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The returns to education for opportunity entrepreneurs, necessity entrepreneurs, and paid employees^{*}

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Abstract:

We assess the relevance of formal education on the productivity of the self-employed, distinguishing between opportunity entrepreneurs, who voluntarily pursue a business opportunity, and necessity entrepreneurs, who lack alternative employment options. We expect differences in the returns to education between these groups due to different levels of control over the use of their human capital. The analysis employs the German Socio-Economic Panel and accounts for the endogeneity of education and non-random selection. Results indicate that the returns to a year of education for opportunity entrepreneurs are similar to the paid employees' rate of 8.8%, but 3 percentage points lower for necessity entrepreneurs. Pooling the two types of entrepreneurs tends to understate the value of education for opportunity entrepreneurs and may spark misguided hopes concerning necessity entrepreneurs. The results may also partly explain Europe/US differences in average entrepreneurial returns.

JEL classification: I20, J23, J24, J31, L26

Keywords: rate of return, human capital, productivity, salary wage differentials, entrepreneurship

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1 Introduction

While estimating the returns to education for wage workers is consistently one of the most prominent topics in labour economics, only recently have researchers attempted to assess how the returns to education compare for entrepreneurs (see Van der Sluis, Van Praag, & Vijverberg, 2008, for a survey). The research frontier concerning entrepreneurs is now taking into account the econometric challenges known from the literature concerning paid employees, such as the endogeneity of education and self-selection. These studies estimate that the returns to education are higher for entrepreneurs than for employees in the United States (Van Praag, Van Witteloostuijn, & Van der Sluis, 2013) and potentially also in the Netherlands (Parker and Van Praag, 2006; although these authors do not offer a direct comparison between the groups).

The emerging literature on the returns to education for entrepreneurs brings together two policy areas of central importance in modern, knowledge-driven economies, education and entrepreneurship. Education, which is known to be a crucial factor for productivity, is publicly provided or subsidised in most countries, including Germany, where schools, including universities, are usually public and charge no or low tuition fees. Entrepreneurship is under increasing scrutiny from academic researchers and policy makers primarily because of its importance for innovation and job creation. Accumulating evidence on positive external effects generated by entrepreneurial activity (Van Praag and Versloot, 2007) evokes interest among policy makers in promoting entrepreneurship.

The extent to which formal education increases entrepreneurial returns relative to an employee's returns determines the role of education in the individual decision to become an entrepreneur and therefore the impact of education on entrepreneurial activity in the economy. Adequate and differentiated estimates of the returns to education, which determine the tax

base generated, are important inputs for cost/benefit analyses of public expenditures for formal education. The literature provides some evidence that better educated entrepreneurs run larger firms and contribute more to economic value creation (e.g. Van Praag and Van Stel, 2013).

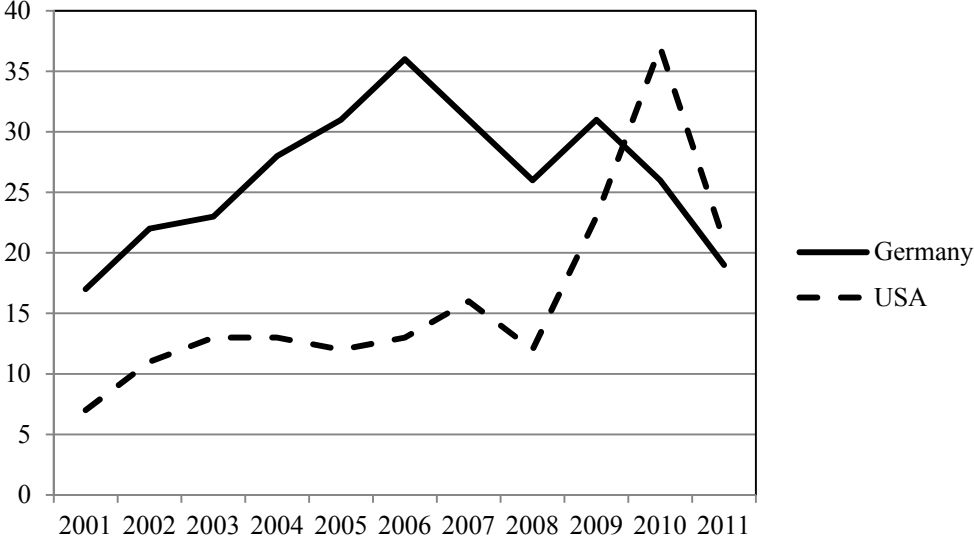
Entrepreneurs are a heterogeneous group, primarily because of large differences in their motivations to become entrepreneurs – you may think of the worlds between a street-food vendor and the creator of a high-tech start-up. Research in the economics of entrepreneurship distinguishes between opportunity entrepreneurs, who voluntarily engage in entrepreneurship to pursue a business opportunity they spotted, and necessity entrepreneurs, who are pushed into entrepreneurship because they lack employment alternatives (e.g. Reynolds, Bygrave, Autio, Cox, & Hay, 2002; Sternberg, Brixy, & Schlapfner, 2006; Ardagna and Lusardi, 2009; Block and Wagner, 2010). Figure 1 depicts the share of entrepreneurial activity that is necessity-driven in Germany and the US, based on data from the Global Entrepreneurship Research Association (2012); clearly indicating that this phenomenon deserves attention. Strikingly, in the US necessity entrepreneurship temporarily tripled between 2008 and 2010, presumably because of the large number of people who lost their jobs during the financial and economic crisis.¹

This paper is the first to extend the emerging literature about entrepreneurs' returns to education, which treats the entrepreneurs as a homogenous group, by investigating the heterogeneity in these returns between opportunity and necessity entrepreneurs and comparing them to those of paid employees. Opportunity entrepreneurs are considerably more likely to generate positive external effects through innovation than necessity entrepreneurs, who usually engage in conventional and established activities. Since the extant literature only

¹ In a New York Times article, former US Secretary of Labor Robert Reich (2010) refers to the seemingly paradoxical phenomenon of an increasing number of start-ups in the midst of the crisis and concludes that “millions of Americans had no choice but to try selling themselves”.

estimates the returns to education averaged over opportunity and necessity entrepreneurs, it possibly underestimates the returns to education for opportunity entrepreneurship, which would make this option appear less attractive for highly educated people in comparison to paid employment than it actually is and discourage potential opportunity entrepreneurs from allocating their human capital to its most productive use. With regard to education policy, the pooled estimates possibly understate the value of formal education for fostering successful opportunity entrepreneurship. In contrast, necessity entrepreneurs may have lower returns to education and might not be able to use their formal education productively at all.

Figure 1: Relative prevalence of necessity-driven entrepreneurial activity (in %)



Source: Own illustration based on data from the Global Entrepreneurship Research Association (2012). Data collection started in 2001.

Public policy concerning entrepreneurship implicitly distinguishes between opportunity and necessity entrepreneurs in many cases. The German government, for example, offers public start-up subsidies for unemployed persons, which effectively targets potential necessity entrepreneurs.² The goal of the programme is to take participants off of unemployment benefits. As both the start-up subsidies and formal education are public expenditures, it is

² Caliendo and Künn (2011) provide an evaluation of this programme.

important to know if the start-up programme allows participating nascent entrepreneurs to use their education productively. Germany is an interesting case not only because of these start-up subsidies, but also because there is concern that entrepreneurial activity in Germany is rather low in international comparison.³

In this study, we estimate the returns to education for opportunity and necessity entrepreneurs in comparison to paid employees using representative household panel data for Germany, the German Socio-economic Panel (SOEP). We apply fixed effects and IV estimations to account for the endogeneity of education and consider non-random selection into different employment states. In addition to socio-demographic control variables, we control for the Big Five personality traits and locus of control, which are elicited using short inventories, as well as a measure of risk aversion. These traits and preferences have been shown to be important determinants of entrepreneurial choice and success (e.g. Evans and Leighton, 1989; Cramer, Hartog, Jonker, & Van Praag, 2002; Zhao and Seibert, 2006; Caliendo, Fossen, & Kritikos, 2009, 2010, 2011).

The empirical results reveal that the impact of formal education on entrepreneurial productivity differs significantly between opportunity and necessity entrepreneurs. The estimates based on the full sample and the preferred specifications indicate that the return to a year of education for opportunity entrepreneurs is similar to the benchmark return for employees, which is estimated to be 8.8%, whereas the returns for necessity entrepreneurs are three percentage points lower.

The paper proceeds as follows. Section 2 develops the hypotheses to be tested from the literature. Section 3 describes the data and explains the econometric approach. Section 4 presents the results, and Section 5 concludes the analysis.

³ Based on the Global Entrepreneurship Monitor, Kelley, Singer and Herrington (2011) report that the rate of early-stage entrepreneurial activity (the percentage of adults in each economy that are in the process of starting businesses or operating new businesses up to 3.5 years old) is 5.6% in Germany as compared to an average of 6.9% in the countries classified as innovation-driven economies as well. For instance, the respective rates are 5.7% in France, 7.3% in the UK and 12.3% in the US.

2 Literature and hypotheses

2.1 Returns to education in human capital and signalling theories

Positive returns to education may be explained by human capital theory, as pioneered by Becker (1962) and Schultz (1963), which states that education increases productivity and, therefore, wages. Alternatively, signalling theory, as largely developed by Spence (1973), argues that instead of causally increasing a person's productivity, formal education works as a signalling device to labour markets with imperfect information. According to this hypothesis, education helps potential employers identify suitable employees in terms of their abilities, stamina, motivation and the like. A higher education degree signals greater inherent productivity and employers, therefore, offer higher wages to the better educated.

The standard method for empirically quantifying the returns to additional schooling, which also provides the basis for this analysis, is to estimate an earnings equation, as developed by Mincer (1974). This estimation consists of a regression of the natural logarithm of wages on the schooling level and other factors influencing human capital, especially work experience. According to Hartog and Oosterbeek (2007), most studies report point estimates for employees of between 5% and 15% higher wages for an additional year of education. The main econometric challenges in this literature are the endogeneity of education, unobserved heterogeneity and sample selection (e.g. Ashenfelter, Harmon, & Oosterbeek, 1999; Card, 1999; Harmon, Oosterbeek, & Walker, 2003; Shane, 2006). Dickson and Harmon (2011) as well as Henderson, Polachek and Wang (2011) point out that researchers focus too much on a single estimated rate of return for the population and neglect how returns to education might differ between sub-populations. We argue that this critique is even more relevant for entrepreneurs because of their apparent heterogeneity and that it is crucial to distinguish between opportunity and necessity entrepreneurs.

An extensive literature attempts to assess the relative importance of the productivity enhancing (human capital) effect of education versus its information (signalling) function in explaining positive returns to education (see Riley, 2001, for a survey, and Chevalier, Harmon, Walker, & Zhu, 2004, for criticism of alleged evidence for the screening hypothesis and own estimations). One strategy frequently applied to test the screening hypothesis is to compare the returns to education of employees to those of the self-employed, as discussed next.

2.2 Returns to education for employees and entrepreneurs

In the prior literature, one motivation to estimate the returns to education of the self-employed was the idea of using the self-employed as a control group to test signalling theory (e.g. Wolpin, 1977; Brown and Sessions, 1999; Heywood and Wei, 2004).⁴ This literature argues that the self-employed are an unscreened group, as they do not need the informative function of education for an employer. The returns to education of employees, in contrast, represent the sum of the human capital and signalling effects. These studies then interpret the difference between a higher rate of returns for employees and a lower rate for the self-employed as the signalling component of the returns.⁵ One caveat of this empirical strategy, recognised by Backes-Gellner and Werner (2007) and Parker and Van Praag (2006), is that entrepreneurs may also need formal education as a signal, e.g. for clients, employees or capital lenders. Signalling theory therefore does not provide clear predictions about the relative returns to education of entrepreneurs and employees. In this study, we show that differences in the

⁴ In this study as in many others, the self-employed are used as a measurable proxy of entrepreneurship (cf. Van der Sluis et al., 2008, and Hamilton, 2000). The concepts of self-employment and entrepreneurship are not necessarily the same, although they certainly overlap widely. Common definitions of entrepreneurship mention innovation and risk bearing, whereas the self-employed bear income risk, but not necessarily innovate. The distinction between opportunity and necessity entrepreneurs is helpful, as opportunity entrepreneurs are closer to narrow definitions of entrepreneurship.

⁵ This literature does not limit the comparison to employees with low tenure, as the signalling component of the returns to education does not on average diminish with tenure; this would mean that employers systematically overestimated the productivity of applicants when hiring them, which would be contrary to the screening hypothesis (Riley, 1979).

returns to education between opportunity and necessity entrepreneurs, which cannot be due to signalling toward employers (because in this respect necessity entrepreneurs do not differ from opportunity entrepreneurs), cast further doubt on the use of the self-employed as a control group to test the signalling theory.

Other theoretical considerations predict that entrepreneurs should enjoy higher returns to education than paid employees. According to Douhan and Van Praag (2009) and Van Praag et al. (2013), entrepreneurs have more control in which ways to employ their human capital than employees, who face organisational constraints (personal control theory).⁶ Entrepreneurs have greater scope to align their business with their specific capabilities than paid employees, who have to fulfil assigned tasks, obey rules set by superiors, and stick to work descriptions that are not individually tailored to them. Entrepreneurs may, therefore, be in a better position to maximise the returns to their education. They also have more control over the accruals from their human capital, as they are the residual claimants of their firms and not tied to wage brackets. In this study, we render this personal control theory more precisely by noting that it should be more relevant for opportunity than for necessity entrepreneurs. The fact that necessity entrepreneurs, by definition, did not voluntarily intend to become entrepreneurs, clearly demonstrates that they do not have full control over the employment of their human capital, very much in contrast to opportunity entrepreneurs.

In their literature review of the empirical evidence, Van der Sluis et al. (2008) find that studies using US data tend to report returns to education that are higher for entrepreneurs than for employees, whereas in Europe the opposite is found, although studies were only available for the UK, Italy, and the Netherlands. Van Praag et al. (2013), taking into account the endogeneity of education (in contrast to the studies surveyed by Van der Sluis et al., 2008), confirm higher returns for entrepreneurs in the US. Parker and Van Praag (2006) estimate

⁶ Benz and Frey (2008) also emphasise that entrepreneurs enjoy more autonomy and control and relate this to higher work satisfaction.

entrepreneurial returns in the Netherlands that exceed estimates for paid employees reported in Levin and Plug (1999), but they do not offer an own direct comparison.⁷

Evidence for Germany is scarce and inconclusive. Williams (2003) reports point estimates of the returns to education for entrepreneurs between 2.5% using OLS regression up to 10.8% using an IV approach, but the effects are not significantly different from zero. Block, Hoogerheide and Thurik (2012) find returns of 10.5% based on a random effects IV model, without a direct comparison to paid employees. Block and Wagner (2010) focus on the characteristics and earnings differentials of opportunity and necessity entrepreneurs. Education is among various variables considered, but its endogeneity is not taken into account. The (potentially biased) estimates imply returns to education of only 4.3% for opportunity entrepreneurs and returns that are not statistically different from zero for necessity entrepreneurs. To reconcile the mixed results, this paper estimates the returns to education for opportunity and necessity entrepreneurs, directly tests for differences from the returns for employees, and accounts for the endogeneity of education and non-random self-selection.

2.3 Necessity and opportunity entrepreneurs

Before we derive hypotheses about the returns to education for opportunity and necessity entrepreneurs, these concepts need further clarification. The Global Entrepreneurship Monitor (GEM) distinguishes between entrepreneurs who (i) perceive a business opportunity and choose entrepreneurship as one of several career options; and (ii) who feel the necessity to engage in such activity due to the absence of other employment opportunities (Reynolds et al., 2002). In contrast to the GEM data, the German Socio-Economic Panel data we chose for this analysis do not include information on a subjective self-classification into opportunity and

⁷ Co, Gang and Yun (2005) use data from Hungary and account for non-random selection; large standard errors do not allow drawing clear conclusions about differences in returns to education between entrepreneurs and employees.

necessity entrepreneurs (except in 2010, see Section 3.2), and we rely on objective information from the recent employment history to classify respondents (see Section 3.1 for our reasons for this choice of data).

We use registered unemployment before entering self-employment as a broad distinction criterion, as someone who registers as unemployed is, by definition, looking for employment. We therefore label those self-employed persons, who were registered unemployed before entering self-employment, as necessity entrepreneurs, and all others as opportunity entrepreneurs. We will refer to this as the general definition of necessity and opportunity entrepreneurs. This procedure allows us to classify all the self-employed in the sample and keep the analysis representative for the German population. By additionally controlling for individually cumulated years of prior unemployment experience in our regressions, we prevent the indicator for necessity entrepreneurship from picking up the potential depreciation effect of unemployment spells on human capital (Arulampalam, 2008).

To assess the sensitivity of the results with respect to the operationalisation of opportunity versus necessity entrepreneurship, we repeat the estimations using an alternative approach that we refer to as the specific definition. Here we closely follow Block and Wagner (2010) and inspect the circumstances under which a self-employed person left her previous job as a paid employee. Self-employed persons who voluntarily quit their previous jobs are labelled opportunity entrepreneurs, as it is straightforward to assume that they did so in order to enter entrepreneurship. Those who lost their last jobs involuntarily because of closure of the company or dismissal are classified as necessity entrepreneurs. While this classification may be seen as more precise than the general definition, a disadvantage is that by construction only those entrepreneurs who had a wage job before can be included in the sample. More precisely, when we use this classification scheme, like Block and Wagner (2010), we only include those self-employed who lost their last wage job not more than two years before they enter self-employment; if the gap between the two employment spells is larger, one may

doubt if the way the former job was ended is informative enough about the motivation to becoming an entrepreneur. Self-employment spells that follow directly after another self-employment spell are excluded as well because again it is hard to make a judgment on the motivation. In this approach we also exclude those self-employed from the sample whose former wage job was terminated because a limited time contract expired, because in this case classification into opportunity or necessity entrepreneurs is unclear. The consequence of these restrictions is that only 1,808 out of the total 6,267 self-employed can successfully be classified into opportunity and necessity entrepreneurs when we use the alternative specific definition; for the remaining entrepreneurs it is unclear if they are of the opportunity or the necessity type, and they must be excluded from the sample. Therefore, we prefer the general definition, which allows us to classify and include all 6,267 entrepreneurs, and use the specific definition in a robustness check only. In Section 3.2, we assess the validity of both the general and the specific operationalisations of opportunity and necessity entrepreneurs by exploiting direct questions on the motivations of becoming self-employed asked in 2010.

2.4 Hypotheses for necessity and opportunity entrepreneurs

We derive hypotheses about the returns to education for opportunity and necessity entrepreneurs based on a novel extension of personal control theory (see Section 2.2), which originally only spoke about the difference between the total of entrepreneurs and paid employees (Douhan and Van Praag, 2009). Opportunity entrepreneurs are in the position to reap the fruits that the enhanced personal control over the employment of and the accruals from their human capital offers them as an entrepreneur. They have spotted a business opportunity that allows them the best use of their specific human capital (in the sense of Lazear, 2009; compare Becker, 1962, and Neal, 1995). Opportunity entrepreneurs can prepare for their step into entrepreneurship thoroughly beforehand – as they have alternative employment options, they can wait till the optimal time has come. If the choice to become an

entrepreneur is economically rational, opportunity entrepreneurs will only make this choice if their returns exceed their opportunity costs, i.e. the wage they would earn in paid employment. Hence, they can use their former education investments more productively than in alternative paid employment.

In contrast, necessity entrepreneurs would not be entrepreneurs if they had alternative employment options. The fact that they are pushed into their entrepreneurial activities demonstrates that they do not have full control over the use of their human capital. Therefore, they cannot fully exploit the benefits from personal control. As entrepreneurship is their remedy of last resort, it is likely that they do not have time to develop a business idea that best fits their skills and that they cannot wait for the optimal point in time. One can argue that the *ex-ante* expected payoffs from necessity entrepreneurs' investments in education do not actualise, as unexpectedly there is no demand for their formally acquired skills on the labour market; necessity entrepreneurs have to reorientate themselves. It is not wages from paid employment that constitute the opportunity costs for necessity entrepreneurs, as this alternative is not available, but rather the transfers they would receive in case of unemployment. Even if necessity entrepreneurship does not use the human capital acquired at all (which is a sunk investment in this situation), it may be more attractive than (long-term) unemployment, which also does not provide returns to human capital. In summary, we derive three hypotheses to be tested, *ceteris paribus*:

Hypothesis 1: Opportunity entrepreneurs have higher returns to education than necessity entrepreneurs.

Hypothesis 2: Opportunity entrepreneurs have higher returns to education than paid employees.

Hypothesis 3: Necessity entrepreneurs have lower returns to education than paid employees.

3 Econometric approach and data

3.1 Representative household panel data

In this analysis we use the German Socio-economic Panel (SOEP), a yearly household panel survey that is representative for the population in Germany.⁸ In 2010 about 23,000 individuals living in more than 10,000 households were successfully interviewed. For our purpose, we prefer the SOEP to other data sources such as the Global Entrepreneurship Monitor, because, as a general household panel, the SOEP has the advantage of offering detailed socio-economic information, in particular with respect to employment, education and income; these data have been used and tested for plausibility in labour economics and other fields extensively. Moreover, the SOEP provides a rich set of control variables unavailable in other data bases, including scores from short psychological inventories of personality traits.

We use unbalanced data consisting of the waves from 1998 to 2010, which allows us to cover several business cycles. The earnings regressions include persons who report earnings from work in employment or self-employment in their working age between 19 and 65 years of age;⁹ the first stage selection regressions additionally include the unemployed and those not participating in the labour market. We exclude from the sample observations of persons who are currently in education or vocational training, in military or community service, pensioners, farmers, and civil servants, because these persons are not usually confronted with the choice to become an employee or an entrepreneur while they are in these states and their incomes are only determined by the market to a limited extent. Family members who help in a family

⁸ The central aim of the SOEP is to collect representative micro-data about individuals and households. It is similar to the PSID (Panel Study of Income Dynamics) in the USA and the BHPS (British Household Panel Survey) in the UK. A stable set of core questions appears every year, covering population and demography; education, training, and qualification; labour market and occupational dynamics; earnings, income, and social security; housing; health; household production; and basic orientation. For a more detailed data description, see Wagner, Frick and Schupp (2007).

⁹ In the alternative estimations with a more specific definition of opportunity and necessity entrepreneurs, not all the self-employed can be included in the sample (see Section 2.3).

business are also removed from the sample, since they are not entrepreneurs in the sense that they are running their own business. People are classified as entrepreneurs if they report self-employment as their primary occupational activity (see footnote 4).

The dependent variable in the Mincer type equation is log hourly gross labour income. The SOEP questionnaire asks for income from employment before tax and social security contributions in the month prior to the interview. The self-employed are explicitly asked to estimate their monthly net profit before tax. Another question asks for the actual (as opposed to the contractual) hours worked in an average week, which allows us to calculate hourly gross labour income. Net profit (i.e. the difference between revenues and expenses) is the standard measure for self-employment earnings (e.g. Hamilton, 2000). When using tax return or other administrative data, this measure is likely to be affected by underreporting due to tax considerations, and it cannot be ruled out that respondents also understate their profit in surveys (Hurst, Li, & Pugsley, 2010), although the SOEP is non-governmental and the interviewers make every effort to reassure the respondents that the data will be treated anonymously and confidentially for research purposes only. Importantly, even if the self-employed underreport their earnings in the survey, the partial effect of education on earnings can be identified as long as the extent of underreporting is not systematically related to education. Unfortunately, no information on withdrawals or retained earnings are available in the data that could, in principle, be used to construct alternative (but not necessarily superior) measures of earnings.

Education as the key explanatory variable is measured as years of education, which is coded as a standardised number of years depending on the highest primary or secondary school degree a person attained (7-13 years) plus any tertiary education (for example, a university degree adds 5 years) or formal occupational training (e.g., an apprenticeship adds 1.5 years). Table A 1 in the Appendix displays the number of years assigned to each educational degree. Because various combinations of secondary school and additional

education are possible, we observe 16 different values of the years of education variable; Figure A 1 in the Appendix shows its distribution by employment type (paid employees, opportunity and necessity entrepreneurs). Each group spreads over the full range of education, with the distribution for paid employees leaning slightly more to the lower end of education and that of entrepreneurs (especially the opportunity, but also the necessity type) more to the higher end.

Personality characteristics are shown to influence wages (Heineck and Anger, 2010) as well as entrepreneurial entry and success (Caliendo et al., 2011); at the same time, they may also be correlated with education. Thus, it is important to control for personality traits in both the selection and earnings equations (this is not relevant for the fixed effects estimations, which eliminate time-invariant individual effects). Personality scores may serve as proxies for unobserved ability and reduce the potential omitted variable bias in the coefficient of education (cf. Almlund, Duckworth, Heckman, & Kautz, 2011), although we also deal with this issue using fixed effects and IV methods (see below). Specifically, in 2005 and 2009, the SOEP included short inventories of the Big Five personality factors: openness, conscientiousness, extraversion, agreeableness, and neuroticism (Costa and McCrae, 1992). In 2005 and 2010, a further inventory measured locus of control (Rotter, 1966).¹⁰ Several survey waves (2004, 06, 08, 09, 10) include a question about the general willingness to take risks.¹¹ Dohmen, Falk, Huffman, Sunde, Schupp and Wagner (2011) demonstrate in a field experiment, with real money at stake, that the answers to this survey question are good predictors for actual risk-taking behaviour.

¹⁰ In the inventories, the respondents were asked how much they agreed with different statements about themselves (on 7-point Likert scales). Fifteen items assessed the Big Five personality traits (3 items for each trait), plus internal and external locus of control were measured by 10 items.

¹¹ In survey waves where no information is available, we impute scores of the same respondents from the past, where possible, or otherwise from later interviews. This assumes that personality traits are stable for adults at least for some years, which is supported by the evidence (Cobb-Clark and Schurer, 2011, 2012).

To control for human capital acquired in addition to formal schooling and human capital depreciation, we include prior labour market experience and tenure with the current employer (or with the current self-employment activity) as well as unemployment experience, all measured in years, in the regressions.¹² We further account for age and dummy variables indicating gender, persons with children younger than 17 years in the household, those living with a partner (married or unmarried), with a migration background, with disabilities, and those living in western Germany. Moreover, we control for the number of children below six years of age in the household and its interaction with the female dummy, because effects of small children may vary by gender.

3.2 Characteristics of opportunity and necessity entrepreneurs

Table 1 provides descriptive statistics for paid employees and opportunity and necessity entrepreneurs based on the full estimation sample (variable definitions appear in Table A 2 in the Appendix). Descriptives for switchers are also shown, i.e. persons who switch at least once between paid employment and self-employment or vice versa during the observation period (the transition may be direct or indirect via unemployment or non-participation). Opportunity entrepreneurs exhibit the highest mean hourly gross earnings; the *t*-tests to the right reveal that the differences in comparison to necessity entrepreneurs and to employees are statistically significant. The variance of hourly earnings is greater for both groups of entrepreneurs than for employees, which reflects the greater risks associated with entrepreneurship. Necessity entrepreneurs, on average, have fewer years of education than opportunity entrepreneurs, but still more education than employees; this confirms the impression from the histograms in Figure A 1. The finding is consistent with the observation of Wagner (2005) and indicates that those unemployed who become entrepreneurs differ from

¹² Prior experience excludes the current year to avoid endogeneity. Squared terms of work experience and tenure are also included.

the average unemployed, who have less education than employees (cf. Hinz and Jungbauer-Gans, 1999). The share of women among the self-employed is only 35-38% and does not differ significantly between opportunity and necessity entrepreneurs. Necessity entrepreneurs are more concentrated in eastern Germany, in comparison to opportunity entrepreneurs, because of the higher unemployment rate.¹³ Opportunity entrepreneurs more often had a self-employed father when they were 15 years old, and they have the most educated fathers. Among opportunity (necessity) entrepreneurs, 52% (24%) have at least one employee, and 36% (24%) are liberal professionals like self-employed physicians, lawyers, architects, journalists, and artists.¹⁴ Both types of entrepreneurs work about the same number of hours per week and significantly more than paid employees.¹⁵

Concerning the personality traits, opportunity and necessity entrepreneurs do not differ very much from one another; in comparison to employees, both exhibit the pattern described in Caliendo et al. (2011) with higher scores in openness to experience, extraversion, a more internal locus of control (this means they believe that their own actions determine their outcomes rather than luck or fate), and they are more willing to take risks.

¹³ This picture does not change when persons who were already self-employed in 1998 are excluded from the sample, which results in comparing only persons who became self-employed nine or more years after reunification in 1990.

¹⁴ Some of the characteristics described here, such as the employment of workers, are not used as control variables in the regressions because they are presumably endogenous; see Section 3.1 for the list of controls.

¹⁵ Parker, Belghitar and Barmby (2005) note that the longer hours worked by self-employed persons may partly be explained by self-insurance against their higher income risk.

Table 1: Descriptive statistics

	Employees (E)		Opportunity entrepren. (OE)		Necessity entrepren. (NE)		Switchers		<i>t</i> -tests of equal means		
	Mean	Sd dv.	Mean	Sd dv.	Mean	Sd dv.	Mean	Sd dv.	OE - E	NE - E	OE - NE
grossEarnings	13.89	8.38	21.44	23.86	12.84	15.93	15.23	14.36	0.00	0.04	0.00
educ (years)	12.46	2.53	13.87	2.93	13.32	2.79	13.50	2.86	0.00	0.00	0.00
<i>educ. dummies:</i>											
educ<10.5y	0.09		0.04		0.08		0.06		0.00	0.17	0.00
10.5y≤educ<13y	0.58		0.42		0.45		0.43		0.00	0.00	0.10
13y≤educ<18y	0.22		0.28		0.29		0.32		0.00	0.00	0.69
18y≤educ	0.10		0.25		0.18		0.19		0.00	0.00	0.00
workExp	16.89	10.52	19.62	10.00	16.69	8.91	15.39	9.62	0.00	0.50	0.00
unemplExp	0.27	1.11	0.10	0.51	0.98	2.02	0.29	1.06	0.00	0.00	0.00
tenure	10.12	9.32	9.97	8.34	3.87	3.71	5.19	6.05	0.21	0.00	0.00
age	41.34	10.43	45.25	9.64	43.06	8.68	40.82	9.80	0.00	0.00	0.00
female	0.50		0.38		0.35		0.42		0.00	0.00	0.13
west	0.73		0.80		0.52		0.75		0.00	0.00	0.00
partner	0.75		0.79		0.75		0.73		0.00	0.73	0.03
hasChildren	0.37		0.39		0.39		0.41		0.00	0.12	0.89
childrenBelow6	0.15	0.44	0.18	0.48	0.18	0.46	0.21	0.51	0.00	0.11	0.85
handicapped	0.06		0.03		0.04		0.04		0.00	0.08	0.11
migrant	0.12		0.08		0.09		0.10		0.00	0.00	0.55
openness	4.49	1.15	4.90	1.11	4.95	1.10	4.91	1.14	0.00	0.00	0.21
conscientiousness	5.99	0.85	5.97	0.92	5.99	0.87	5.94	0.88	0.10	0.85	0.38
extraversion	4.86	1.11	5.10	1.09	5.13	1.10	5.15	1.05	0.00	0.00	0.50
agreeableness	5.40	0.96	5.37	0.96	5.38	0.99	5.43	0.96	0.02	0.51	0.77
neuroticism	3.86	1.19	3.68	1.21	3.79	1.11	3.68	1.14	0.00	0.04	0.00
internal locus	5.76	0.92	5.92	0.87	5.95	0.91	5.88	0.88	0.00	0.00	0.47
external locus	3.62	0.90	3.34	0.91	3.56	0.97	3.46	0.93	0.00	0.07	0.00
risk tolerance	4.67	2.15	5.53	2.17	5.64	2.03	5.49	2.23	0.00	0.00	0.14
father selfempl	0.07		0.17		0.09		0.13		0.00	0.02	0.00
father's educ	11.31	2.33	12.30	2.93	12.07	2.88	12.15	2.82	0.00	0.00	0.03
mother's educ	10.55	1.92	11.18	2.50	11.19	2.32	11.25	2.46	0.00	0.00	0.83
other hh income	1912	2303	2160	3124	1752	2026	2101	2731	0.00	0.02	0.00
occTrainedFor	0.62		0.66		0.57		0.60		0.00	0.03	0.00
employsWorkers	0.00		0.52		0.24		0.17		0.00	0.00	0.00
libProfessional	0.00		0.36		0.24		0.13		0.00	0.00	0.00
hoursWorked	37.61	12.39	44.24	17.48	44.15	16.85	39.67	16.69	0.00	0.00	0.87
Person-year obs.	65192		5315		952		5254				

Notes: The classification of person-year observations into observations in paid employment and opportunity and necessity entrepreneurship is mutually exclusive and exhaustive in the sample used for the earnings regressions. For further information, the column labelled “switchers” includes all person-year observations of persons who switch between employment and self-employment or vice versa at least once during the observation period (directly or indirectly via unemployment or non-participation). The three rightmost columns report *p*-values of two-sample *t*-tests with unequal variances. Definitions of the variables appear in Table A 2. Standard deviations (sd dv.) are not shown for binary variables.

Source: Authors' calculations based on SOEPv27, 1998-2010.

Importantly, 66% of opportunity entrepreneurs report that they are working in the profession that they were trained for, but only 62% of the paid employees and only 57% of

the necessity entrepreneurs make this claim; all these differences are significant.¹⁶ This finding supports the personal control theory extended in this paper (Section 2.4): Opportunity entrepreneurs can make better use of their specific human capital than paid employees, whereas some of the specific human capital of necessity entrepreneurs lies idle. Figure 2 demonstrates that this gap between opportunity and necessity entrepreneurs with respect to the share working in the profession trained for opens up at almost all levels of education.¹⁷ Table A 3 in the Appendix shows descriptive statistics for the alternative specific operationalisation of opportunity and necessity entrepreneurs (see Section 2.3), which provide a similar picture.¹⁸

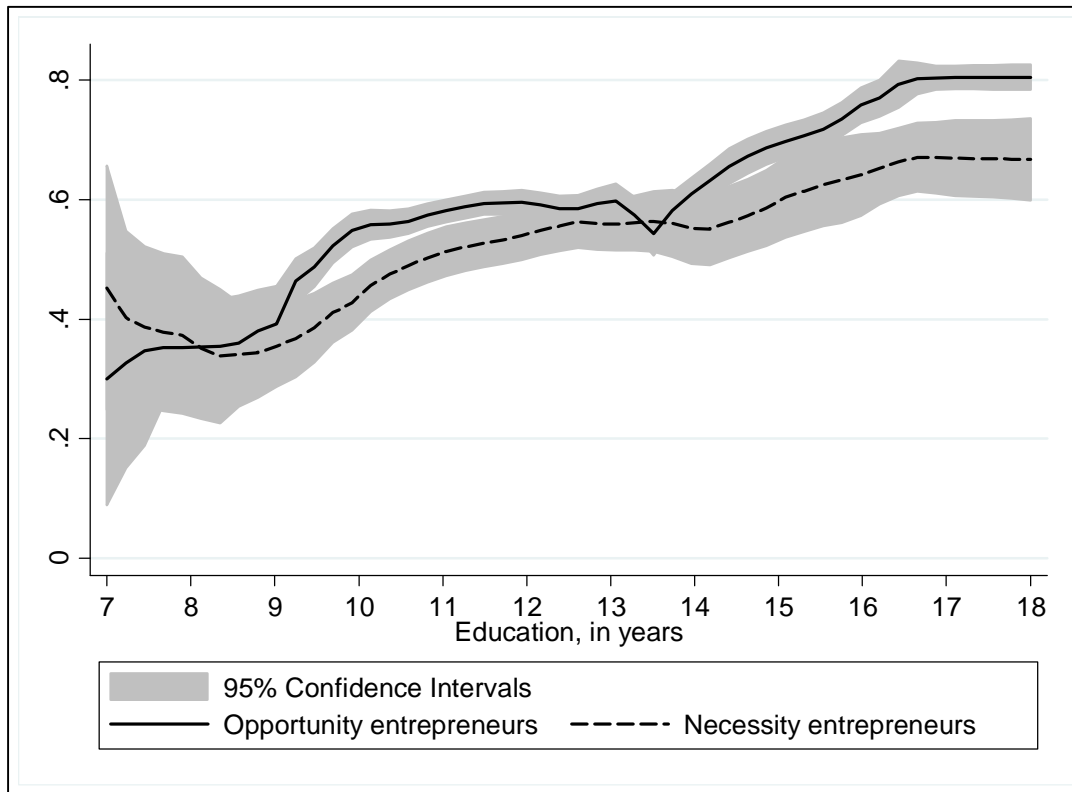
To further assess if our classifications capture the intended concepts of necessity and opportunity entrepreneurs, we evaluate novel questions exclusively available in the 2010 SOEP questionnaire. These questions were posed to respondents who indicated that they had entered self-employment in the previous year and sought the reasons for their new self-employment.

¹⁶ The wording of the SOEP question is: “Is [your] position the same as the profession for which you were educated or trained?” with the response options “Yes”; “No”; “In training”; and “Have no job training”. We construct a dummy variable with 1 referring to “Yes” and 0 to “No” or “In training”; no assignment is made for respondents without job training.

¹⁷ The difference between the two groups is always positive when it is significant (i.e., where the grey confidence intervals do not overlap). For people with only seven years of education, no statistical inference can be made about the sign of the difference, because the number of observations in this group is too small (see Figure A 1 in the Appendix).

¹⁸ Using our baseline method of exploiting prior unemployment to distinguish between opportunity and necessity entrepreneurs, we classify 15% of the self-employed as necessity entrepreneurs (Table 1), which is less than the share reported for Germany by the Global Entrepreneurship Monitor (Figure 1) based on self-classification. Obviously, our group of opportunity entrepreneurs includes some people that the GEM would classify as necessity entrepreneurs. Our second approach of inspecting the way an entrepreneur’s prior job was terminated is more specific with regard to opportunity entrepreneurs, but not all the self-employed can be classified using this approach. Here, even 38% of the self-employed that can be classified are labelled as necessity entrepreneurs (Table A 3 in the Appendix), which exceed the share in the GEM. Thus, our two classification approaches provide upper and lower bounds.

Figure 2: Share of entrepreneurs working in the profession trained for



Note: The figure shows bivariate local mean regressions of the dummy variable indicating if an entrepreneur works in the profession she was trained for on the years of education, separately for opportunity and necessity entrepreneurs.

Source: Authors' calculations based on SOEPv27, 1998-2010.

Table 2 shows the descriptive results. The columns labelled “general definition” refer to the baseline classification based on prior unemployment, and “specific definition” refers to the alternative classification based on the way the last job was terminated. For opportunity entrepreneurs the wish to be their own boss is more important than for necessity entrepreneurs, while for necessity entrepreneurs, escaping unemployment and being unable to find employment are more important reasons for becoming self-employed. These differences are statistically significant when the general definition is used, as indicated by *t*-tests; for the specific definition, the differences are all insignificant, presumably because of the smaller

sample size, but the point estimates tell the same story.¹⁹ We conclude that our operationalisations capture the concepts of opportunity and necessity entrepreneurs well.²⁰

Table 2: Reasons for becoming an entrepreneur

	General definition			Specific definition		
	Oppor. entre.	Necess. entre.	OE vs NE	Oppor. entre.	Necess. entre.	OE vs NE
	Mean	Mean	<i>p</i> -value	Mean	Mean	<i>p</i> -value
<i>Reasons for having entered self-employment on a scale from 1 (does not apply at all) to 7 (fully applies)</i>						
I have always wanted to be my own boss.	5.19	3.36	0.01	5.30	4.58	0.41
I did not want to be unemployed anymore.	2.37	5.36	0.00	2.00	3.73	0.15
Others advised me to start up a business.	3.10	2.38	0.32	2.70	2.91	0.84
I discovered a market gap.	2.60	2.50	0.89	2.90	2.64	0.78
I wanted to earn more money.	4.30	3.00	0.10	4.80	4.00	0.50
I did not find employment (anymore).	1.77	3.50	0.03	1.70	2.45	0.34
I had an idea that I really wanted to implement.	3.50	3.64	0.86	3.70	3.09	0.58
I was disadvantaged at my previous workplace.	2.52	1.86	0.29	2.50	2.27	0.82
<i>Additional questions: 1 (yes) or 0 (no)</i>						
I actively searched before starting this job.	0.33	0.40	0.66	0.25	0.38	0.49
I received start-up subsidies.	0.29	0.67	0.02	0.36	0.42	0.81
Person-year observations	423	96		89	69	

Notes: The SOEP questionnaire 2010 included some special questions that were directed at respondents who indicated that they became self-employed in the previous year. The general definition refers to the classification based on prior unemployment; the specific definition refers to the classification based on the way the last job was terminated. The columns headed “OE vs NE” include *p*-values of two-sample *t*-tests of equal means comparing opportunity and necessity entrepreneurs (with unequal variances).

Source: Authors’ calculations based on SOEPv27, 2010.

3.3 Earnings equation and ability bias

The basis for estimating the returns to education of paid employees, opportunity and necessity entrepreneurs is a Mincerian earnings function for person *i* in year *t*. Consider

$$\ln(w_{it}) = \beta_0 + \beta_1 educ_{it} + \beta_2 educ_{it} * oppEntre_{it} + \beta_3 educ_{it} * necEntre_{it} + \beta_4 oppEntre_{it} + \beta_5 necEntre_{it} + \beta'_c X_{it} + \beta_\lambda \lambda_{it} + \theta_t d_t + \mu_i + \varepsilon_{it} \quad (1)$$

where \ln denotes the natural logarithm, w_{it} gross hourly earnings, $educ_{it}$ years of education, $educ_{it} * x$ its interactions with x , $oppEntre_{it}$ and $necEntre_{it}$ dummy variables marking opportunity and necessity entrepreneurs, X_{it} a vector of control variables (see Section 3.1), λ_{it}

¹⁹ Necessity entrepreneurs are also more likely to receive start-up subsidies (note that these are not included in the gross earnings reported and therefore not used in the regressions), which is very plausible because most subsidies are only available for the unemployed.

²⁰ We cannot make use of these special questions to classify opportunity and necessity entrepreneurs in our regressions because the sample size would be too small if we used the year 2010 only, and we could not eliminate individual fixed effects.

a selection correction term (see Section 3.4), d_t year dummies, β and θ coefficients to be estimated, μ_i a time invariant person-specific effect, which includes unobserved ability, and ε_{it} a time varying error term. The coefficient β_1 measures the returns to education for employees (the reference group), the sum of $\beta_1 + \beta_2$ the returns for opportunity and $\beta_1 + \beta_3$ for necessity entrepreneurs. To facilitate comparisons with the extant literature, we additionally estimate eq. (1) including a general self-employment dummy and its interaction with education instead of distinguishing between opportunity and necessity entrepreneurs.

For a consistent estimation of this equation, endogeneity of education and its interactions with *oppEntre* and *necEntre* must be taken into account, as unobserved ability may induce individuals to acquire more education and, at the same time, may have a direct effect on earnings, as discussed extensively in the literature (e.g. Ashenfelter et al., 1999; Harmon et al., 2003). We are primarily interested in the differences in the returns to education between employees, opportunity and necessity entrepreneurs, i.e. in the coefficients β_2 and β_3 of the interaction terms. These interactions vary over time whenever persons in the sample change their employment status. Their coefficients (and any coefficients of variables that vary over time) can consistently be estimated by the fixed effects (FE) estimator, which transforms all variables into deviations from their person-specific means over time and eliminates μ_i from the equation. Only variation within persons is used to identify the coefficients, so the observed changes in hourly labour income of individuals who switch from paid employment to entrepreneurship or vice versa identify β_2 and β_3 .²¹ Therefore, the FE estimator is the preferred method to eliminate potential ability bias from the estimation. Two caveats should be discussed, however. First, using the FE estimator, we estimate the difference in the returns to education between the employment states for switchers. If this difference is heterogeneous

²¹ Both direct and indirect transitions via unemployment or non-participation (for example, persons who are regularly employed first, then unemployed and then self-employed) contribute to identification, because any intermediary person-years in non-employment are excluded from the sample for the estimation of the earnings regression (see also Section 3.4).

in the population, we estimate an average treatment effect on the treated in the sense that we cannot generalize the results to the hypothetical difference in the returns to education between the states for those who never switch.²² Second, coefficients of time-invariant variables cannot be estimated using the FE estimator, including the coefficient of education β_1 , because education does not change over time for the working adults in the sample. Van Praag et al. (2013) similarly use the FE estimator to estimate the difference in the returns to education between paid employment and self-employment in the US, but they do not distinguish between opportunity and necessity entrepreneurship.

The literature in labour economics estimating homogenous returns to education for employees cannot invoke FE estimation because of the time-invariant nature of education in a sample of working adults where wages are observed. This literature therefore mostly relies on instrumental variables (IV) methods. We will adopt this approach in alternative specifications, which has the advantage of additionally identifying the benchmark returns to education for employees (β_1) and not only the differences between the employment types. Some candidate IVs used in the literature, which for example exploit compulsory schooling laws (Angrist and Kruger, 1991), are criticised because these instruments tend to be weak (Bound, Jaeger, & Baker, 1995) or to identify a local treatment effect for a sub-group that is not representative (Card, 1999). Family background variables do not suffer as much from these problems, as they have strong predictive power for education that is not limited to a specific subgroup. A possible concern with these variables is that the family background may have a direct effect on earnings that does not work through education. Specifically considering father's education, Hoogerheide, Block and Thurik (2012) investigate this potential issue using Bayesian

²² Of the 71,459 person-year observations in the full sample, 5,254 belong to switchers who experience at least one direct or indirect transition from paid employment to self-employment or vice versa during the observation period (see Table 1). More specifically, 2,264 of the 6,267 observations in self-employment belong to switchers, and 2,990 of the 65,192 observations in paid employment. With regard to the type of entrepreneur, 1,723 (541) of the 5,315 (952) observations of opportunity (necessity) entrepreneurs belong to switchers.

analysis, based on the SOEP, the same data we employ. By experimenting with relaxations of the strict exclusion restriction, they show that the size of a bias introduced by a potential direct effect of father's education on wages is typically smaller than the width of the 95% posterior interval of the education coefficient of interest in the IV model, even if the strict exogeneity assumption were substantially violated. They conclude that using father's education as an instrument in earnings regressions is a viable option, especially considering the problems with alternatives mentioned above. Therefore, in the IV regressions we use father's education²³ and its interactions with *oppEntre* and *necEntre* as excluded instruments to account for the endogeneity of education and its interactions.²⁴

3.4 Non-random selection

Apart from the endogeneity of education, two potential mechanisms of non-random self-selection may be at play. First, persons who are unemployed or who do not participate on the labour market do not report a wage and must be excluded from the earnings equation. As long as this selection depends on time-invariant characteristics or time-varying observable control variables, the fixed effects estimator is still consistent. In addition, we address potential selection on time-varying unobservables with a Heckman (1979) style two-step selection correction, which in the first step estimates binary participation equations separately for each year and in the second step introduces the combined predicted inverse Mills ratio λ as an additional regressor when estimating equation (1). The participation equations include the

²³ Father's number of years in education is calculated based on his educational degree, analogously to the calculation of the respondent's own education. We do not use mother's education or other family background variables, as these variables have not been investigated as potential instruments in the way described, and as information on mother's education is often missing in the data.

²⁴In case of heterogeneous treatment effects, the monotonicity assumption allows causal interpretation of the estimated coefficients as average effects (Imbens and Angrist, 1994; Angrist, Imbens, & Rubin, 1996). Since father's education increases the expectation of offspring's education, in this context this assumption means that there shall be no defiers in the sense that someone would have attained more education if the father had attained less education. This must be true for employees, opportunity and necessity entrepreneurs (if one is not willing to assume a homogeneous effect of education on wages within the employment types). The monotonicity assumption is untestable, as it invokes counterfactuals.

same control variables as the second step earnings regressions. For better identification, two additional variables are included in the selection equations, but not in eq. (1), i.e. gross labour income from other household members and an indicator for a self-employed father.²⁵

Second, the non-random selection into self-employment, and more specifically, into opportunity and necessity entrepreneurship may potentially introduce bias. Then education *and* the dummy variables indicating the employment type would be endogenous in eq. (1). The choice of the employment type may depend on unobserved *entrepreneurial* ability in the error term, which at the same time is likely to influence earnings from entrepreneurship. To the extent that entrepreneurial ability is time-invariant, it is included in μ_i and eliminated in the FE estimation. At the same time, macroeconomic entrepreneurial opportunities are captured by the time dummies. If we had a convincing instrument for entrepreneurial ability that varied over time, we could combine FE and IV estimation, which would allow consistent estimation of the coefficients of the interaction terms even if entrepreneurial ability changed over time; however, we are not aware of such an instrument that can be excluded from the earnings equation and leave this potential issue for future research.²⁶

²⁵ The sum of gross monthly labour income of household members other than the respondent, i.e. most often the labour income of the spouse, is likely to influence the decision to participate in the labour market or not, especially for married women, but not the respondent's productivity and thus not her earnings conditional on working. This variable varies over time and is therefore useful to control for selection in the fixed effects estimations. The second exclusion restriction, a dummy variable indicating whether the father was self-employed when the respondent was 15 years old, helps to predict participation, especially as an entrepreneur (cf. Taylor, 1996). Taylor (2001) reports that a self-employed father increases the probability of becoming self-employed, but does not influence performance (see also Fairlie and Robb, 2007). This time-invariant variable is useful to control for selection in the IV (and OLS) estimations, which do not eliminate fixed effects. Furthermore, in the specifications that treat education as endogenous, we use father's education in the selection equations instead of education; see Wooldridge (2002) for the econometric combination of selection correction and IV methods.

²⁶ We considered labour income of household members other than the respondent and its interactions with father's education and a dummy for a self-employed father as time-varying instruments, but they turned out to be weak instruments for the dummy variables marking opportunity and necessity entrepreneurs, according to relevance tests. For comparison with Van Praag et al. (2013), who use time-invariant family background variables and their interactions with the self-employment dummy as instruments in a combination of the FE and IV methods, we also present a corresponding estimation which uses the interactions of father's education with the dummies for opportunity and necessity entrepreneurs as instruments in a FE IV estimation, being aware that this does not solve the potential problem of time-varying entrepreneurial ability. In another robustness check in Section 4.2, we also consider separate earnings regressions for each employment type, where selection is modelled based on a multinomial logit model.

4 Empirical results

4.1 Results for the full representative sample

In this section, we first examine the results when classification into opportunity and necessity entrepreneurs is based on prior unemployment (general definition), using the full representative sample; in Section 4.3, we will consider the alternative, more specific classification, which considers the way the last job was terminated, using a sub-sample where these information are observed (see Section 2.3). Referring to the first classification approach, Table 3 presents the results from estimating the baseline earnings equation (1). The fixed effects estimation in column (S3) is preferred because it controls for unobserved ability, including entrepreneurial ability, to the extent that ability is time-invariant for the working adults in the sample. Indeed, a Hausman (1978) test rejects consistency of the alternative random effects estimator (p -value below 0.001). Specification (S2) accounts for the endogeneity of education using the IV approach described in Section 3.3, but in contrast to the FE estimator, it does not control for potential endogeneity of entrepreneurial status based on time-invariant unobservables. The pooled OLS estimates in column (S1) are potentially affected by ability bias and shown for comparison only. We report standard errors robust to heteroscedasticity and clustering at the individual level in all estimations.²⁷

²⁷ This includes the FE estimations, to be cautious. Because the FE estimator removes μ_i from equation (1), by its use “the serial correlation in errors can be greatly reduced, but it may not be completely eliminated” (Cameron and Trivedi, 2005, p. 705).

Table 3: Main earnings regressions

Specification	(S1)	(S2)	(S3)
Estimation method	OLS	IV	FE
educ (years)	0.0811 (0.0019)***	0.0880 (0.0063)***	
educ x oppEntre	0.0006 (0.0066)	0.0017 (0.0171)	0.0067 (0.0080)
educ x necEntre	-0.0666 (0.0150)***	-0.1165 (0.0399)***	-0.0298 (0.0147)**
oppEntre	0.0111 (0.0204)	-0.0042 (0.0322)	-0.0394 (0.0276)
necEntre	-0.1257 (0.0425)***	-0.0865 (0.0604)	-0.0801 (0.0455)*
workExp	0.0327 (0.0024)***	0.0345 (0.0036)***	0.0416 (0.0051)***
workExp squared	-0.0051 (0.0004)***	-0.0052 (0.0004)***	-0.0069 (0.0004)***
unemplExp	-0.0471 (0.0043)***	-0.0437 (0.0048)***	-0.0956 (0.0099)***
tenure	0.0246 (0.0011)***	0.0247 (0.0012)***	
tenure squared	-0.0004 (0.0000)***	-0.0004 (0.0000)***	0.0002 (0.0000)***
age	-0.0075 (0.0014)***	-0.0088 (0.0023)***	0.0074 (0.0075)
female	-0.1839 (0.0079)***	-0.1831 (0.0084)***	
west	0.3399 (0.0088)***	0.3427 (0.0111)***	0.1118 (0.0370)***
partner	0.0294 (0.0080)***	0.0297 (0.0082)***	0.0204 (0.0074)***
hasChildren	0.0107 (0.0075)	0.0113 (0.0078)	0.0034 (0.0059)
childrenBelow6	0.0579 (0.0076)***	0.0593 (0.0080)***	0.0188 (0.0060)***
childrenBelow6 x female	-0.0952 (0.0201)***	-0.0933 (0.0244)***	-0.0430 (0.0172)**
handicapped	-0.0788 (0.0201)***	-0.0770 (0.0208)***	-0.0207 (0.0107)*
migrant	0.0077 (0.0108)	0.0098 (0.0114)	
openness	0.0061 (0.0039)	0.0038 (0.0045)	
conscientiousness	0.0001 (0.0039)	0.0011 (0.0043)	
extraversion	-0.0049 (0.0039)	-0.0040 (0.0041)	
agreeableness	-0.0187 (0.0038)***	-0.0179 (0.0039)***	
neuroticism	-0.0131 (0.0037)***	-0.0119 (0.0039)***	
internal locus	0.0014 (0.0037)	0.0035 (0.0041)	
external locus	-0.0530 (0.0040)***	-0.0490 (0.0047)***	
risk tolerance	0.0147 (0.0032)***	0.0142 (0.0033)***	
λ	0.0734 (0.0350)**	0.0673 (0.0449)	0.0031 (0.0274)

continued on the following page

Table 3 continued

Specification	(S1)	(S2)	(S3)
Year dummies	$p\text{-val.} < 0.001$	$p\text{-val.} < 0.001$	$p\text{-val.} < 0.001$
Constant	2.0092 (0.0265)***	2.0354 (0.0387)***	1.6606 (0.2438)***
R^2 (overall model)	0.401	0.398	0.135
educ:			
1 st stage F statistic		205.005	
Shea's Partial R^2		0.076	
educ x oppEntre:			
1 st stage F statistic		114.616	
Shea's Partial R^2		0.152	
educ x necEntre:			
1 st stage F statistic		16.652	
Shea's Partial R^2		0.135	
Person-year observations	71459	68004	69761

Notes: Standard errors are robust to heteroscedasticity and clustering at the individual level. Instrumental variables estimation (S2) with endogenous variables *educ* and its interactions with *oppEntre* and *necEntre*; excluded instruments: father's education and its two interactions. F -statistics at the bottom of the table refer to first stage tests of joint significance of the excluded instruments. λ is the selection correction term. In the row of the year dummies, the p -values refer to F -tests of joint significance. Definitions of the variables appear in Table A 2.

*/**/***: Significance of the coefficient at the 10%/5%/1% level.

Source: Authors' calculations based on SOEPv27, 1998-2010.

The point estimate from the IV regression (S2) for the return to education of paid employees, the reference group, is 8.8% for a year of education, which is in the expected range, and is highly significant. As mentioned, this coefficient is not identified in the FE estimation. Based on the preferred FE estimator (S3), the return to education of necessity entrepreneurs is 2.98 percentage points lower than the return of employees (34% lower in relative terms), and the difference is significant at the 5% level. The return of opportunity entrepreneurs is 0.67 percentage points higher than the employee's return (8% in relative terms), but this difference is not significant based on cluster robust standard errors.²⁸ The returns for opportunity entrepreneurs are significantly higher than those for necessity entrepreneurs (p -value = 0.018 based on the FE estimation with clustered standard errors). The difference between the returns to education for employees and necessity entrepreneurs is even larger based on the IV estimation, but the estimate is still consistent with the FE estimate

²⁸ This difference is significant at the 5% level when using conventional, but not clustered standard errors in the FE estimation; however, conventional standard errors may be biased if the first differenced error terms are still correlated over time for a given individual.

as the confidence intervals overlap. In summary, the data clearly support Hypotheses 1 and 3, developed in Section 2.4, about the lower returns of necessity entrepreneurs in comparison to both opportunity entrepreneurs and paid employees. There is no robust evidence for Hypothesis 2 about the higher returns of opportunity entrepreneurs in comparison to employees.

The first stage statistics indicate that the instruments used in column (S2) are sufficiently relevant. For the endogenous variables (education and its interactions with the opportunity and necessity entrepreneurship dummies), the first stage F statistics of the excluded instruments and Shea's Partial R^2 are shown at the bottom of the table.²⁹

The years of education variable used in the interactions is normalized (education minus its sample mean), so the coefficients of the dummy variables indicating opportunity and necessity entrepreneurs *oppEntre* and *necEntre* can conveniently be interpreted as the effects of being in one of these employment states for a person with the average level of education. The preferred FE estimate indicates that such a person earns 8% less as a necessity entrepreneur than as an employee (the reference category), and this difference is significant at the 10% level. No significant difference is detected for opportunity entrepreneurs at the average education level.

The estimated coefficients of the control variables are consistent with expectations in all columns. Time-invariant variables, such as gender, are not included in the FE estimation.³⁰ Work experience increases earnings at diminishing rates, whereas unemployment experience decreases earnings; this is in line with human capital theory and human capital depreciation. Women and people living in eastern Germany have lower earnings. Interestingly, higher scores in agreeableness and neuroticism and a more external locus of control decrease

²⁹ Full results for all first stage and selection equations are available from the authors upon request.

³⁰ We also exclude the personality characteristics from the FE estimation because conceptually these are stable over time for adults and changes between measurements are thus likely to be due to measurement error.

earnings. The coefficient of λ_{it} , which controls for non-random selection into the working population, is insignificant in the IV and FE estimations, so there is no indication for selection based on unobservables, whereas in the pooled OLS estimation, λ_{it} is significant at the 5%-level.

4.2 Robustness checks

To gain further insights and to assess the sensitivity of the results, in Table 4 we use the preferred FE estimator to test further specifications and sample restrictions. Specification (S4) does not distinguish between opportunity and necessity entrepreneurs and only considers the total of the self-employed, like the prior literature. The coefficient of the interaction term with education is very close to zero and insignificant. This approach hides the statistically and economically important heterogeneity between the two types of entrepreneurs revealed in the previous section.

In specification (S5), we assess the robustness of the results with respect to the exclusion of liberal professionals, i.e. mostly academic professions among the self-employed like physicians, lawyers, architects, journalists, and artists. Applying the FE estimator to the sample without liberal professionals, we obtain point estimates that are similar to those from the baseline estimation (S3). However, the cluster robust standard errors increase, presumably because of the smaller number of entrepreneurs and correspondingly smaller number of transitions into and out of entrepreneurship in the sample, which identify the FE coefficients, and the difference between paid employees and necessity entrepreneurs becomes insignificant. Again based on the full sample, specification (S6) excludes the selection term λ_{it} . The results are almost identical to those from (S3), which is not surprising given the insignificance of λ_{it} in (S3).

Table 4: Earnings regressions: Robustness checks

Specification	(S4)	(S5)	(S6)	(S7)	(S8)
Estimation method	FE	FE	FE	IV FE	FE
Description	Self-empl. dummy	No lib. professionals	No selection control		Non-linear education
educ x selfempl	-0.0008 (0.0076)				
selfempl	-0.0493 (0.0252)*				
educ x oppEntre		0.0065 (0.0098)	0.0067 (0.0080)	0.0144 (0.0247)	0.0010 (0.0118)
educ x necEntre		-0.0255 (0.0181)	-0.0298 (0.0147)**	-0.0876 (0.0442)**	-0.0387 (0.0230)*
oppEntre		-0.0453 (0.0302)	-0.0394 (0.0276)	-0.0606 (0.0405)	-0.0364 (0.0326)
necEntre		-0.0709 (0.0473)	-0.0800 (0.0455)*	-0.0186 (0.0613)	-0.0905 (0.0543)*
educ squared					0.0073 (0.0009)***
educ_sq x oppEntre					0.0003 (0.0027)
educ_sq x necEntre					0.0021 (0.0052)
λ	0.0025 (0.0273)	-0.0133 (0.0272)		0.0661 (0.0287)**	0.0114 (0.0273)
Control variables	yes	yes	yes	yes	yes
R^2 (overall model)	0.135	0.142	0.136	0.100	0.105
educ x oppEntre: 1 st stage F statistic				37.754	
Shea's Partial R^2				0.105	
educ x necEntre: 1 st stage F statistic				17.318	
Shea's Partial R^2				0.138	
Person-year observations	69761	67567	69761	66389	69761

Notes: Standard errors are robust to heteroscedasticity and clustering at the individual level. The fixed effects instrumental variables estimation (S7) treats the interactions of *educ* with *oppEntre* and *necEntre* as endogenous and uses the two corresponding interactions with father's education as excluded instruments. λ is the selection correction term.

*/**/***: Significance of the coefficient at the 10%/5%/1% level.

Source: Authors' calculations based on SOEPv27, 1998-2010.

In specification (S7), we combine the IV and FE methods by transforming all the variables, including the interacted instruments also used in (S2), in mean-deviations form before IV estimation, which treats the interactions of education as endogenous. This increases the estimated difference in the returns to education between paid employees and necessity entrepreneurs, which remains significant. Van Praag et al. (2013) similarly obtain larger absolute point estimates for the difference between employees and the total of the self-employed in an FE IV estimation in comparison to a standard FE estimation. However, since both here and in Van Praag et al. (2013) the instruments are interactions of time invariant

family background variables and entrepreneurship indicator dummies, the FE IV estimator does not solve the potential issue of time-varying entrepreneurial ability. Therefore, we prefer the standard FE estimator (S3), which consistently accounts for time-invariant unobserved ability as well, but does not require assumptions about instruments.

Next, we consider the possibility that the returns to education are not constant, which means that log wages are a nonlinear function of years of education, and that such nonlinearities may differ between paid employees, opportunity and necessity entrepreneurs. Based on data from Denmark, Iversen, Malchow-Møller and Sørensen (2010) estimate nonlinear OLS earnings regressions for the self-employed and find that their returns to education are small for most educational levels and large only for higher educational levels (they do not account for endogeneity of education or non-random selection, however). To detect possible nonlinearities in Germany, in specification (S8) we repeat the consistent FE estimations with quadratic years of education and the corresponding interactions with the opportunity and necessity entrepreneurship dummies.

The quadratic specification confirms that necessity entrepreneurs have lower returns to education than paid employees, as indicated by the coefficient of the interaction of the necessity entrepreneurship dummy with education of -3.9 percentage points, which is significant and somewhat larger than in the baseline estimation (S3). There is no evidence of nonlinearities in the differences between the employment types, since the interactions of both, necessity and opportunity entrepreneurship, with education squared are insignificant. The returns to education for necessity entrepreneurs are also significantly lower than for opportunity entrepreneurs again (p-value = 0.0999 based on clustered standard errors). The returns for opportunity entrepreneurs do not significantly differ from those for paid employees in this estimation, as the two corresponding interaction terms are jointly not significant.

To explore possible nonlinearities further, we estimate two additional FE models with education dummies, one with four interval dummies of education years (the definitions are

provided in Table A 2 in the Appendix), and the second with four dummies for the highest educational degree obtained.³¹ While the results remain consistent with the linear approximations estimated in the baseline regressions, few additional insights are gained, because the standard errors become fairly large. Among the interaction terms of interest only the interaction of necessity entrepreneurship with the university degree dummy in the second model is statistically significant (and negative, as expected), based on clustered standard errors.³²

4.3 Results for the more specific definition of entrepreneurial types

To assess the sensitivity of the results with respect to the operationalisation of opportunity and necessity entrepreneurs, we repeat the main estimations using the alternative specific classification scheme, which exploits the way the previous wage job was terminated, based on the sub-sample where such information are available (see Section 2.3). The results from estimating equation (1) using the OLS, IV and the preferred FE estimator appear in Table 5, which is analogous to Table 3. The estimated returns to education for paid employees in the IV estimation (S2b) are similar to those in estimation (S2) of Table 3.³³ The estimated difference between the returns to education for employees and necessity entrepreneurs in the FE estimation (S3b) is very similar to the baseline estimate (S3), although insignificant based on cluster robust standard errors. The standard errors are generally larger than in the baseline

³¹ We use the following categories: Basic education as the base category; apprenticeship; *Abitur* (higher secondary school degree qualifying for university admission); university degree.

³² In a further robustness check, we estimate separate IV earnings regressions for paid employees, opportunity and necessity entrepreneurs instead of including interaction terms and employ a multinomial logit model as the first step selection equation, which accounts for selection into the three different employment states or non-employment. The results are similar to the baseline joint estimations in Table 3: The return to education for paid employees is estimated at 8.35%, opportunity entrepreneurs have a slightly higher point estimate of 8.44%, and necessity entrepreneurs have a much lower point estimate of 3.11%. Full results from these regressions and from the FE models with education dummies mentioned before are available from the authors upon request.

³³ The first stage statistics provided at the bottom of the table again indicate that the instruments are sufficiently relevant. The selection correction term is statistically significant in the OLS estimation (S1b) only.

estimations, presumably because of the exclusion of self-employed persons who could not be classified using this scheme. In the OLS and IV regressions, the difference is still significant.

Table 5: Earnings regressions with specific definition of entrepreneurial types

Specification	(S1b)	(S2b)	(S3b)
Estimation method	OLS	IV	FE
Sample	Full sample	Full sample	Full sample
<i>educ</i>	0.0805 (0.0019)***	0.0871 (0.0062)***	
<i>educ</i> x <i>oppEntre</i>	-0.0029 (0.0118)	0.0128 (0.0311)	-0.0012 (0.0119)
<i>educ</i> x <i>necEntre</i>	-0.0546 (0.0169)***	-0.0952 (0.0421)**	-0.0282 (0.0204)
<i>oppEntre</i>	0.0608 (0.0360)*	0.0141 (0.0563)	0.0464 (0.0447)
<i>necEntre</i>	-0.0044 (0.0511)	0.0373 (0.0678)	-0.0818 (0.0567)
λ	0.0586 (0.0337)*	0.0551 (0.0426)	0.0049 (0.0253)
Control variables	yes	yes	yes
R^2 (overall model)	0.423	0.422	0.136
<i>educ</i> :			
1 st stage F statistic		195.902	
Shea's Partial R^2		0.076	
<i>educ</i> x <i>oppEntre</i> :			
1 st stage F statistic		29.521	
Shea's Partial R^2		0.167	
<i>educ</i> x <i>necEntre</i> :			
1 st stage F statistic		22.093	
Shea's Partial R^2		0.190	
Person-year observations	67000	63781	65333

Notes: Standard errors are robust to heteroscedasticity and clustering at the individual level. Instrumental variables estimation (column S2b) with endogenous variables *educ* and its interactions with *oppEntre* and *necEntre*; excluded instruments: father's education and its two interactions. F -statistics at the bottom of the table refer to first stage tests of joint significance of the excluded instruments. λ is the selection correction term.

*/**/***: Significance of the coefficient at the 10%/5%/1% level.

Source: Authors' calculations based on SOEPv27, 1998-2010.

5 Conclusion

We estimate the returns to education for opportunity entrepreneurs, who voluntarily become entrepreneurs because they spot a business opportunity; for necessity entrepreneurs, who are pushed into entrepreneurship because they lack alternative employment options; and for paid employees, who provide a benchmark. We use representative household panel data for Germany, the SOEP, and account for the endogeneity of education and non-random selection. The results from the preferred specification indicate that the returns to an additional year of

education are three percentage points lower for necessity entrepreneurs than for opportunity entrepreneurs and for paid employees, whose rate of return is estimated at 8.8%. Thus, it is important to distinguish between opportunity and necessity entrepreneurs when estimating entrepreneurial returns to education.

We derive hypotheses about the relative returns to education for opportunity entrepreneurs, necessity entrepreneurs and paid employees from our extension of the theory of personal control. According to the original theory (Douhan and Van Praag, 2009), entrepreneurs should enjoy higher returns to education than paid employees, because they have better control over the employment of and the accruals from their own human capital. We argue that this should apply for opportunity entrepreneurs, while the fact that necessity entrepreneurs cannot find employment in the labour market indicates that they have only limited control over the employment of their human capital. The empirical results confirm Hypotheses 1 and 3 about the lower returns to education for necessity entrepreneurs than for either opportunity entrepreneurs (Hypothesis 1) or paid employees (Hypothesis 3). While the preferred fixed effects estimation also points into the direction of Hypothesis 2, which states that opportunity entrepreneurs should have higher returns to education than paid employees, the null hypothesis of no difference cannot statistically be rejected based on cluster robust inference.

When pooling opportunity entrepreneurs with necessity entrepreneurs with their lower returns to education, as in prior literature, the single estimate of the average return to a year of education for entrepreneurs tends to understate the value of formal education for those who become entrepreneurs because they spot a business opportunity. At the same time, the pooled estimates available may spark misguided hopes concerning necessity entrepreneurs. Ignorance of their lower returns to education may lead to inadequate policy conclusions: For instance, necessity entrepreneurs may receive public start-up subsidies in the vain expectation that

becoming an entrepreneur will allow them to use their education as productively as in paid employment.

This analysis also provides a possible explanation for country differences in entrepreneurial returns to education. In their meta-analysis, Van der Sluis et al. (2008) speculate that higher entrepreneurial returns to education in the US in comparison to the European countries, where studies were available (the UK, Italy, and the Netherlands), could be due to different abilities of the educational systems to prepare the countries' citizens for entrepreneurial activity (although the econometric shortcomings in the extant studies highlighted by Van der Sluis et al. constitute a limitation to this comparison). Combining this explanation with Lazear's (2004) "jack-of-all-trades" view of entrepreneurs, could imply that the educational system in the US is more successful at teaching the general skills that entrepreneurs need to cope with their wide spectrum of responsibilities, while European education may tend to create specialists who do better as employees (see also Doms, Lewis, & Robb, 2010). However, the differences in the returns to education for opportunity versus necessity entrepreneurs found in this study suggest that different shares of necessity and opportunity entrepreneurs in a country's total set of entrepreneurs may explain an important part of the country differences in the average returns to education of the self-employed. Brixy, Hundt, Sternberg and Vorderwülbecke (2011) demonstrate that the ratio between opportunity and necessity entrepreneurs varies widely between countries. Figure 1 shows that necessity entrepreneurship was more prevalent in Germany than in the US before the financial and economic crisis, so average returns to education for entrepreneurs might have been lower in Germany, even if the educational systems did not have different effects. These differences in the composition of entrepreneurs may have reasons unrelated to the quality of education; for instance, tighter labour market regulation may push individuals into necessity entrepreneurship if this creates barriers to obtaining paid employment. Further research may endeavour to explore these relationships.

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Appendix

Table A 1: Assignment of years of education based on educational degrees obtained

Degree	Years of education assigned
Schooling (panel 1):	
No degree	7
Lower school degree	9
Intermediary school degree	10
Higher technical college entrance qualification (<i>Fachabitur</i>)	12
University entrance qualification (<i>Abitur</i>) ^a	13
Other	10
Additional education / occupational training (panel 2):	
Apprenticeship	1.5
Civil servants apprenticeship	1.5
Technical school (including health school) degree	2
Higher technical college degree (<i>Fachhochschulabschluss</i>)	3
University degree	5

Notes: The variable “years of education” (*educ*) is generated based on the educational degrees obtained by the respondent. It is the sum of the years of schooling (panel 1) and any additional completed education or occupational training (panel 2). See Figure A 1 for the distribution of the generated years of education by employment type.

^a In recent years, but mostly after 2010, i.e. after the observation period, the duration of schooling required to obtain the university entrance qualification (*Abitur*) was reduced to 12 years. Four of the 16 Federal States in Germany implemented this reform between 2007 and 2010 already, and two Eastern states had had a 12 year policy before. As the curriculum was not reduced, but taught in shorter time, for the purpose of this study it is appropriate to always assign 13 years of education to the *Abitur* degree.

Source: Adapted from Anger et al. (2013).

Table A 2: Description of variables

Variable	Description
oppEntre	Dummy for a person who is classified as an opportunity entrepreneur.
necEntre	Dummy for a person who is classified as a necessity entrepreneur.
selfempl	Dummy for a self-employed person (sum of opportunity and necessity entrepreneurs).
grossEarnings	Gross (before-tax) earnings per actual hours worked (in Euro).
educ	Number of years in formal education, generated based on educ. degrees (see Table A 1).
<i>educ. dummies:</i>	
educ<10.5y	Below 10.5 years of education (generated, cf. educ). This usually corresponds to a lower or intermediary school degree.
10.5y≤educ<13y	At least 10.5 and below 13 years of education. This usually corresponds to having obtained a lower or intermediary school degree plus having finished an apprenticeship.
13y≤educ<18y	At least 13 and below 18 years of education. This usually corresponds to having obtained the higher secondary school degree <i>Abitur</i> , which qualifies a student for university admission in Germany.
18y≤educ	At least 18 years of education. This usually corresponds to a university degree.
workExp ^a	Experience in full- and part-time work prior to the year of observation (in years).
unemplExp ^a	Accumulated duration of unemployment prior to the year of observation (in years).
tenure	Tenure with current employer or current self-employment activity (in years).
age	Age of person (in years).
female	Dummy for females.
west	Dummy for a person living in western Germany (i.e. the old member states of former West Germany).
partner	Dummy for a person living with a partner (married or unmarried).
hasChildren	Dummy for a person with at least one child less than 17 years old in the household.
childrenBelow6	Number of children below 6 years of age in the household.
handicapped	Dummy for a physically or mentally challenged person.
migrant	Dummy for a person with a migration background.
openness	Openness to experience (scale 1-7).
conscientiousness	Conscientiousness (scale 1-7).
extraversion	Extraversion (scale 1-7).
agreeableness	Agreeableness (scale 1-7).
neuroticism	Neuroticism, i.e. the opposite of emotional stability (scale 1-7).
internal locus	Internal locus of control (scale 1-7).
external locus	External locus of control (scale 1-7).
risk tolerance	General willingness to take risks (scale 0-10).
father selfempl	Dummy for a person whose father was self-employed when the respondent was 15 years old.
father's educ	Father's number of years in formal education, generated based on educational degrees.
mother's educ	Mother's number of years in formal education.
other hh income	Gross labour earnings of other household members per month (in Euro).
occTrainedFor	Dummy for a person who works in an occupation she was trained for.
employsWorkers	Dummy for a self-employed person who has at least one employee.
libProfessional	Dummy for a self-employed liberal professional (physicians, lawyers, architects, journalists, artists, etc.).
hoursWorked	Hours usually worked per week including overtime work.
Year dummies	Dummy variables for the years 1999-2010.

Note: Dummy variables equal 1 if condition holds and 0 otherwise.

^a Uses information from the lifetime employment history in the SOEP.

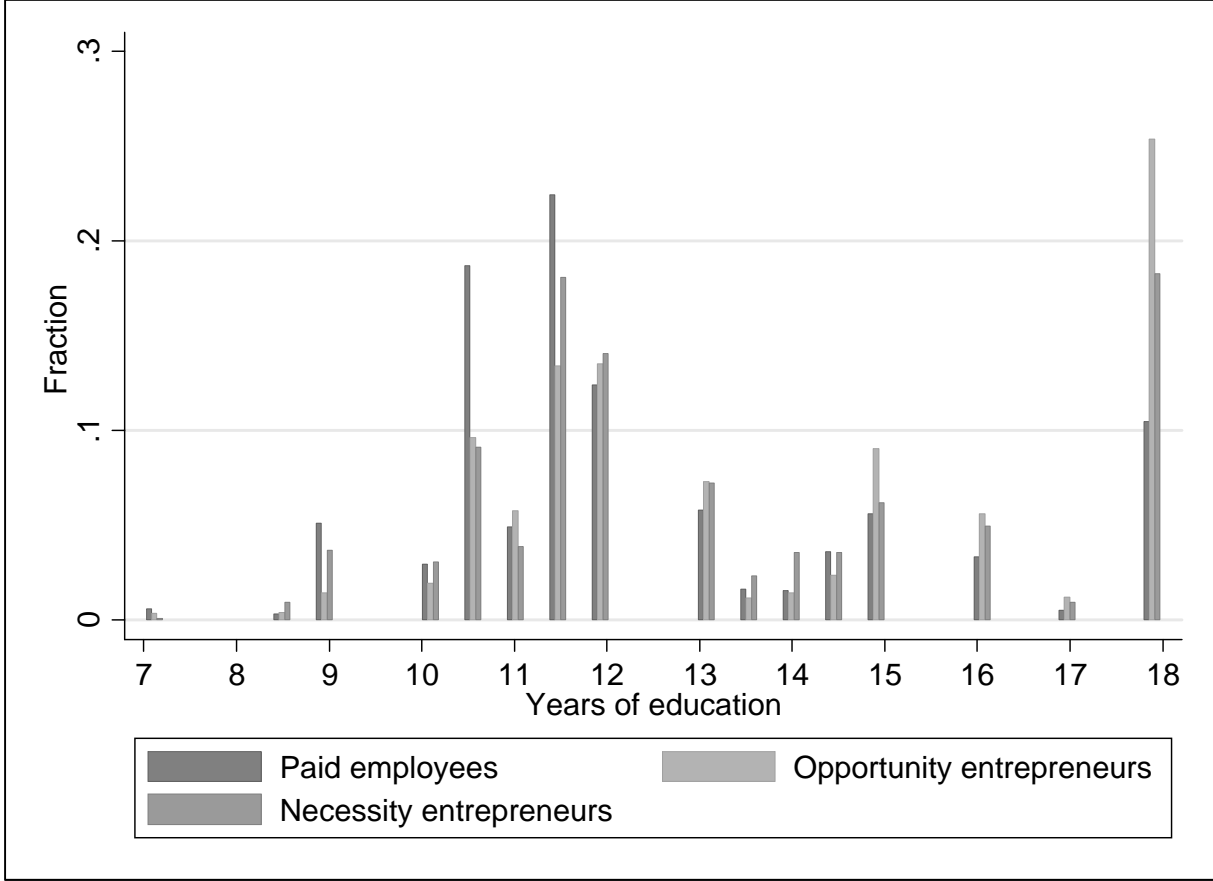
Table A 3: Descriptive statistics for the specific definition of entrepreneurial types

	Opportunity entrepreneurs (OE)		Necessity entrepreneurs (NE)		<i>t</i> -tests of equal means		
	Mean	Std dev.	Mean	Std dev.	OE vs E	NE vs E	OE vs NE
grossEarnings	19.00	14.08	14.96	18.49	0.00	0.13	0.00
educ (years)	13.76	2.99	13.40	2.75	0.00	0.00	0.01
<i>educ. dummies:</i>							
educ<10.5y	0.08		0.08		0.20	0.28	0.95
10.5y≤educ<13y	0.38		0.43		0.00	0.00	0.05
13y≤educ<18y	0.29		0.33		0.00	0.00	0.10
18y≤educ	0.25		0.16		0.00	0.00	0.00
workExp	17.66	8.95	18.81	9.09	0.00	0.00	0.01
unemplExp	0.14	0.63	0.53	1.29	0.00	0.00	0.00
tenure	5.69	4.98	4.46	4.19	0.00	0.00	0.00
age	42.45	8.59	44.35	8.61	0.00	0.00	0.00
female	0.33		0.33		0.00	0.00	0.78
west	0.83		0.48		0.00	0.00	0.00
partner	0.74		0.77		0.32	0.13	0.07
hasChildren	0.41		0.35		0.00	0.47	0.01
childrenBelow6	0.20	0.48	0.15	0.44	0.00	0.79	0.04
handicapped	0.04		0.04		0.00	0.05	0.59
migrant	0.08		0.08		0.00	0.00	0.64
openness	4.74	1.10	4.86	1.06	0.00	0.00	0.03
conscientiousness	6.03	0.92	5.89	0.92	0.15	0.00	0.00
extraversion	5.13	1.00	5.06	1.04	0.00	0.00	0.17
agreeableness	5.34	0.97	5.30	0.94	0.06	0.01	0.37
neuroticism	3.75	1.10	3.71	1.11	0.00	0.00	0.44
internal locus	6.03	0.81	5.93	0.84	0.00	0.00	0.01
external locus	3.36	0.92	3.63	0.92	0.00	0.67	0.00
risk tolerance	5.70	2.16	5.54	1.97	0.00	0.00	0.10
father selfempl	0.11		0.06		0.00	0.46	0.00
father's educ	12.18	2.87	12.01	2.88	0.00	0.00	0.24
mother's educ	10.92	2.10	11.36	2.52	0.00	0.00	0.00
other hh income	1904	2670	1688	2202	0.92	0.01	0.06
occTrainedFor	0.71		0.56		0.00	0.00	0.00
employsWorkers	0.49		0.34		0.00	0.00	0.00
libProfessional	0.37		0.25		0.00	0.00	0.00
hoursWorked	47.48	16.53	45.74	15.67	0.00	0.00	0.03
Person-year obs.	1121		687				

Notes: Standard deviations are not shown for binary variables. The three rightmost columns report *p*-values of two-sample *t*-tests with unequal variances. Definitions of the variables appear in Table A 2.

Source: Authors' calculations based on SOEPv27, 1998-2010.

Figure A 1: Distribution of years of education by employment type



Note: The years of education are generated based on educational degrees obtained (see Table A 1).
Source: Authors' calculations based on SOEPv27, 1998-2010.