contribution of entrepreneurs to the economic development of nations. However, Henrekson and Johansson (2009) show that the higher end of the distribution of entrepreneurs over performance levels is to a disproportionately large extent responsible for creating economic value. Successful entrepreneurs are responsible for economic growth, sustained levels of competition, the creation of jobs, and innovations. The established benefits imply positive external effects at the societal level, making insight in determinants of success, the "what" question, valuable: "*Those business men who have pioneered new paths have often conferred on society benefits out of all proportion to their own gains, even though they have died millionaires*" (Marshall, 1890: 598). Indeed, many developed countries and regions, including the US and the EU, have installed policies fostering successful entrepreneurship. One of these is providing people opportunities to develop their human capital by means of education. An underlying assumption of this approach is that investments in human capital increase people's performance as an entrepreneur. In other words, these policies are consistent with the belief that entrepreneurship competencies can be developed through education. But how valid is this assumption? Can entrepreneurship be learned in school?

To answer this "what" question, we measure the effect of investing in human capital through formal education on the performance of entrepreneurs, and compare this to employees. In so doing, we believe we introduce a good proxy for the impact of opportunity cost. From the perspective of the management literature, key is that an entrepreneur's "performance advantage may be insufficient to compensate for the opportunity cost of the alternatives" (Shane and Venkataraman, 2000: 217). In line with this fundamental starting point, Shane and Venkataraman (2000) recommend to focus on the individual whilst taking into account opportunity costs. This is anything but easy, as profit opportunities and opportunity costs are difficult-to-observe constructs. The returns to education measure suits this purpose very well, we argue, by offering the opportunity to compare the entrepreneurs' returns to education with the employees'. In so doing, the entrepreneurs' returns are

estimated in comparison with that which forms the key alternative career option: wage employment. Although the comparison is sometimes flawed with measurement issues, as we will discuss below, the income performance measure is the only one available for both entrepreneurs and employees, albeit in somewhat different fashions (Hamilton, 2000). It reflects an appropriate complementary measure of entrepreneurial performance, next to the standard objective and subjective performance measures currently in use in the management literature. It is the most widely used performance measure in the economics of entrepreneurship (see the survey of Van der Sluis, Van Praag and Vijverberg, 2008).

Basically, the measured effect of education on performance boils down to the measured return to education in terms of income. For the US, we show that formal education enhances the performance of entrepreneurs importantly and significantly. Even stronger, the returns to education for entrepreneurial spells are not only large and significant, they are also significantly higher than the returns to education in wage employment, at least in the US. Of course, we do not argue that income reflects the measure of entrepreneurial performance. Without any doubt, depending upon the research question at hand and the associated level of analysis, other performance measures such as new venture survival, small firm growth or subjective performance evaluation offer rich yardsticks in entrepreneurial research. Rather, we argue that our analysis provides an interesting complementary perspective by offering a way to deal with the tricky issue of opportunity costs. This is our first contribution.

The second, supplementary, issue we address relates to an important "who" question: "Are higher educated people more or less likely to enter into entrepreneurship?" One all too frequently hears those stories about very successful entrepreneurs who were early dropouts from the education system. For instance, at www.yougentrepreneur.com a list is (more or less proudly) presented consisting of the world's richest billionaire dropouts from school. Among them are Sir Richard Branson (Virgin), Michael Dell (Dell computers), Bill Gates (Microsoft) and Larry Ellison (Oracle), who all dropped out from their schools at various stages. It is often claimed that education is a waste of time in case you want to become an entrepreneur. Education would only be worthwhile for wage employees. Hence, these claims imply that entrepreneurship competencies cannot be (effectively) developed through formal education. However, perhaps, this popular rhetoric should be taken with a grain of salt, since the most recent list of the world's billionaires included 1,125 individuals with only 73 of them, i.e., six per cent, having dropped out at some stage of schooling. This popular narrative as to what may be coined the Bill Gates effect can be contrasted with the standard argument that formal education is associated with a higher likelihood of opting for entrepreneurship, the reason being that higher educated people are more likely to observe entrepreneurial opportunities. In this paper, we will test both alternative hypotheses. That is, is choice behavior more in line with Bill Gates' dropout example or with the belief that entrepreneurship performance (and thereby rewards) can be boosted by education? Is there a negative, positive or zero correlation between an individual's education level and the probability that they are observed as an entrepreneur? Our analyses show that the choice for entrepreneurship versus wage employment is negatively related to education. So, the choice behavior is inconsistent with (information about) higher returns to education in entrepreneurship than in wage employment. We put these seemingly contradictory findings in the perspective of the literature that has shown wide support for the fact that the choice for entrepreneurship is not primarily driven by income

maximization. It is referred to as the 'returns to entrepreneurship puzzle' (Benz and Frey, 2008; Blanchflower and Oswald, 2008; Hamilton, 2000; Hartog, Van Praag and Van der Sluis, 2009; Hyytinen, Ilmakunnas and Toivanen, 2008; Parker, 2004; Van Praag and Versloot, 2007). Since we study the effect of education on the proceeds from and choice for entrepreneurship, we can suggest a solution for this particular demonstration of the puzzle: the Bill Gates effect. This is our second contribution.

The third issue that we focus on deals with a key question associated with may be coined the "why" question, given the finding of the employee-entrepreneur returns to education differential in favor of entrepreneurs: "Why are the returns to education higher for entrepreneurs than for wage employees?" Using insights from personal control theory (e.g., Benz and Frey, 2008; Douhan and Van Praag, 2009; Hyytinen *et al.*, 2008), we argue that the higher returns to education for entrepreneurs are due to fewer (organizational) constraints faced by entrepreneurs when optimizing the profitable employment of their education. As an entrepreneur, an individual can operate as a residual claimant. S/he can freely decide to engage in those activities where s/he believes that her / his talents are most likely to generate high returns. In contrast, as an employee, an individual is bounded by organizational processes and structures, with the higher ranked making the key decisions. So, there are limits to what an individual can decide to do inside the "iron cage" of an organization owned by others. We will test this personal control hypothesis, as well as a number of alternative explanations of the higher entrepreneurial returns to education. This is our third contribution.

A fourth motivation for this paper relates to the way in which we deal with three important econometric issues. Shane (2006) concludes that entrepreneurship (performance) studies have to deal with three econometric issues: unobserved heterogeneity, sample selection and endogeneity (see his "Introduction to the Focused Issue on Entrepreneurship" of Management Science). Only then, we can hope to generate unbiased estimates. Our data are from the 1979 National Longitudinal Survey of Youth (NLSY1979), which runs from 1979 to 2000. The nationally representative part of this survey panel includes 6,111 individual respondents aged between 14 and 22 in 1979. These respondents have been interviewed annually up to 1994, and on a bi-annual basis since then. Apart from entrepreneurship-employment status, money income and formal education, this survey includes rich information about a variety of other issues. Exploiting the panel nature and richness of this dataset, we take great care in dealing with the three econometric pitfalls of entrepreneurial (performance) research. In so doing, we respond to "the desire among entrepreneurship scholars to form longitudinal or panel samples and then to use appropriate methods for testing purposes" (Ireland *et al.*, 2005: 562; see Özcan and Reichstein, 2009, for a recent example). We benefit from the returns to education literature in labor economics, albeit almost exclusively applied to employees, by adopting the estimation strategies developed in that literature that adequately deal with critical econometric pitfalls that are endemic in earlier entrepreneurship performance work. Thus, we form econometrically sound answers to relevant questions about the role that education plays for entrepreneurship choices and performance, and why this is so. This is our fourth contribution.

The structure of this paper is as follows. First, we briefly review the labor economics literature on returns to education, specifically focusing on work on entrepreneurship in relation with econometric issues (Section 2). Subsequently, we develop a set of four hypotheses that help to structure our series of empirical analyses (Section 3). After that, we introduce our data and method (Section 4). Next, we present the empirical

evidence (Section 5). Finally, we conclude with an appraisal, reflecting on this study's limitations and the implied opportunities for future research (Section 6).

## 2. THE RETURNS TO EDUCATION LITERATURE

The study of returns to education has a long tradition in labor economics. By and large, this tradition is based on standard human capital theory. Human capital refers to the stock of skills and knowledge relevant to performing labor to produce economic value. It is the skills and knowledge gained through education and experience that was first defined as such by Adam Smith (1776). Thus, schooling is viewed as an investment in human capital (Mincer, 1958; Becker, 1964), implying that the returns to schooling may be measured in terms of the extra income due to additional schooling. More precisely, the internal rate of return is the discount rate that equates the present values of the lifetime earnings flows in the case of $x$ years of education versus the case of $x$-1 years of education (Hartog and Oosterbeek, 2007). Mincer (1974) has introduced a simplified estimation strategy of rates of return to schooling, which boils down to estimating the rate of return as the coefficient of schooling years in a cross-section regression for individual earnings (Hartog and Oosterbeek, 2007). The rate of return thus measures how much extra units of income are generated, *ceteris paribus*, by an extra unit of education. The more recent labor economics literature has produced estimates of the rate of return to education that, apart from controlling for a variety of alternative explanations, address the three critical econometric pitfalls identified by Shane (2006): unobserved heterogeneity, sample selection and endogeneity (e.g., Card, 1999; Oreopoulos, 2006). However, these estimates pertain almost exclusively to the returns to education in wage employment. There is a separate but less developed educational returns literature for entrepreneurs. Bringing them together is interesting since a combined analysis of entrepreneurs and employees enables a comparison of the *relative* value of education for the performance of entrepreneurs versus employees, so indirectly capturing the critical notion in the entrepreneurship literature of opportunity cost.

In the entrepreneurship literature, a stream of studies has focused on determinants of performance of entrepreneurs. In many of these studies, education has been included as a determinant. Van der Sluis *et al.* (2008) draw four conclusions relevant in our context, based on a meta-analysis of more than hundred studies of the relationship between education and entrepreneurship (entry and performance). First, the relationship between education and selection into entrepreneurship is mostly insignificant – i.e., in 75 per cent of the cases. Second, the relationship between schooling and entrepreneurship performance is unambiguously positive, and significant in 67 per cent of the studies, irrespective of the performance measure used (such as survival, profit, income or firm growth).[2] Third, the meta-analysis identifies approximately twenty studies that have actually measured the relationship between education and earnings for both entrepreneurs and employees in a comparable fashion. The conditional correlations between education and income turn out to be similar for entrepreneurs and employees, though somewhat higher for entrepreneurs in the US.

The fourth conclusion from the meta-analysis is that only few studies try to cope (in credible manners) with endogenous selection of individuals into entrepreneurship *vis-à-vis* wage employment. Moreover, earlier

[2] The meta-analysis further reveals that the most widely used performance measure for entrepreneurs is their income, in line with the measure used in this study.

studies did not yet employ estimation strategies that account for the endogeneity of schooling in performance equations, nor did they deal with unobserved individual characteristics that may drive the result, possibly leading to inconsistent estimates. This may perhaps be explained by the fact that many of the earlier studies measure the relationship between education and entrepreneurship outcomes as a by-product, while focusing on different issues. This is in sharp contrast with the common practices developed in labor economics, when studying the returns to education for employees (see Ashenfelter, Harmon and Oosterbeek, 1999). The first strategy used to cope with unobserved ability is trying to make the unobservable observable. Various proxies of intelligence and other test scores have been included in income equations. The effects of adding such controls on the estimated returns to education have been ambiguous (see Table 3 in Ashenfelter *et al.*, 1999, for an overview).[3] Inclusion of ability proxies in the income function does not completely shield the estimated returns against ability bias due to an imperfect correlation between such proxies and ability. Similarly, the endogeneity issue is not solved since ability is not necessarily perfectly correlated with the optimization behavior of individuals. Additional approaches are thus used to estimate the returns to education for employees, such as the employment of samples of monozygotic twins (e.g., Ashenfelter and Krueger, 1994; Bonjour *et al.*, 2003), where identification comes from those twins who differ in their schooling and income, assuming that all unobserved factors are approximately equal. The usual finding is that treating education as an exogenous variable leads to downward biased estimates of the returns to education (e.g., Ashenfelter *et al.*, 1999).

The most widely used identification strategy is the instrumental variables (IV) approach. Instruments are identified that explain a substantial proportion of the variance of the endogenous variable, education in this case, but are unrelated to the dependent variable – i.e., income. Key is that the instrumented endogenous variable is not related to the error term anymore. This method strongly hinges on the quality and validity of the identifying instruments used. Like using twins, the IV-strategy leads to higher estimates of the returns to education of employees than when treating education as an exogenous variable. This is not only the case when parental background variables are used as identifying instruments (Blackburn and Neumark, 1993), but also when changes in compulsory schooling laws are introduced (e.g., Angrist and Krueger, 1991; Oreopoulos, 2006). Harmon, Oosterbeek and Walker (2003: Figure 6 on page 139) show that, based on a meta-analysis of models with endogenous schooling, IV-estimates of returns to schooling are higher than OLS-estimates, and that IV-estimates based on exogenous variation in schooling attainment are even higher than when instruments are based on family background variables.

Since the meta-analysis by Van der Sluis *et al.* (2008), and prior to this study, three studies have used IV-methodologies to measure the returns to education for entrepreneurs: Van der Sluis and Van Praag (2004, 2007) and Parker and Van Praag (2006). In the current study, we re-evaluate the returns to education for entrepreneurs (relative to employees), without some of the drawbacks that characterized the earlier attempts. Like Van der Sluis and Van Praag (2004, 2007), and unlike Parker and Van Praag (2006), we measure the returns to education for entrepreneurs as well as employees. Unlike Van der Sluis and Van Praag (2004), we measure the returns to education for both groups within one framework (income equation) such that the (significance of the) difference

[3] Theory predicts that omitting ability in the wage equation causes OLS-estimates to be upward biased (Griliches, 1977; Harmon and Walker, 1995; Ashenfelter *et al.*, 1999).

in the returns to education across the two groups can be compared (by including interactions: see below). Moreover, using one framework offers the opportunity to produce fixed effects estimates, which has not been attempted previously.[4]

Like Van der Sluis and Van Praag (2004), but unlike Parker and Van Praag (2006) and Van der Sluis and Van Praag (2007), the data enable estimating income equations with limited survival bias for entrepreneurs thanks to the (bi)annual (panel) data collection of all labor market activities and sources of income in the past period (see below). Furthermore, the identifying instruments used for estimating education imply, albeit based on family background characteristics, an improvement over Van der Sluis and Van Praag (2004) and Parker and Van Praag (2006). Nevertheless, relying on family background variables as identifying instruments for education is a limitation in comparison to Van der Sluis and Van Praag (2007), where identification is based on changes in compulsory schooling laws. Finally, in the current study, we suggest and find an explanation for the robust finding of Van der Sluis and Van Praag (2004, 2007) and the current study that the returns to education are higher for entrepreneurs than for wage employees. This is a novel result.

## 3. HYPOTHESES

In this paper, we take an individualistic perspective on entrepreneurship as our starting point, in line with the Austrian school in economics (Kirzner, 1973, 1997), and as recommended by Shane and Venkataraman (2000). We assume that individuals maximize utility and that utility is determined mainly by financial income. Thus, if a (potential) entrepreneur evaluates the income from wage employment to be higher than from entrepreneurship, s/he will opt for the former, and *vice versa*. With these assumptions in place, we formulate two hypotheses that deal with the "what" question (Hypotheses 1 and 2), one that involves the "why" question (Hypothesis 3), and a pair of hypotheses that relates to the "who" question (Hypotheses 4 and 4alt).

A basic proposition derived from human capital theory is that education leads to higher productivity and thus to higher income (Mincer, 1958; Becker, 1964). This proposition has been widely tested and supported by labor economists (Ashenfelter *et al.*, 1999). According to Hartog and Oosterbeek (2007), these returns are typically estimated to be between 5 and 15 per cent. The far majority of tests pertain to employees only (or an implicit combination of entrepreneurs and wage employees). However, it has been contended that, in general, human capital theory indicates that the previously acquired knowledge plays a critical role in intellectual performance, also assisting in the integration and accumulation of new knowledge as well as the adaptation to new situations (Weick, 1996). This must then be the case for entrepreneurs as well. Indeed, there is broad and rather strong empirical support for a positive relationship between the performance of entrepreneurs and education (see the meta-analysis of Van der Sluis *et al.*, 2008), although the evidence is not unambiguous (e.g., Davidsson and Honig, 2003).

[4] The interacted regressor 'Entrepreneur*Education' in the income equation varies over time per individual due to variations over time per individual in occupational status. A substantial fraction of the individuals in the sample has been both an entrepreneur and an employee in the observed period, and can thus be used to identify the differential effect of education for spells in entrepreneurship *vis-à-vis* wage employment for specific individuals.

*Hypothesis 1: The returns to education are positive for entrepreneurs.*

The human capital model offers just one of several perspectives on the role of education, however (Van der Sluis *et al.*, 2008). As Harmon *et al.* (2003: 133–134) argue, "[t]he literature has been dominated by human capital theory and the econometric analysis has been interpreted in this framework. However, an important concern is that education may have a value in the labor market not because of any effect on productivity but for 'spurious' reasons." In particular, education may act as a signal of ability (or other characteristics that employers value because they contribute to productivity, but which they cannot easily observe). Thus, schooling is not only acknowledged for its productive effect, as assumed by Mincer, but also has value as a signal of productive ability in labor markets without complete information (Spence, 1973; Riley, 2002), leading to positive returns to education as well (even if education *per se* had no productive value). For long, economists believed that education is a valuable signal only for employees – i.e., in the selection and hiring process by employers (Weiss, 1995). They treated entrepreneurs as a control group for which education was assumed not to have signalling value (Van der Sluis *et al.*, 2008). However, as recent studies indicate and support empirically, entrepreneurs may use their education as a signal toward suppliers of capital (Parker and Van Praag, 2006) or (prospective) customers and highly qualified employees (Backes-Gellner and Werner, 2007). Thus, there is no reason to believe *a priori* that education has a greater value for employees than for entrepreneurs. So, human capital and signalling theories are silent about the relative returns to education for entrepreneurs in comparison to employees.

However, combining empirical evidence with organization and economic theory may give insight into this issue. The scarce evidence discussed above suggests that the returns to education are higher for entrepreneurs than for employees (Van der Sluis and Van Praag, 2004, 2007). What could be the underlying mechanism? Douhan and Van Praag (2009) build a theoretical model proposing that the underlying mechanism is "personal control". The type of control they refer to is an individual's control over the employment of and accruals from human capital. Entrepreneurs can better form, manage and control the environment in which they operate than wage employees. They can more easily adapt their production processes such that they yield the highest returns to their assets. One of these assets is their own human capital obtained through education. Entrepreneurs are not constrained by rules from superiors, and can decide on how to employ their education in such a way that its productive effect is the highest. In addition, the benefits of the profitable use of their human capital accrue fully to the entrepreneur as (s)he is the residual claimant of the firm. In contrast to the free agency of the entrepreneur, the organizational structure surrounding an employee makes it more difficult, or perhaps even impossible, to maximize this individual's returns to education. Organizations cannot adapt their structure to every individual, due to organizational inertia and individual incompatibilities. Furthermore, entrepreneurs can also better control the accruals from the employment of their human capital: there is a one-to-one correspondence between profits and the employment of assets, whereas wage employees are tied to wage brackets that are based on the average productivity of their peers. As a consequence, entrepreneurs are in a position to better control the profitable employment of their education.

Indeed, there is some direct and indirect evidence that entrepreneurs experience more personal control and autonomy than employees. The indirect evidence is drawn from the observation that it may be more

satisfying to be an entrepreneur than an employee, despite longer working hours, more risk, and more variable but often lower expected incomes, based on a number of cross-section studies (e.g. Blanchflower and Oswald, 1998; Hundley, 2001) and panel studies (e.g. Benz and Frey, 2008, Kawagushi, 2006, Taylor, 1996,). The direct evidence relates to the explanation of this difference that can be attributed to more autonomy and personal control over (the accruals from) one's own work as an entrepreneur compared to positions in wage employment (Benz and Frey, 2008; Hyytinen *et al.*, 2008). Interestingly, Hyytinen *et al.* (2008) studying the decision to become an entrepreneur in a large and rich panel of Finnish monozygotic twins, find a significant difference between entrepreneurial versus wage positions on exactly the dimension of the influence one has on how to conduct one's task (p. 18): entrepreneurs have more influence, and thus more personal control, compared to employees. Control over one's work thus seems like an important distinguishing feature of entrepreneurship, leading to higher returns to human capital, including education.

Studies from an organizational perspective addressing the effect of organizational context on the entrepreneurship decision have also built theory and produced (indirect) evidence in line with the argument of limited personal control for employees in larger and older organizations (Dobrev and Barnett, 2005; Sørensen, 2007), more bureaucratic organizations (Sørensen, 2007, who argues that organization size and age are indicators of bureaucracy) or public sector organizations (Özcan and Reichstein, 2009). All these organizational contexts are argued to reflect non-entrepreneurial, i.e., constraining, environments. For example, Dobrev and Barnett (2005: 445) observe that "[m]embers of organizations become unlikely to leave their organizations to build new ones as their organizations age and grow—evidence that organizations are effective in shaping and constraining the innovative behavior of their members." Hvide (2009) shows that high-quality entrepreneurs come from larger firms. He explains this result exactly in line with the "personal control" explanation , arguing that small firms are more entrepreneurial than large firms: "Small firms can implement a wage policy that is fine-tuned to workers' outside option … On the other hand, large firms have a more rigid wage policy and as a consequence lose the best workers and ideas" (Hvide, 2009: 1011).

> *Hypothesis 2: The returns to education are higher for entrepreneurs than for employees*
> *Hypothesis 3: The higher returns to education for entrepreneurs vis-à-vis employees are due to higher levels of personal control as how to employ one's assets, including human capital obtained through education.*

The above logic has implications for the "who" question as well. The assumption that individuals maximize utility and that utility is determined mainly by financial income results in the proposition that the relatively high returns to education for entrepreneurs would lead to a higher marginal effect of education on the probability of choosing for entrepreneurship versus the alternative, i.e., wage employment. A recent example of a study supporting this claim is Özcan and Reichstein (2009), who report a significantly positive effect of years of education on the likelihood of a transition to entrepreneurship. Moreover, Dobrev and Barnett (2005) show that employees with top jobs and larger spans of control are more likely to leave their organization to establish an entrepreneurial venture than their counterparts with non-top jobs. However, we must admit, although this argument is consistent with Hypothesis 2 and the assumption of rational behavior of income-maximizing agents,

the evidence about the relationship between education and entrepreneurship status is rather mixed (see the meta-analysis of Van der Sluis *et al.*, 2008). The ambiguous evidence may well be caused by the possibility that other non-pecuniary and cognitive factors than income maximization may play a more prominent role in this decision: autonomy, as we indicated (Benz and Frey, 2008), a tendency towards entrepreneurship caused by genetic factors (Nicolaou *et al.*, 2008), cognitive biases arising from overoptimism (Lowe and Ziedonis, 2006; Dushnitsky, 2009) and / or overconfidence (Hayward, Shepherd and Griffin., 2006). Also, this mixed evidence echoes the Bill Gates effect as discussed in the Introduction.

*Hypothesis 4: Education is positively associated with entrepreneurship status.*
*Hypothesis 4alt: Education is negatively associated with entrepreneurship status.*

## 4. DATA AND ESTIMATION

### National Longitudinal Survey of Youth

We will estimate Mincerian income equations using panel data from (the representative part of) the National Longitudinal Survey of Youth (NLSY) 1979-2000, see also Hartog, Van Praag and Van Der Sluis, 2009. The nationally representative part of the NLSY consists of 6,111 individuals aged between 14 and 22 years in 1979.[5] 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, 5,600 entrepreneurs/employees, leading to a total number of person-year observations of 66,000. Hence, the average number of year-observations per individual is 11. 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. This enables estimating the differential returns to education in an entrepreneurial spell versus a spell in wage employment controlling 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. Therefore, the survivorship bias is limited. That is, our estimates of the returns to education will not pertain to surviving entrepreneurs only.

### Key variables

We define entrepreneurs conventionally as labor market participants whose main occupation is in self-employment or who are owner-director of an incorporated business.[6] We acknowledge the limitations of this definition, also including, for instance, independent bar and bookkeepers, in the set of entrepreneurs. Moreover,

[5] The original NLSY sample consists of 12,686 individuals. We exclude the supplementary military and minority samples.
[6] Thus, entrepreneurs in our sample are not necessarily founders, as they may as well have bought an existing business. We presume that the majority will be founders, however. Parker and Van Praag (2007) calculate that 83 per cent of the entrepreneurs in their representative Dutch sample have started up a firm, whereas only 17 per cent acquired their entrepreneurial positions through takeover of a (family) firm.

not all entrepreneurial activities take place in (newly founded) firms, initiated by their founders. As usual, farmers are excluded from the sample of entrepreneurs. Furthermore, in line with common practice (Fairlie, 2005b; Hartog *et al.*, 2009), we exclude 'hobby' entrepreneurs from the sample by using a lower boundary of 300 hours per year worked as an entrepreneur.[7] An employee is defined as a person whose main occupation is a salaried job. The descriptives in Table 1 reveal that approximately six per cent of the (fairly young) sample is entrepreneur at any moment, a quarter of the sample has ever been an entrepreneur at some point, and the average entrepreneurial spell is 3.3 years. The education level of both groups is measured in years of completed schooling, with a topcode of 20. The mean education level is similar for entrepreneurs and employees.

[Insert Table 1 about here]

Absolute labor market performance is measured by means of gross incomes, as this is the only performance measure which is (to some extent) comparable for entrepreneurs and employees. It is constructed as the average annual total earnings (from wage and business income; see Fairlie, 2005b). We also use hourly incomes as a performance measure, where the gross annual income is divided by the number of hours worked in that year.

Parker (2004) documents various reasons that limit the comparability of entrepreneurs' incomes to those of employees: for instance, the fact that the self-employed have more opportunity to under-report (tax) income (Levitt and Dubner, 2006: 237), the 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 absolute income levels of entrepreneurs and employees may only be compared with great caution. However, the extent to which all these biases affect the marginal returns to a regressor such as education is probably limited. In robustness analyses, we shall explicitly evaluate the presence and effect of several of the potential problems of the income measure for entrepreneurs mentioned by Parker (2004) and Fairlie (2005b). Based on this, we are rather confident about the comparability of regression coefficients pertaining to the main "anchoring" variable of interest – i.e., education. Table 1 shows the income statistics of entrepreneurs and employees separately. The mean, median and standard deviation of the distribution of hourly and annual incomes are higher for entrepreneurs than for employees, in line with Fairlie (2005a) and Parker (2004), among many.[8]

Finally, we need to construct a measure that reflects Hypothesis 3's control argument. Ideally, we would like to test this explanation directly by randomly allocating entrepreneurs and employees to environments with more or less control, to subsequently observe the differences in returns to education between people working in these two sorts of environments. Unfortunately, such an experiment is very difficult to realize – if at all. However, if it is true that a better control of the environment influences the possibility to optimize the returns to education, it might also be true that individuals' perceived control of the environment affects their returns to education. Those entrepreneurs and employees having the perception that they are in control of their environment should then experience higher average returns to education than others. This would support the control-related

[7] We tested whether the results are sensitive to increasing this lower boundary of the number of hours. We find that the results do not change substantially.

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

explanation indirectly. An individual's perceived control of the environment is measured by psychologists through the personality trait called 'locus of control'. This measure, introduced by Rotter in 1966 in the context of his social learning theory, is included in the NLSY.[9] Locus of control is defined as an individual's general expectancy of the outcome of an event as being either within or beyond her or his personal control and understanding (Rotter, 1966). Individuals with an external locus-of-control personality tend to perceive an event as beyond their control, and attribute the outcomes of the event to chance, luck, as under control of powerful others, or as unpredictable. Individuals with an internal locus of control tend to believe that events are contingent upon their own behavior or relatively permanent characteristics. In the psychological literature, there is ample evidence that locus of control is a fundamental and stable personality trait, with clear behavioral consequences (Boone and De Brabander, 1993; Boone, Van Olffen and Van Witteloostuijn, 2005). The argument is that people with "more internal locus of control are more likely to exploit opportunities" and will thus with a higher probability engage in entrepreneurial activities (Shane and Venkataraman, 2000: 223), perform better as entrepreneurs (Brockhaus, 1980) or be more effective leaders (Boone, De Brabander and van Witteloostuijn, 1996).[10] So, we decided to exploit the NLSY data on this personal characteristic well known in the entrepreneurship literature: locus of control. Table 1 includes the descriptive statistics of the standardized locus-of-control variable.

*Control variables*

We include a series of control variables known from the large labor economics literature to affect returns to education. The bottom panel of Table 1 shows the descriptive statistics of the control variables included in the analyses. Parental education levels are measured in the same fashion as the respondents' education levels: the number of completed years of education (with a topcode of 20 years). Furthermore, dummy variables are included for gender, ethnicity, marital status, geographic location in the US and health conditions, where the latter three variables vary over time. All equations, even the ones where the dependent variable is hourly income, control for the number of hours worked per year since this may affect both income measures strongly.[11] As a measure of general ability we use the Armed Forces Qualification Testscore (AFQT) included in the NLSY, as administered in 1980. This 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, Stixrud and Urzua, 2006: 415). It comprises five areas of ability: word knowledge, paragraph comprehension, arithmetic reasoning, coding speed and mathematics knowledge.

However, ability measures administered at different ages and different education levels within this age range (in our case, between 15 and 23 years old) are incomparable (Heckman *et al.*, 2006; Hartog *et al.*, 2009). Age affects measured ability, whereas the causality of the relationship between education and measured ability

[9] The NLSY includes an abbreviated version of the original Rotter scale. The test was administrated in 1979, before the respondents had made any major decisions regarding their jobs or occupations. We use a normalized version of the Rotter score.

[10] Locus of control plays a role in the literature on the "how" question as well. There, the argument is that entrepreneurs with specific traits have a preference for specific strategies (Wijbenga and van Witteloostuijn, 2007). We here ignore this issue.

[11] We note that the number of hours worked may depend, in turn, on income. Thus the variable is not truly exogenous.

goes both ways: "schooling causing test scores and test scores causing schooling" (Hansen, Heckman and Muller, 2004: 40). Therefore, we remove the age and education effects from the AFQT by regressing the test scores on a set of age and education dummies (see also Blackburn and Neumark, 1993; Hartog *et al.*, 2009). The individuals' residuals are computed and normalized. These corrected test scores are used as the measure of general ability. Since education and general ability are so closely related, we shall estimate all equations while including and excluding the corrected AFQT scores. Moreover, each income equation includes a set of transformed year, birth year and age dummies according to the method proposed by Deaton (2000), such that the year effects add to zero, and are orthogonal to a time trend (see Hartog *et al.*, 2009). In this manner, the estimates are obtained while controlling for cohort effects, age effects and macroeconomic circumstances.[12] Finally, we include four detailed family background variables in the income regression equations. As we shall discuss in the empirical methodology subsection, they are not just used as regular controls, but as instrumental variables for education.[13] Although administered in 1979-1980, these variables are most of the time recollections of household characteristics at the age of 14 (e.g., the presence of a library card in the household). They will be discussed in detail in the next subsection.

**Empirical methodology**

To estimate the returns to education for entrepreneurs relative to employees, we specify a series of income equations where the dependent variable is the log of income, as defined above. Our main interest is in the difference between entrepreneurs and employees of the estimated coefficients pertaining to the education variable. Therefore, we first estimate separate income equations for entrepreneurs and employees such that we can compare the estimated levels of the coefficients of the education variable. These are specifications (1) and (2) throughout. We then combine the equations in the third specification, (3), and include interacted regressors of occupational status (a dummy variable that is equal to one for spells in entrepreneurship and equal to zero for spells in wage employment) with all other regressors. The coefficient of prime interest relates to the interaction of education and occupational choice, as this indicates the differential returns to education for entrepreneurs *vis-à-vis* employees.

All three equations – i.e., the ones for entrepreneurs, employees and all labor force participants – are estimated by means of a random effects (RE) model. A potential problem when estimating these specifications is that the resulting estimates might be biased due to the fact that the choice between entrepreneurship and salaried employment may well be endogenous. Individuals might decide to become entrepreneurs because their education and some of their unobserved (fixed) characteristics have higher value as an entrepreneur than as an employee.[14] To address the issue of selectivity, the third equation – i.e., the one combining entrepreneurs and

[12] These transformed dummies are included in all regression models, but their coefficients will not be shown in the tables reporting the estimation results.
[13] They may be valid as such as they are possibly good predictors of the educational level of the respondent while otherwise independent of their future earnings.
[14] As we shall show in the results section, selection into entrepreneurship is, indeed, co-determined by education.

employees – is also estimated by means of an individual fixed effects (FE) model.[15] This fourth specification, (4), 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 from 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. A fifth specification, (5), is added that uses clustered standard errors.[16] The drawback of these fixed effects specifications is that we do not obtain estimates of the absolute levels of the returns to education for entrepreneurs and employees, but only of the difference between the two. We are therefore also interested in the results from the random effects specifications, albeit they may be biased due to selection.

All five specifications are estimated (i) with a limited number of control variables so as to obtain some sort of 'descriptive statistics', (ii) with all control variables except general ability, and (iii) with all control variables including general ability. However, as was pointed out already, the education variable is likely to be endogenous in the income equation. Therefore, we next instrument this variable included in all five specifications. Whenever interacted terms with education are included in the specification, i.e., "Education*Entrepreneur", this interacted variable is instrumented in the same fashion. We introduce four family background variables as identifying instruments: (1) *Magazines present in the household at age 14*; (2) *Library card present in the household at age 14*; (3) *Presence of a stepparent in the parental household*; and (4) *Number of siblings in the parental household*. These instruments are expected to have a significant relationship with the number of years of education attained, but not with income directly (given that we control for parental education and general ability).[17] Having magazines and/or a library card in the household signifies access to reading/studying material, which might inspire the child to learn more, thereby possibly affecting the number of years of education. In contrast, the presence of a stepparent is expected to reduce the level of education by increasing the probability that there has been turmoil (divorce or death of a parent) in the child's learning environment. The number of siblings is expected to have a negative relationship with education, as explained in, for instance, Black, Devereux and Salvanes (2005), Parker and Van Praag (2006) and De Haan (2009).[18]

---

[15] Please note that the estimate of interest, the coefficient pertaining to the interacted variable 'Education*Occupational status', is identified based on the subset of individual observations (approximately 1,000 individuals) that switch occupational status in the observed time horizon. Obviously, education as a stand-alone variable and other time-invariant variables are omitted from this specification. The model is identified because we only estimate the difference in returns to education between entrepreneurial and employee status.

[16] As long as there is no serial correlation in the error terms, the use of these clustered or heteroskedasticity and autocorrelation-consistent (HAC) standard errors will generate the same results as the fourth specification (see, for instance, Angrist and Pischke, 2008). However, it could be the case that there are some unobserved individual characteristics that vary over time whilst (a) affecting income levels and (b) being serially correlated. This will not affect the estimated coefficients, but only the standard errors and therefore the significance levels.

[17] Blackburn and Neumark (1993) use an IV-approach to estimate the returns to education (for employees) based on the NLSY data. They use a broad set of identifying instruments, including the set of instruments we use, as well as the education levels of the respondents' parents.

[18] As de Haan (2009: 2) discusses "anegative relationship between family size and educational achievements is not necessarily proof of a negative effect of the number of children. The number of children is a choice variable of the parents and it might be that certain characteristics of parents, such as their educational attainments, affect both the number of children as well as the educational attainments of those children." Various authors, including De Haan, have analyzed whether this negative relationship is evidence of a causal effect. Most studies then find this not to be the case. Anyway, for our purposes, the negative relationship is what counts.

There are two sorts of critique on the aforementioned instruments (but we do not have better ones). First, family background variables may, besides influencing education, have a direct impact on the labor market performance of the respondent. In order to minimize this direct impact, which would turn the instrument invalid, the education levels of the parents are used as control variables in all equations – rather than as additional identifying instruments, as is common when using this type of instruments. Moreover, controlling for indicators of ability decreases the likelihood that the identifying instruments do, in fact, measure the unobserved (inherited) talents of the respondent. Using the number of siblings as an instrument in an entrepreneurship context has an additional drawback: the availability of (inherited) resources – per child – could also have a direct effect on the child's ability to invest in a new business, thereby diluting any capital constraints and thus increasing business earnings (Parker and Van Praag, 2006). We address this critique in our robustness analyses, where we find that the estimation results are invariant to the inclusion of a direct measure of assets in the earnings equation.[19]

To assess the credibility of the results that will be obtained by using the selected identifying instruments, we check whether the proposed set of identifying instruments is (i) of sufficient quality and (ii) valid, and (iii) whether instrumentation is relevant at all. The results from the tests of validity and relevance do critically depend on the choice of regressors to be used in the second-stage earnings equation (see below). All outcomes support the use of this set of identifying instruments as being of sufficiently high quality, validity and relevance.[20] Besides, as we shall see in the next section, the basic result pertaining to the difference in returns to education between entrepreneurs and employees remains qualitatively the same, irrespective of whether or not education is instrumented.

To estimate the determinants of occupational choice – i.e., entrepreneurship versus employment – from which we can assess whether or not education affects this choice, we estimate probit equations where the dependent variable is occupational status, measured in three different ways. We estimate this relationship with and without control variables in a random effects framework. Also in this case, education may be an endogenous variable (people who wish to become entrepreneurs would attain higher or lower schooling levels than others). Therefore, once again, we also run a version of the model where education is instrumented by means of the same set of identifying instruments as is used in the income equations.

## 5. EVIDENCE

Table 2 reports the benchmark results from estimating our five specifications without control variables. Column (1) shows that the conditional correlation between an entrepreneur's income and her education level is 0.094. In other words, on average, each additional year of education increases an entrepreneur's earnings by a significant 9.4%. This is in line with Hypothesis 1. The results from the second specification in Column (2) reveal that the

[19] The measure of assets is excluded from the basic set of regressions since it is available for fewer years, and would therefore limit the sample size.

[20] The set of identifying instruments is also tested to be valid when capital-constraint related variables, such as residence value, stock value, value of assets, value of inheritances and total savings, were included in the earnings equation. This renders additional support for the validity of the identifying instrument 'number of siblings' that could perhaps affect earnings through its effect on capital constraints.

corresponding percentage for employees is somewhat lower at 8.1%. The third specification in Column (3) shows that the difference between what entrepreneurs and employees gain, on average, from an extra year of education is significant. [Insert Table 2 about here]

The last two Columns (4) and (5) indicate what the average individual in the sample who switches from wage employment (entrepreneurship) to entrepreneurship (wage employment) gains (loses) per year of education. As it turns out, the significant difference is 1.7%. In other words, when you are an entrepreneur you earn 1.7% higher returns on your education than when you are an employee. These results have been obtained without controlling for other individual covariates and with the log of annual income the as dependent variable. Panel B of Table 2 indicates that the results are very similar when applying the same specifications while using hourly income as the dependent variable.[21]

Panel A of Table 3 shows the estimation results upon inclusion of the discussed control variables into the regression, whereas 'general ability' is included as an additional regressor in Panel B of Table 3. The resulting pattern of findings is consistent with the picture drawn by Table 2, although slightly more pronounced. The significant premium for entrepreneurs *vis-à-vis* employees on the payoff of an additional year of education is around 1.5%, on average, in the random effects framework, amounting to 2% in the fixed effects framework. The 1.5%-premium is in accordance with previously obtained results using OLS-estimation on US data (see, for instance, Fredland and Little, 1981; Tucker 1985, 1987; Evans and Leighton, 1990; Robinson and Sexton, 1994). Adding general ability as a control to the regression does not decrease the premium for entrepreneurs (who also earn a premium on their general ability; see also Hartog *et al.*, 2009), on the contrary.

[Insert Table 3 about here]

The next step is to estimate all these specifications by using instrumental variables to cope with the possible endogeneity of education in these income equations, as discussed in Section 4. Table 4 shows the results of estimating the five specifications using IV.

[Insert Table 4 about here]

Again, the difference between Panels A and B is the inclusion of general ability as a control variable. These results reveal, as above, that the returns to education are (a) larger for entrepreneurs than for employees and (b) larger in an entrepreneurial spell for any individual than in a spell in wage employment. The results show that the estimated returns to education are much higher both for entrepreneurs and employees than when estimated without instrumentation. The increased estimate of the returns to education for employees is consistent with previous research, using various sets of identifying instruments (e.g., Ashenfelter *et al.*, 1999; Blackburn and Neumark, 1993). A novel finding is the greater jump in the returns to education for entrepreneurs from 6.4 to 17.6 per cent.

Overall, the results in Tables 2-4 thus conform that neither selectivity, nor the omission of control variables, including general ability, nor the endogenous nature of education in income equations is the driving force behind the higher returns to education for entrepreneurs versus employees. We conclude from these

[21] For this reason, in what follows, we shall only tabulate the results for annual income (the others are available upon request).

results that the returns to education are significantly and substantially higher for entrepreneurs than for employees, in support of Hypothesis 2.

This relates to the next issue: why is education more valuable for entrepreneurs than for employees? The suggestion implied by Hypothesis 3 is a control-based explanation. That is, a straightforward organization-oriented argument could be that entrepreneurs have more freedom than employees to optimize their employment of assets, such as human capital obtained through education. We explore this control-related explanation for the higher returns to education for entrepreneurs versus employees indirectly by testing whether individuals with an internal locus of control generate higher returns from their education than their external counterparts.

Table 5 reports the results for the same specifications as provided in Table 3, but now upon the inclusion of the standardized locus-of-control variable, *Locus*, its interaction with occupational status and education, *Locus*Occupational status* and *Locus*Education*, as well as the three-way interaction of *Locus*Education*Occupational status*.[22] If differences between entrepreneurs and employees in the extent to which they can employ their control would explain the premium of entrepreneurs in the returns to education, we should find a significantly positive difference between entrepreneurs and employees for the interacted variable of education and locus of control. Moreover, the 'raw' difference in returns to education between entrepreneurs and employees should become smaller and/or less significant.

[Insert Table 5 about here]

We find, indeed, that the returns to education are higher for individuals with a more internally oriented locus of control than for individuals with an external locus of control. However, this holds true for entrepreneurs only. The coefficient pertaining to the three-way interaction is significantly positive in all equations. Moreover, the overall difference in the returns to education between entrepreneurs and employees has become insignificant. We conclude that control matters, offering a plausible explanation for the higher returns to education obtained by entrepreneurs. This is in support of Hypothesis 3. Entrepreneurs who feel more in control of their environment extract higher returns from their investment in education. We do not find the same result for employees, because the organizational constraints they experience possibly prevent them from using their control profitably.

To close the circle, our next and final step is to analyze the effect of education on occupational choice, as reflected in Hypothesis 4 and Hypothesis 4alt. A first glance at Table 6 reveals that the effect of education on the choice to become an entrepreneur instead of a wage employee is negative in all specifications and panels.[23] The marginal effect of an extra year of education decreases the probability of entrepreneurship by between one and four percentage points.

[Insert Table 6 about here]

[22] IV-estimation is left out since it does not render credible results upon the inclusion of all these interactions, resulting in four endogenous variables: (1) *Education*, (2) *Education*Entrepreneurship*, (3) *Education*Locus of control*, and (4) *Education*Entrepreneur*Locus of control*.

[23] The IV-results are not shown because the Wald tests of exogeneity (Wooldridge, 2002: 472-477) all rejected the hypothesis that the difference between the IV-results and the ones tabulated were significantly different.

The first panel shows the effects on the probability that someone in the sample has been observed at least once as an entrepreneur in the sample period, while the standard errors are corrected for the fact that individuals are observed for more than once in most cases (standard errors are based on clusters per individual). Time-varying covariates are not included as control variables in this specification. The second panel provides the results from a random effects panel probit regression, where the dependent variable is one for spells in entrepreneurship and zero for spells in wage employment. The third panel is most comparable to the results obtained in the literature so far (see Van der Sluis *et al.*, 2008, for an overview), and results from estimating a probit regression where the occupational status in the year 2000 (a random choice, the last observed year) is the dependent variable. Again, time-varying covariates are not included as control variables in this specification.

The lowest estimates (of even less than one percentage point) are shown in Column (1), where the regressions include no control variables. The results in Column (2), where control variables are included, and Column (3), where general ability has also been added, do not differ much. All effects in these two columns are between 2 and 4 per cent, being significantly negative. Apparently, higher levels of education are, if anything, driving people out of entrepreneurship (although the returns to education are higher in entrepreneurial spells than in spells of wage employment). So, people either perceive education as less valuable for entrepreneurship or people with higher levels of education are less motivated to become entrepreneurs, in line with the Bill Gates effect and Hypothesis 4alt. Perhaps, the educational system teaches them to become employees or, perhaps, many individuals are motivated by other issues than income. Anyway, the choice behavior is inconsistent with (information about) higher returns to education in entrepreneurship than in wage employment in the context of assuming income-maximizing individuals. As was noted, indeed, the literature has provided, so far, quite wide support for the fact that the choice for entrepreneurship is not primarily driven by income maximization, which is referred to as the 'returns to entrepreneurship puzzle' (Benz and Frey, 2008; Blanchflower and Oswald, 2008; Hamilton, 2000; Hartog *et al.*, 2009; Hyytinen *et al.*, 2008; Parker, 2004; Van Praag and Versloot, 2007). Since we study the effect of education on the proceeds from and choice for entrepreneurship, we can suggest a solution for this particular demonstration of the puzzle: the Bill Gates effect. Future research is needed to further explore this suggestion and other possible explanations.

**Robustness analyses**

Of course, we cannot exclude that the above findings are due to misspecification or alternative explanations. Hence, this subsection is devoted to exploring four plausible alternative explanations for the key result that the estimated returns to education are significantly and substantially higher for entrepreneurs than for employees. Where appropriate, we checked the validity of a possible alternative explanation by running additional analyses based on the fixed effects specifications – i.e., specifications (4) and (5) in Table 3.[24]

*Risk premium*

[24] The tables on which the conclusions are based are available upon request.

The first possible explanation relates to the question as to whether the difference in returns to education between entrepreneurs and employees can be attributed to a *risk premium* required by higher educated entrepreneurs. More highly educated individuals would perhaps require a higher risk premium for being an entrepreneur if higher educated individuals experience more additional income risk as an entrepreneur compared to employees *vis-à-vis* lower educated individuals. This could perhaps be the case if higher educated individuals have better outside opportunities, and are thus more likely to venture into projects with a higher expected return. If such projects are at the same time more risky, they may require an additional risk premium.

The check proceeds in three steps. First, we regress the individual (time) variances of the residuals of the income equations presented above on entrepreneurs' education levels and control variables.[25] We find no significant education effect. Hence, the variance over time of an individual's entrepreneurial income, our indicator of risk, is not higher for more highly educated individuals, all else equal. Second, we estimate the same equation for employees, revealing a significant positive coefficient for education. Third, the variance in earnings is lower for employees than for entrepreneurs, at all possible education levels. These three observations together imply that entrepreneurs are exposed to more income risk than employees, but that the difference is a decreasing rather than an increasing function of education. Thus, we conclude that the higher returns to education for entrepreneurs are not a kind of risk premium.

*Underreporting of earnings*

The second possible explanation pertains to recent evidence that entrepreneurs underreport their incomes more than employees do (Levitt and Dubner, 2006; Feldman and Slemrod, 2007). Underreporting is not a problem for the estimation of the returns to education, as long as underreporting and education are unrelated. However, there is evidence by Lyssiotou, Pashardes and Stengos (2004) showing that this might not be the case. Blue-collar entrepreneurs underreport their incomes to a higher degree than white-collar entrepreneurs. Since blue-collar entrepreneurs have a lower average level of education than white-collar entrepreneurs, the returns to education estimate for the total population of entrepreneurs could be upward biased. This, in turn, might explain the difference in returns to education between employees and entrepreneurs that we established. If underreporting has an effect on our estimation results, we would expect that the difference in returns to education between entrepreneurs and employees would be smaller for the group of white-collar workers. However, this is not the case.[26]

*Returns to capital*

As a third explanation, we address the issue raised by Fairlie (2005b) that some entrepreneurs in the NLSY might have erroneously included the returns to (business) capital in their reported income. This could explain the result if more highly educated entrepreneurs have higher returns to capital than lower educated

[25] For this purpose, since the analysis requires time series of an individual's income, we define an entrepreneur as someone who has ever been observed as an entrepreneur and an employee as someone who has ever been observed as an employee but never as an entrepreneur.

[26] Using only the subset of white collar workers does not render valid results for the instrumentation of the education variable. The conclusion is based on the results obtained without using instruments for education.

entrepreneurs. As proposed by Fairlie (2005b), income possibly needs to be adjusted for entrepreneurs who receive a business income from unincorporated businesses (others receive a 'wage' from their incorporated business that excludes returns to capital). Following Fairlie (2005b), the adjustment implies that five per cent of their total business value is subtracted from their business incomes. As was indicated above, the variable 'total business value' has not been measured in every year, resulting in a smaller sample size. Therefore, we compare the estimation results obtained while adjusting entrepreneurial incomes with the results obtained for the same subsample without the correction in the income measure. The difference in the returns to education between entrepreneurs and employees becomes, if anything, larger instead of smaller upon adjustment for capital returns.

*Professional workers*

The fourth and final possible explanation we want to explore here is based on the idea that professional workers such as lawyers and medical doctors have high earnings, are highly educated and are often entrepreneurs. This might drive the result. However, excluding professional workers, including accountants, actuaries, pharmacists, health-diagnosing occupations, therapists, lawyers, dieticians, and architects, from the sample does not decrease the estimated difference between entrepreneurs and employees.

## 6. CONCLUSION

### Contributions

This study's aim was to answer three questions: How valuable is education for entrepreneurs' incomes as compared to employees (the "what" question)?; If we find a significant difference between the returns to education for entrepreneurs and employees, can we find an explanation for the difference (the "why" question)?; and Does education affect peoples' occupational choices accordingly (the "who" question)? We find rather consistent answers to each of these questions, which are robust against various alternative explanations.

To answer the first question, we estimated income equations by means of random effects for entrepreneurs and employees separately and in a combined fashion. The combined sample of entrepreneurs and employees also enabled us to estimate the difference in returns to education by means of fixed effects, where estimates of the coefficient of interest are based on those individuals who have moved at least once in the observed period in or out of entrepreneurship. All these equations have been estimated with(out) controls, controlling for general ability as well as by means of instrumental variables. The latter addresses the endogenous nature of education in an income equation. The fixed effects estimates are meant to control for the possible endogeneity of occupational choices in an income equation. All results (see Tables 2-4) point in the same direction: as an entrepreneur the returns to education are between 2 and 13 per cent higher than as an employee. The significant result turned out not to vanish, on the contrary, upon estimating fixed effects (thereby accounting for selectivity), upon including general ability as a control (thereby diminishing ability bias) or upon instrumenting education (thereby accounting for endogeneity). We compare our results pertaining to employees to previous studies and conclude that our estimates are in line with the ones reported there. For entrepreneurs, there are few comparable previous studies. The exceptions are Parker and Van Praag (2006) and Van der Sluis *et al.* (2004, 2007), whose findings are consistent with the current results.

The explanation for the significantly higher returns to education for entrepreneurs relative to employees supported by the test outcomes that utilize the locus-of-control concept is that entrepreneurship gives better opportunities to optimize the use of and returns from one's education, i.e., higher levels of personal control. This result is consistent with recent insights and evidence in support of higher levels of personal control and autonomy in entrepreneurship than in wage employment (e.g., Benz and Frey, 2008; Douhan and Van Praag, 2009; Hyytinen *et al.*, 2008) and organization theory (e.g., Dobrev and Barnett, 2005; Sørensen, 2007; Özcan and Reichstein, 2009). The higher returns to education for entrepreneurs are due to fewer (organizational) constraints faced by entrepreneurs when optimizing the profitable employment of their education. Entrepreneurs can freely decide to engage in those activities where their human capital is likely to generate high returns. In contrast, as an employee, an individual is bounded by organizational processes and structures. Wage employees are constrained inside the "iron cages" of organizations owned by others.

The choice for entrepreneurship is not positively, but even negatively associated with education. The expectedly higher returns in entrepreneurship for the higher educated are apparently not incorporated in their occupational decision. People either perceive education as less valuable for entrepreneurship or people with higher levels of education are less motivated to become entrepreneurs, in line with the Bill Gates effect. Anyway, the choice behavior is inconsistent with (information about) higher returns to education for entrepreneurs if we assume that labor market decisions are based, primarily, on income maximization. Previous studies have shown that this latter assumption is, at least, questionable, which is referred to as the 'returns to entrepreneurship puzzle' (e.g., Benz and Frey, 2008).

**Limitations**

This is one of the first studies aiming at estimating the returns to education for entrepreneurs relative to employees, while accounting for endogeneity of education and self-selection. Our estimates only pertain to a specific US cohort. Although the significant results are very consistent, they do vary widely (the point estimates of the premium on the returns to education in entrepreneurship over wage employment varies between two and thirteen percentage points). Moreover, the instruments that we have used are certainly not without critique, although all tests we performed are passed. Moreover, we only account for self-selection insofar determined by fixed individual unobserved characteristics, not for temporary unobserved circumstances that increase the probability of entrepreneurship. As always, more research is required to study remaining questions: Is the observation that the (downward) bias in the estimated returns to education without using IV is larger for entrepreneurs than for employees a finding that would also result when using other instruments and datasets (see also Van Der Sluis and Van Praag, 2007)? Why would this be the case? Will other studies support the conclusion that the returns to education are larger for entrepreneurs than for employees? Will this turn out to be a US phenomenon or will the same results be obtained for other parts of the world, such as Europe? Would other studies using panel data also find that the effect of education on the probability to be (ever) observed as an entrepreneur is negative (where the only alternative is wage employment)? And, is the control explanation also valid when tested using a different and more direct operationalization than 'locus-of-control beliefs'? Can we find alternative explanations, not addressed in this study, that are responsible for the higher returns to education

for entrepreneurs than for employees? These questions point to interesting avenues for future research, inspired by the current study's limitations.

**Implications**

The limitations pertaining to this study (and remaining questions), however, do not prevent us from drawing conclusions and stressing implications based on our unambiguous answers to the three questions posed. However, before doing so, we elaborate on the remaining assumptions that are required to translate the estimation results into policy implications. First of all, taking into account that entrepreneurship is economically valuable (Van Praag and Versloot, 2007), we assume that the difference between the social and private returns to education of entrepreneurial activity is at least as large as this difference is for employees. A successful entrepreneur is, for example, more likely to influence competition in a market positively, create employment, innovation and growth than an employee. Since all these performance measures, such as growth, employment creation and innovation, are strongly correlated with incomes (Van Der Sluis *et al.*, 2008), we can safely assume that higher levels of education in entrepreneurship do not only – more rapidly than for employees – lead to higher incomes, but also to more economic value creation. Second, we assume that individuals invest in formal schooling at a stage in their lives at which they do not know yet, in general, whether they will become entrepreneurs or employees, or a (sequential) combination of both. As a consequence, investment in schooling is not motivated by the specific expected returns when belonging to the group of entrepreneurs, but by some (weighted) average expected returns of both employment modes. Our third assumption, based on our own results, is that individuals, policymakers, bankers and other parties involved do not have more insight in the returns to education than we as researchers have. This implies that individuals and policymakers share the common opinion that the returns to education for employees are at least as high as, or lower than, these of entrepreneurs.

Given these rather broad assumptions, the implications of this study are fourfold. First, as more highly educated entrepreneurs seem to perform better on average and this is not incorporated in people's occupational choices, it seems value enhancing to stimulate people with higher levels of education to become entrepreneurs, since, in particular, successful entrepreneurs (who often have higher levels of education) create economic value. Second, and in the same vein, it seems value enhancing to stimulate people who wish to become entrepreneurs to go to school first and not follow the ideas propagated by the relatively few billionaire dropouts, such as Richard Branson and Bill Gates. Third, it would be interesting to further investigate how firms can be organized such that human capital renders higher returns as is the case for entrepreneurs. Apparently, an avenue of organizing towards more value creation seems the assignment of more control to workers, a conclusion that aligns well with the literature on high-commitment HRM practices (e.g., Huselid, 1995). Fourth, it seems valuable to further investigate how one can best develop skills and knowledge within educational programs that enhance entrepreneurial performance. Many programs are run and supported financially by governments to teach entrepreneurship in schools. However, little is known about how to proceed. Now that we know that formal education contributes to the development of entrepreneurial performance in general, the next question is: How can one build entrepreneurial competencies and relevant knowledge efficiently in entrepreneurship

courses? A literature on the evaluation of entrepreneurship education has only recently emerged (see, for instance, Oosterbeek, Van Praag and IJsselstein, 2009).

**REFERENCES**


Angrist, J. and A. Krueger (1991), Does compulsory school attendance affect schooling and earnings?, *Quarterly Journal of Economics* 106(4), 979-1014.

Angrist, J. and J. Pischke, 2008, *Mostly Harmless Econometrics*, Princeton University Press, Princeton NJ.

Ashenfelter, O., C. Harmon and H. Oosterbeek (1999), A review of estimates of the schooling/earnings relationship, with tests for publication bias, *Labour Economics* 6(4), 453-470.

Ashenfelter, O. and A. Krueger (1994), Estimates of the returns to schooling from a new sample of twins, *American Economic Review* 84(5), 1157-1173.

Backes-Gellner, U., and A. Werner (2007), Entrepreneurial signalling via education: A success factor in innovative start-ups, *Small Business Economics* 29, 173-190.

Becker, G. (1964) *Human Capital*: *A theoretical and empirical analysis with special reference to education*, Chicago, University of Chicago Press (3rd edition, 1993).

Benz, M. and B. Frey (2008), Being independent is a great thing: Subjective evaluations of self-employment and hierarchy, *Economica* 75(298), 362-383.

Black, S., P. Devereux and K. Salvanes (2005), The more the merrier? The effect of family composition on children's education, *Quarterly Journal of Economics* 120(2), 669-700.

Blackburn, M. and D. Neumark (1993), Omitted-ability bias and the increase in the return to schooling, *Journal of Labor Economics* 11(3), 521-544.

Blanchflower, D. and A. Oswald (1998), What makes an entrepreneur?, *Journal of Labor Economics* 16, 26-60.

Bonjour, D., L. Cherkas, J. Haskel, D. Hawkes and T. Spector (2003), Returns to education: Evidence from U.K. twins, *American Economic Review* 93(5), 1799-1812.

Boone, C. and B. De Brabander (1993), Generalized versus specific locus of control expectancies of chief executive officers, *Strategic Manangement Journal* 14, 619-626.

Boone, C., B. De Brabander and A. van Witteloostuijn (1996), CEO locus of control and small firm performance: An integrative framework and empirical test, *Journal of Management Studies* 33(5), 667-699.

Boone, C., W. Van Olffen and A. Van Witteloostuijn (2005), Team locus-of-control composition, leadership structure, information acquisition, and financial performance: A business simulation study, *Acadamy of Management Journal* 48, 889-909.

Brockhaus, R (1980), The effect of job dissatisfaction on the decision to start a business, *Journal of Small Business Management* 18(1), 37-43.

Card, D. (1999). The causal effect of education on earnings, In *Handbook of Labor Economics, Volume 3A*, ed. O. Ashenfelter, 1801–63. Amsterdam, New York and Oxford: Elsevier Science, North-Holland.

Davidsson, P. and B. Honig (2003), The role of social and human capital among nascent entrepreneurs, *Journal of Business Venturing* 18(3), 301-331.

De Haan, M. (2009), Birth order family size and educational attainment, forthcoming in *Economics of Education Review*.

Deaton, A. (2000), *The Analysis of Houshold Surveys*, Johns Hopkins University Press, Washington D.C.

Dobrev, S.D. and W.P. Barnett (2005), Organizational roles and transition to entrepreneurship, *Academy of Management Journal* 48: 433-449.

Douhan, R. and M. van Praag (2009), Entrepreneurship, wage employment and control in an occupational choice framework, *Tinbergen Institute Discussion Paper*, Amsterdam.

Dushnitsky, G. (2009), A cross-country study of entrepreneurial optimism and valuations, *University of Pennsylvania Working Paper*, Philadephia.

Evans, D. and L. Leighton (1990), Small business formation by unemployed an employed workers, *Small Business Economics* 2(4), 319-330.

Fairlie, R. (2005a), Entrepreneurship and earnings among young adults from disadvantaged families, *Small Business Economics* 25(3), 223-236.

Fairlie, R. (2005b), Self-employment, entrepreneurship, and the NLSY79, *Monthly Labor Review* 128(2), 40-47.

Feldman, N. and J. Slemrod (2007), Estimating tax non-compliance with evidence from unaudited tax returns, *Economic Journal* 117(518), 327-352.

Fredland, J. and R. Little (1981), Self-employed workers: Returns to education and training, *Economics of Education Review* 1(3), 315-337.

Griliches, Z. (1977), Estimating the returns to schooling: Some econometric problems, *Econometrica* 45(1), 1-22.

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

Hansen, K., J. Heckman and K. Muller (2004), The effect of schooling and ability on achievement test scores, *Journal of Econometrics* 121, 39-98.

Harmon, C. and I. Walker (1995), Estimates of the economic returns to schooling for the United Kingdom, *American Economic Review* 85(5), 1278-1286.

Harmon, C., H. Oosterbeek and I. Walker (2003), The returns to education: Microeconomics, *Journal of Economic Surveys* 17, 115-156.

Hartog, J. and H. Oosterbeek (2007), What should you know about private returns to education? In Hartog, J and Maassen van den Brink, H., eds, *Human Capitial: Moving the Frontier*. Cambridge University Press, Cambridge.

Hartog, J., M. Van Praag and J. Van Der Sluis (2009), If you are so smart, why aren't you an entrepreneur? Returns to cognitive and social ability: Entrepreneurs versus employees, forthcoming in the *Journal of Eocnomics and Management Strategy*.

Hayward, M., D. Shepherd and D. Griffin (2006), A hubris theory of entrepreneurship, *Management Science* 52(2), 160-172.

Heckman, J., Stixrud J. and Urzua S. (2006), The effects of cognitive and noncognitive abilities on labor market outcomes and social behavior, *Journal of Labor Economics*, 24(3), 411-481.

Henrekson, M. and D. Johansson (2009), Gazelles as job creators: a survey and interpretation of the evidence, forthcoming in *Small Business Economics*.

Hundley, G. (2001), Why and when are the self-employed more satisfied with their work?, *Industrial Relations* 40(2), 293-317.

Huselid, M. (1995), The impact of human resource management practices on turnover, productivity, and corporate financial performance, *Academy of Management Journal* 38(3), 635-672.

Hvide, H. (2009), The quality of entrepreneurs, *Economic Journal* 119, 1010–1035.

Hyytinen, A., P. Ilmakunnas and O. Toivanen (2008), The return to entrepreneurship puzzle, *Working Paper*, Helsinki School of Economics.

Ireland, R, C. Reutzel and J. Webb (2005), From the editor: Entrepreneurship research in *AMJ* – What has been published and what might the future hold?, *Academy of Management Journal* 48, 556-564.

Kawagushi, D. (2006), Compensating wage differentials among self-employed workers: Evidence from job satisfaction scores, *Working Paper Hitotsubashi University*, Tokyo.

Kirzner, I. (1973), *Competition and Entrepreneurship*, Chicago: University of Chicago Press.

Kirzner, I. (1997), Entrepreneurial discovery and the competitive market process: An Austrian approach, *Journal of Economic Literature* 35(1), 60–85.

Levitt, S. and S. Dubner (2005), *Freakonomics: The rogue economist explores the hidden side of everything*, HarperCollins Publishers, New York.

Lowe, R. and A. Ziedonis (2006), Overoptimism and the performance of entrepreneurial firms, *Management Science* 52(2), 173-186.

Lyssiotou, P., P. Pashardes and T. Stengos (2004), Estimates of the black economy based on consumer demand approaches, *Economic Journal* 114(497), 622-640.

Marshall, A. (1930), *Principles of Economics*, Macmillan and Co., London (first edition 1890).

Mincer, J. (1958), Investment in human capital and personal income distribution, *Journal of Political Economy* 66(4), 281-302.

Mincer, J. 1974. *Schooling, Experience, and Earnings*, National Bureau for Economic Research, Cambridge, Mass.

Nicolaou, N., S. Shane, L. Cherkas, J. Hunkin and T.D. Spector (2008), Is the tendency to engage in entrepreneurship genetic?, *Management Science* 54, 167-179.

Oosterbeek, H., M. Van Praag and A. IJsselstein (2009), The impact of entrepreneurship education on entrepreneurship skills and motivation, forthcoming in *European Economic Review*.

Oreopoulos, P. (2006), Estimating average and local average treatment effects of education when compulsory schooling laws really matter, *American Economic Review*, 96(1), 152-175.

Özcan, S. and T. Reichstein (2009), Transition to entrepreneurship from the public sector: Predispositional and contextual effects, *Management Science* 55, 604-618.

Parker, S. (2004), *The Economics of Self-employement and Entrepreneurship*, Cambridge University Press, Cambridge.

Parker, S. and M. Van Praag (2006), Schooling, capital constraints and entrepreneurial performance: The endogenous triangle, *Journal of Business and Economic Statistics* 24(4), 416-431.

Parker, S. and Van Praag, M. (2007) The entrepreneur's mode of entry: Business takeover or new venture start?, *Working Paper Max Planck Institute for Economics*, Jena.

Riley, J. (2002), Weak and strong signals, *Scandinavian Journal of Economics* 104 (2), 213-36.

Robinson, P. and E. Sexton (1994), The effect of education and experience on self-employment success, *Journal of Business Venturing* 9(2), 141-156.

Rotter, J. (1966), Generalized expectancies for internal versus external control of reinforcement, *Psychological Monographs* 80(1), 1-28.

Shane, S. (2006), Introduction to the focused issue on entrepreneurship, *Management Science* 52, 155-159.

Shane, S. and S. Venkataraman (2000), The promise of entrepreneurship as a field of rsearch, *Academy of Management Review* 25: 217-226.

Smith, A. (1904:) *An Inquiry into the Nature And Causes of the Wealth of Nations*, Edwin Cannan, ed., Methuen & Co, London (first published in 1776).

Sørensen, J. (2007), Bureaucracy and entrepreneurship: Workplace effects on entrepreneurial entry, *Administrative Science Quarterly*, 52, 387-412.

Spence, A. (1973), Job market signaling, *Quarterly Journal of Economics* 87(3), 355-374.

Taylor, M, (1996), Earnings, independence or unemployment: Why become self-employed?, *Oxford Bulletin of Economics and Statistics* 58, 253–266.

Tucker, I. (1985), Use of the decomposition technique to test the educational screening hypothesis, *Economics of Education Review* 4(4), 321-326.

Tucker, I. (1987), The impact of consumer credentialism on employee and entrepreneur returns to higher education, *Economics of Education Review* 6(1), 35-40.

Van Der Sluis, J. and M. Van Praag (2004), Economic returns to education for entrepreneurs: The development of a neglected child in the economics of education, *Swedish Economic Policy Review* 11(2), 183-225.

Van Der Sluis, J. and M. Van Praag (2007), Identifying the difference in returns to education for entrepreneurs and employees: Identification by means of changes in compulsory schooling laws, *Working Paper University of Amsterdam*, Amsterdam.

Van Der Sluis, J., M. Van Praag and W. Vijverberg (2008), Education and entrepreneurship selection and performance: A review of the empirical literature, *Journal of Economic Surveys*, 22(5), 795-841.

Van Praag, M. and P. Versloot (2007), What is the value of entrepreneurship? A review of recent research, *Small Business Economics* 29(4), 351-382.

Weick, K. (1996), Drop your tools: An allegory for organizational studies, *Administrative Science Quarterly* 41(2), 301-313.

Wijbenga F. and A. van Witteloostuijn (2007), Entrepreneurial locus of control and competitive strategies: The moderating effect of environmental dynamism, *Journal of Economic Psychology* 28(5), 566-589.

Wooldridge, J. (2002) *Econometric Analysis of Cross Section and Panel Data*, MIT Press, Boston, Mass.

Wu, B. and A.M. Knott (2006), Entrepreneurial risk and market entry, *Management Science* 52(9), 1315-1330.

Zott, C. and R. Amit (2007), Business model design and the performance of entrepreneurial firms, *Organization Science* 18(2), 181-199.

**Table 1. Descriptive statistics of the key and control variables by occupational status***

| **Panel A – Key variables: Entrepreneurship, income and education** | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Entr=1 (N=4,083; n=1,355)** | | **Entr=0 (N=62,130; n=5893)** | | **All (N=66,213; n=5,608)** | | |
| | **Mean** | **Std Dev** | **Mean** | **Std Dev** | **Mean** | **Std Dev** | **N** |
| 1. Fraction entrepreneurs | | | | | 0.062 | 0.241 | 66,213 |
| 2. Percentage ever entrepreneur | | | | | 0.240 | 0.431 | 66,213 |
| 3. Duration entrepreneur spell (in yrs) | | | | | 3.281 | 3.048 | 66,213 |
| 4. Gross annual income ($) | 31,097 | 56,334 | 21,184 | 34,537 | 21,796 | 36,340 | 66,213 |
| 5. Gross hourly income | 14.10 | 26.53 | 10.28 | 15.85 | 10.52 | 16.73 | 66,213 |
| 6. Education in years (topcode 20 yrs) | 13.131 | 2.477 | 13.15451 | 2.491979 | 13.153 | 2.491 | 66,213 |
| 7. Locus of control (standardized) | 0.126 | 0.976 | -0.008 | 1.001 | 0.000 | 1.000 | 66,213 |
| **Panel B – Control variables** | | | | | | | |
| | **Entr=1 (n=3,025)** | | **Entr=0 (n=46,272)** | | **Entr=1 (n=3,025)** | | |
| | **Mean** | **Std Dev** | **Mean** | **Std Dev** | **Mean** | **StD** | **N** |
| 1. General ability | 0.015 | 0.945 | -0.001 | 1.003 | 0.000 | 1.000 | 62,880 |
| 2. Birth year | 1960 | 2.19 | 1960 | 2.18 | 1960 | 2.18 | 66,213 |
| 3. Age | 30.21 | 5.34 | 28.15 | 5.66 | 28.28 | 5.66 | 66,213 |
| 4. Hours worked per year | 2192 | 933 | 1950 | 692 | 1965 | 712 | 66,213 |
| 5. Gender (male=1) | 0.633 | | 0.517 | | 0.524 | | 66,213 |
| 6. Married (=1) | 0.629 | | 0.504 | | 0.512 | | 66,211 |
| 7. Not healthy (=1) | 0.039 | | .024 | | 0.025 | | 65,553 |
| 8. Education father (in years) | 12.15 | 3.45 | 11.74 | 3.47 | 11.77 | 3.47 | 60,270 |
| 9. Education mother (in years) | 12.01 | 2.46 | 11.51 | 2.66 | 11.55 | 2.65 | 62,863 |
| 10. Live in the South of US (=1) | 0.261 | | 0.327 | | 0.323 | | 63,025 |
| 11. Live outside big city, SMSA, (=1) | 0.221 | | 0.226 | | 0.225 | | 63,516 |
| 12. Hispanic (=1) | 0.049 | | 0.061 | | 0.060 | | 66,213 |
| 13. Black (=1) | 0.046 | | 0.111 | | 0.107 | | 66,213 |
| 14. Magazines in the parental hh (=1) | 0.741 | | 0.658 | | 0.663 | | 65,825 |
| 15. Library card in the parent hh (=1) | 0.763 | | 0.743 | | 0.744 | | 65,948 |
| 16. Stepparent in the parental hh (=1) | 0.055 | | 0.066 | | 0.066 | | 66,213 |
| 17. No of siblings in the parental hh | 3.189 | 2.101 | 3.289 | 2.195 | 3.282 | 2.190 | 66,155 |

*The values in the table represent averages over the period 1979-2000, where each year-sample includes only entrepreneurs and employees; hh = household.

**Table 2. The effect of education on income: No control variables**

| **Panel A: baseline; no controls; dependent variable = Log of annual income** | | | | | |
|---|---|---|---|---|---|
| Specification | (1) | (2) | (3) | (4) | (5) |
| Sample | Entr | Empl | All | All | All |
| Estimation Method | RE GLS | RE GLS | RE GLS | FE | FE clustered |
| **Estimates** | | | | | |
| Education | 0.0944<br>(.0098)*** | 0.0810<br>(.0022)*** | 0.0816<br>(.0021)*** | | |
| Entrepreneur | | | .1674<br>(.1015)* | 0.1408<br>(.1044) | 0.1408<br>(.1384) |
| Education*Entrepreneur | | | 0.0137<br>(.0067)** | 0.0165<br>(.0070)** | 0.0165<br>(.0095)* |
| Income regr includes controls* | No | No | No | No | No |
| Income regr includes general ability | No | No | No | No | No |
| R-sq within | 0.1425 | 0.4741 | 0.4431 | 0.4431 | 0.4431 |
| R-sq between | 0.4162 | 0.6376 | 0.6362 | 0.5550 | 0.5550 |
| R-sq overall | 0.2927 | 0.5328 | 0.5073 | 0.4638 | 0.4638 |
| # Observations | 4,083 | 62,130 | 66,213 | 66,213 | 66,213 |
| # Individuals | 1,355 | 5,893 | 5,916 | 5,916 | 5,916 |
| **Panel B: baseline; no controls; dependent variable = Log of hourly income** | | | | | |
| Specification | (1) | (2) | (3) | (4) | (5) |
| Sample | Entr | Empl | All | All | All |
| Estimation Method | RE GLS | RE GLS | RE GLS | FE | FE clustered |
| Education | 0.0926<br>(.0095)*** | 0.0808<br>(.0020)*** | 0.0812<br>(.0020)*** | | |
| Entrepreneur | | | 0.0726<br>(.0981) | 0.0352<br>(.1009) | 0.0352<br>(.1339) |
| Education* Entrepreneur | | | 0.0126<br>(.0063)** | 0.0163<br>(.0068)** | 0.0163<br>(.0092)* |
| Income regr includes controls* | No | No | No | No | No |
| Income regr includes general ability | No | No | No | No | No |
| R-sq within | 0.0043 | 0.0547 | 0.0457 | 0.0458 | 0.0458 |
| R-sq between | 0.0901 | 0.3343 | 0.3326 | 0.1792 | 0.1792 |
| R-sq overall | 0.0418 | 0.1791 | 0.1604 | 0.0803 | 0.0803 |
| # Observations | 4,083 | 62,130 | 66,213 | 66,213 | 66,213 |
| # Individuals | 1,355 | 5,893 | 5,916 | 5,916 | 5,916 |

Significance levels: * 10%; ** 5%; and *** 1%. Robust standard errors are between brackets. Entr = Entrepreneur; Empl = Employee.

*In the 'no control' specification, the only control variable, besides the constant term, is 'Number of hours worked' (and its interaction with 'Occupational status' in specification (3), (4) and (5)).

**Table 3. The effect of education on income: Including control variables***

| **Panel A: baseline; including controls; dependent variable = Log of annual income** | | | | | |
|---|---|---|---|---|---|
| Specification | (1) | (2) | (3) | (4) | (5) |
| Sample | Entr | Empl | All | All | All |
| Estimation Method | RE GLS | RE GLS | RE GLS | FE | FE clustered |
| **Estimates** | | | | | |
| Education | 0.0644<br>(.0119)*** | 0.0544<br>(.0027)*** | 0.0542<br>(.0025)*** | | |
| Entrepreneur | | | -.4398<br>(.2778) | -.4165<br>(.2977) | -.4165<br>(.3282) |
| Education*Entrepreneurship | | | 0.0160<br>(.0081)** | 0.0223<br>(.0084)*** | 0.0223<br>(.0109)** |
| Income regr includes controls* | Yes | Yes | Yes | Yes | Yes |
| Income regr includes general ability | No | No | No | No | No |
| R-sq within | 0.2786 | 0.6886 | 0.6534 | 0.6538 | 0.6538 |
| R-sq between | 0.5481 | 0.6923 | 0.6907 | 0.5837 | 0.5837 |
| R-sq overall | 0.4510 | 0.6773 | 0.6530 | 0.5967 | 0.5967 |
| # Observations | 3,275 | 49,423 | 52,698 | 52,698 | 52,698 |
| # Individuals | 1,107 | 4,852 | 4,879 | 4,879 | 4,879 |
| **Panel B Estimates; Controls include general ability; Dependent variable: Log of Annual Income** | | | | | |
| Specification | (1) | (2) | (3) | (4) | (5) |
| Sample | Entr | Empl | All | All | All |
| Estimation Method | RE GLS | RE GLS | RE GLS | FE | FE clustered |
| **Estimates** | | | | | |
| Education | 0.0559<br>(.0130)*** | 0.0437<br>(.0029)*** | 0.0443<br>(.0027)*** | | |
| Entrepreneur | | | -.2939<br>(.2899) | -.3345<br>(.3102) | -.3345<br>(.3424) |
| Education* Entr | | | 0.0143<br>(.0087)* | 0.0204<br>(.0090)** | 0.0204<br>(.0116)* |
| General ability | 0.1069<br>(.0351)*** | 0.0834<br>(.0074)*** | 0.0846<br>(.0071)*** | | |
| General ability* Entr | | | 0.0365<br>(.0220)* | 0.0385<br>(.0224)* | 0.0385<br>(.0303) |
| Income regr includes controls* | Yes | Yes | Yes | Yes | Yes |
| Income regr includes general ability | Yes | Yes | Yes | Yes | Yes |
| R-sq within | 0.2798 | 0.6894 | 0.6545 | 0.6549 | 0.6549 |
| R-sq between | 0.5491 | 0.6985 | 0.6958 | 0.5763 | 0.5763 |
| R-sq overall | 0.4515 | 0.6820 | 0.6573 | 0.5959 | 0.5959 |
| # Observations | 3,109 | 47,336 | 50,445 | 50,445 | 50,445 |
| # Individuals | 1,052 | 4,583 | 4,607 | 4,607 | 4,607 |

Significance levels: * 10%; ** 5%; *** 1%. Robust standard errors are between brackets.

*Controls include all the variables discussed in the previous section, including a set of transformed year, birth year and age dummies according to the method proposed by Deaton (2000). General ability is not included as a regressor in panel A. Specifications (3) to (5) include also interacted terms of all these regressors and the occupational choice dummy 'entrepreneur'.

**Table 4. The effect of education on income: Including control variables and estimated by IV**

| **Panel A Base line; Including controls; Dependent variable: Log of Annual Income** | | | | | |
|---|---|---|---|---|---|
| Specification | (1) | (2) | (3) | (4) | (5) |
| Sample | Entr | Empl | All | All | All |
| Estimation Method | RE GLS | RE GLS | RE GLS | FE | FE clustered |
| **Estimates** | | | | | |
| Education | 0.1764 (.0552)*** | 0.1273 (.0118)*** | 0.1127 (.0107)*** | | |
| Entrepreneur | | | -1.009 (.4535)** | -1.284 (.4543)*** | -1.284 (.3471)*** |
| Education* Entr | | | 0.0705 (.0202)*** | 0.0827 (.0217)*** | 0.0827 (.0460)* |
| Income regr includes controls* | Yes | Yes | Yes | Yes | Yes |
| Income regr includes general ability | No | No | No | No | No |
| | | | | | |
| R-sq within | 0.2782 | 0.6886 | 0.6985 | 0.6981 | 0.6981 |
| R-sq between | 0.5080 | 0.6476 | 0.7002 | 0.6389 | 0.6389 |
| R-sq overall | 0.4119 | 0.6505 | 0.6801 | 0.6437 | 0.6437 |
| # Observations | 3,275 | 49,423 | 52,698 | 52,698 | 52,585 |
| # Individuals | 1,107 | 4,852 | 4,879 | 4,879 | 4,766 |
| **Panel B Estimates; Controls include general ability; Dependent variable: Log of Annual Income** | | | | | |
| Specification | (1) | (2) | (3) | (4) | (5) |
| Sample | Entr | Empl | All | All | All |
| | | | | | |
| **Estimates** | | | | | |
| Education | 0.2123 (.0552)*** | 0.1181 (.0163)*** | 0.0999 (.0146)*** | | |
| Entrepreneur | | | -1.260 (.4764)*** | -1.640 (.4826)*** | -1.640 (.4919)*** |
| Education* Entr | | | 0.1157 (.0254)*** | 0.1301 (.0279)*** | 0.1301 (.0631)** |
| General ability | 0.034 (.0788) | 0.0101 (.0183) | 0.0245 (.0164) | | |
| General ability* Entr | | | -0.0547 (.0243)** | -0.0609 (.0263)** | -0.0609 (.0612) |
| Income regr includes controls* | Yes | Yes | Yes | Yes | Yes |
| Income regr includes general ability | Yes | Yes | Yes | Yes | Yes |
| Estimation Method | RE GLS | RE GLS | RE GLS | FE | FE clustered |
| R-sq within | 0.2801 | 0.6894 | 0.6975 | 0.6966 | 0.6966 |
| R-sq between | 0.4851 | 0.6552 | 0.7050 | 0.6289 | 0.6289 |
| R-sq overall | 0.3919 | 0.6569 | 0.6842 | 0.6402 | 0.6402 |
| # Observations | 3,109 | 47,336 | 50,445 | 50,445 | 50,356 |
| # Individuals | 1,052 | 4,583 | 4,607 | 4,607 | 4,518 |

Significance levels: * 10%; ** 5%; *** 1%. Robust standard errors are between brackets.

*Controls include all the variables discussed in the previous section, including a set of transformed year, birth year and age dummies according to the method proposed by Deaton (2000). General ability is not included as a regressor in panel A. Specifications (3) to (5) include also interacted terms of all these regressors and the occupational choice dummy 'entrepreneur'. Instruments are described in the methodology subsection.

**Table 5. The effect of education on income: Including locus-of-control beliefs**

| **Panel A Base line; Including controls; Dependent variable: Log of Annual Income** | | | | | |
|---|---|---|---|---|---|
| Specification | (1) | (2) | (3) | (4) | (5) |
| Sample | Entr | Empl | All | All | All |
| Estimation Method | RE GLS | RE GLS | RE GLS | FE | FE clustered |
| Income regr includes controls* | Yes | Yes | Yes | Yes | Yes |
| Income regr includes general ability | No | No | No | No | No |
| Education | 0.0594 (.0123)*** | 0.0525 (.0027)*** | 0.0523 (.0025)*** | | |
| Entrepreneur | | | -0.4440 (.2862) | -0.4109 (.3063) | -0.4109 (.3381) |
| Education* Entrepreneur | | | 0.0106 (.0086) | 0.0168 (.0087)* | 0.0168 (.0110) |
| Internality of Locus of control (Locus) | 0.0860 (.0286)*** | 0.0331 (.0059)*** | 0.0327 (.0056)*** | | |
| Locus *Education (demeaned) | 0.0047 (.0114) | -0.0019 (.0024) | -0.0016 (.0023) | | |
| Locus*Entrepreneur | | | 0.0373 (.0183)** | 0.0327 (.0185)* | 0.0327 (.0250) |
| Locus*Entrepreneur*Education (demeaned) | | | 0.0170 (.0076)** | 0.0194 (.0079)** | 0.0194 (.0093)** |
| R-sq within | 0.2767 | 0.6885 | 0.6536 | 0.6540 | 0.6540 |
| R-sq between | 0.5508 | 0.6957 | 0.6942 | 0.5856 | 0.5856 |
| R-sq overall | 0.4534 | 0.6785 | 0.6544 | 0.5968 | 0.5968 |
| # Observations | 3,235 | 49,198 | 52,433 | 52,433 | 52,433 |
| # Individuals | 1,097 | 4,826 | 4,851 | 4,851 | 4,851 |
| **Panel B Estimates; Controls include general ability; Dependent variable: Log of Annual Income** | | | | | |
| Education | 0.0529 (.0134)*** | 0.0428 (.0029)*** | 0.0425 (.0027)*** | | |
| Entrepreneur | | | -0.2972 (.3007) | -0.3219 (.3213) | -0.3219 (.3538) |
| Education*Entrepreneur | | | 0.0090 (.0092) | 0.0147 (.0093) | 0.0147 (.0118) |
| Internality of Locus of control (Locus) | 0.0720 (.0294)** | 0.0230 (.0060)*** | 0.0227 (.0057)*** | | |
| Locus *Education (demeaned) | 0.0052 (.0117) | -0.0016 (.0024) | -0.0013 (.0023) | | |
| Locus*Entrepreneur | | | 0.0330 (.0188)* | 0.0279 (.0190) | 0.0279 (.0256) |
| Locus*Entrepreneur*Education (demeaned) | | | 0.0182 (.0078)** | 0.0203 (.0080)** | 0.0203 (.0095)** |
| General ability | 0.0974 (.0355)*** | 0.0800 (.0074)*** | 0.0808 (.0071)*** | | |
| General ability* Entrepreneur | | | 0.0363 (.0228) | 0.0414 (.0227)* | 0.0414 (.0304) |
| R-sq within | 0.2776 | 0.6893 | 0.6548 | 0.6551 | 0.6551 |
| R-sq between | 0.5507 | 0.6998 | 0.6972 | 0.5768 | 0.5768 |
| R-sq overall | 0.4530 | 0.6826 | 0.6581 | 0.5960 | 0.5960 |
| # Observations | 3,069 | 47,143 | 50,212 | 50,212 | 50,212 |
| # Individuals | 1,042 | 4,562 | 4,584 | 4,584 | 4,584 |

Significance levels: * 10%; ** 5%; *** 1%. Robust standard errors are between brackets.

*Controls include all the variables discussed in the previous section. General ability is not included as a regressor in panel A. Specifications (3) to (5) include also interacted terms of all these regressors and the occupational choice dummy 'entrepreneur'. Instruments are described in the methodology subsection.

**Table 6. The effect of education on occupational choice**

| **Panel A Dependent variable: Ever been Entrepreneur (dummy) [Clustered Probit, s.e. adjusted for clustering]** | | | | |
|---|---|---|---|---|
| Specification | (1) | (2) | (3) | (4) |
| | Marginal effects | Marginal effects | Marginal effects | Marginal effects |
| Education | -0.0088<br>(.0023)*** | -0.0191<br>(.0031)*** | -0.0166<br>(.0034)*** | -0.0171<br>(.0034)*** |
| General ability | | | -0.0172<br>(.0088)** | -0.0174<br>(.0089)** |
| Internality of locus of control | | | | 0.0076<br>(.0072) |
| Occupational choice regr includes controls* | No | Yes | Yes | Yes |
| Occupational choice regr includes general ability | No | No | Yes | Yes |
| # Observations | 66,213 | 52,698 | 50,445 | 50,212 |
| # Individuals | 5,916 | 4,879 | 4,607 | 4,584 |
| **Panel B Dependent variable: Entrepreneur spell in any year (dummy) [Panel Probit, s.e. adjusted for clustering]** | | | | |
| Specification | (1) | (2) | (3) | (4) |
| Education | -0.0073<br>(.0062) | -0.0384<br>(.0091)*** | -0.0313<br>(.0102)*** | -0.0343<br>(.0103)*** |
| General ability | | | -0.0648<br>(.0274)** | -0.0766<br>(.0275)*** |
| Internality of locus of control beliefs | | | | 0.0627<br>(.0209)*** |
| Occupational choice regr includes controls* | No | Yes | Yes | Yes |
| Occupational choice regr includes general ability | No | No | Yes | Yes |
| # Observations | 66,213 | 52,698 | 50,445 | 50,212 |
| # Individuals | 5,916 | 4,879 | 4,607 | 4,584 |
| **Panel C Dependent variable: Entrepreneurial spell observed in year 2000 (dummy) [Probit]** | | | | |
| Specification | (1) | (2) | (3) | (4) |
| Education | -0.0072<br>(.0026)*** | -0.0194<br>(.0036)*** | -0.0180<br>(.0039)*** | -0.0185<br>(.0039)*** |
| General ability | | | -0.0116<br>(.0099) | -0.0109<br>(.0100) |
| Internality of locus of control beliefs | | | | 0.0038<br>(.0082) |
| Occupational choice regr includes controls* | No | Yes | Yes | Yes |
| Occupational choice regr includes general ability | No | No | Yes | Yes |
| # Individuals | 3,934 | 3,259 | 3,125 | 3,111 |

Significance levels: * 10%; ** 5%; *** 1%. Robust standard errors are between brackets.

*Controls include all the variables discussed in the previous section, including a set of transformed year, birth year and age dummies according to the method proposed by Deaton (2000). The results in panels A and C have been obtained upon exclusion of time-varying covariates as control variables.