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Education and Entrepreneurial Choice: An Instrumental Variables Analysis

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Abstract: Education is argued to be an important driver of the decision to start a business. The measurement of its influence, however, is difficult since it is considered to be an endogenous variable. This study is the first to account for this endogeneity by using an instrumental variables approach. The effect of education on the decision to become self-employed is found to be strongly positive, much higher than the estimated effect in case no instrumental variables are used. That is, the higher the respondent's level of education, the greater the likelihood that she starts a business. Implications for method and practice are discussed.

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Executive Summary

The advent of the knowledge economy together with the recognition that such an economy requires a prominent entrepreneurial sector produced many studies regarding the effect of education on entrepreneurial choice and performance. Moreover, of the many factors known to influence entrepreneurial choice and performance education is popular among politicians since it can be influenced. Our study contributes to this literature by showing that a higher level of education increases the likelihood of becoming self-employed. Our data set comprises of more than ten thousand individuals from 27 European countries and the US, who are either self-employed or in a paid employment job.

There are at least two important implications for both method and practice: *first*, our results show that a standard Probit (or Logit) model should not be used to estimate the effect of education, since it tends to underestimate the effect of education. An so called Instrumental Variable approach is needed to find the 'true' effect. *Second*, the popularity among politicians to promote education as an important driver of economic growth is supported by the 'second order' effect that education promotes entrepreneurship which itself is a driver of economic growth.

Introduction

The effect of education on entrepreneurial choice and performance is widely researched (Van der Sluis et al., 2008). Policy-makers are particularly interested in the effect of education since it can be influenced by policy measures (European Commission, 2003; OECD, 2009). Establishing its effect, however, is difficult due to endogeneity (Griliches and Mason, 1972; Blackburn and Neumark, 1993; Ashenfelter et al., 1999). That is, education appears as a causal variable in an econometric model while it is in fact correlated with the errors in the model. This correlation can be caused by measurement errors or omitted variables. Measurement errors in the observed education variable may push the estimated return to schooling towards zero, since they lead to variation in the education variable that has no effect on income. Further, education may be correlated with explanatory variables that are omitted. A typical omitted variable is unobserved 'ability'. Individuals with higher ability typically obtain higher education levels, but also earn higher income given a certain education level. This may lead to an overestimated return to schooling.

In these situations the use of instrumental variables regressions (IV regressions) is a solution to isolate the causality (Angrist and Krueger, 1991; Angrist et al., 1996). Using such IV regressions, Parker and Van Praag (2006) find that education is indeed endogenous to *entrepreneurial performance* and that it makes a difference whether or not IV methods are used. So far, however, no studies use IV regressions to analyze the effect of education on *entrepreneurial choice*. This is surprising, since entrepreneurial choice is widely examined in the literature (Evans and Jovanovic, 1989; Lévesque et al., 2002; Lévesque and Minniti, 2006; Grilo and Thurik, 2008; Parker, 2009). This study is a first attempt.

There are two main groups of candidate instruments for education: family background variables and natural experiment variables such as changes or differences in compulsory schooling laws (Angrist and Krueger, 1991; Webbink, 2005; Hoogerheide et al., 2007). In the present study, we rely on the first category and use the social class of the parents as an instrument. Our data set comprises of more than ten thousand individuals from 27 European countries and the US, who are either self-employed or in a paid employment job. We obtain two important findings: *first*, the effect of education on the decision to become self-employed is found to be strongly positive. The higher the respondent's level of education, the greater the likelihood that (s)he starts a business. *Second*, our results show that a standard Probit or Logit model strongly underestimates the effect of education on entrepreneurial choice and leads to biased results. We suggest that this is the precise reason why many earlier studies have found weak or insignificant results (Van der Sluis et al., 2008). The underestimation (under the assumption of no endogeneity) of the effect of education on the choice to become self-employed is also in line with the underestimation of the OLS estimator for the effect of education on wage (Angrist and Krueger, 1991).

Data and Method

To analyze the effect of education on entrepreneurial choice, we use data from the 2007 Flash Eurobarometer Survey on Entrepreneurship. The dataset has been used in a number of published studies (Grilo and Irigoyen, 2006; Grilo and Thurik, 2008; Van der Zwan et al., 2009) and contains detailed information on the respondents' employment status. We restrict the sample to those respondents who are either self-employed or in a paid employment job (10,962 obs.). We excluded respondents with solely domestic activities (1,678 obs.) or searching for a job (632 obs.), students (1,443 obs.), retirees (5,242 obs.), and respondents who refused to give an answer or do not fall in any of these categories (717 obs.). We lose some further observations due to missing values. The final dataset contains 10,397 observations.

Our dependent variable is a dummy variable, which indicates whether the participant is self-employed or not. Education is measured as the number of years which the participant spent receiving education. We include a number of commonly used control variables in the regression model such as gender or job experience (Grilo and Thurik, 2008). We also controlled for country effects. Table 1 describes the construction of the variables; Table 2 shows correlations and descriptive statistics.

Table 1 and 2 about here

To analyze the effect of education on the decision to become self-employed, we estimate both a standard Probit model and an IV Probit model. As instruments, we use the social class of the parents (e.g., blue collar vs. white collar). The IV model is estimated to account for the above discussed endogeneity issue associated with the education measure (Angrist and Krueger, 1991; Angrist et al., 1996). We test the validity of the instruments with the Amemiya-Lee-Newey minimum chi-square statistic (Amemiya, 1978; Newey, 1987; Lee, 1992). The null hypothesis of valid instruments is not rejected ($p=0.146$). Hence, the instrument seems not to have a direct effect on the dependent variable: its only effect on the dependent variable seems to go via its effect on the endogenous explanatory variable. In general, family background variables are common, although not undisputed, instruments (Blackburn and Neumark, 1993, 1995; Parker and Van Praag, 2006). Other authors have used regional and legal variations in education as instruments, which are also not immune to criticism (Card, 2001; Deaton, 2009; Heckman and Urzua, 2009; The Economist, 2009). Our dataset does not include the latter types of instruments.

Results

Table 3 shows the regression results.

Table 3 about here

The results regarding the effect of education on entrepreneurial choice are clear-cut: both in the standard Probit model and in the IV model, a positive effect of education regarding the decision to start a business is found. The IV model however shows a much stronger effect ($\beta=0.014$ in the standard Probit model[1]; $\beta=0.137$ in the IV model)[2]. This strong difference in the size of the effects is explained by the fact that education is endogenous to entrepreneurial choice: estimating a standard Probit model underestimates the 'true' effect. The Wald-test of exogeneity is highly significant. There are two possible reasons for the negative bias in the standard Probit model. *First*, there may be omitted variables such as cognitive ability that have both a positive influence on education level and a negative effect on the decision to become self-employed (Griliches and Mason, 1972; Blackburn and Neumark, 1993). *Second*, if years of education is a poor proxy for the level of education[3] then measurement error drives the estimate for education in

[1] Using a standard Logit model yields $\beta=0.024$ ($p<0.001$).

[2] The respective marginal effects are $\beta=0.003$ in the standard Probit model and $\beta=0.023$ in the IV model. Hence, an additional year of education increases the probability of becoming self-employed by 0.3% in the standard Probit model and 2.3% in the IV model. For the calculation, all dummy variables are set at zero (the modal value) and all continuous variables are set at their sample mean.

[3] For example, years of education as a measure does not account for the *quality* of education.

the standard Probit model towards zero or insignificance (similar to the linear model for which the effect of measurement errors is discussed by Griliches, 1977, and Angrist and Krueger, 1991).

The almost zero correlation between education and entrepreneurship may seem surprising at first sight (Table 2), given our finding of a significant effect of education on entrepreneurship in the IV model (Table 3). However, the correlation merely tells the story of the data without use of IV: that is, if this correlation were to be interpreted and hence 'trusted' as a proper indicator for the causality between education and entrepreneurship, we would not need IV in the first place. The correlation suffers from all the problems that the standard Probit estimator suffers from in the case of an endogenous explanatory variable: the -0.01 incorporates the influence of measurement errors, omitted variables, etc..

The results regarding the control variables are as expected (Davidsson and Honig, 2003; Grilo and Thurik, 2008). For example, male respondents have a higher likelihood of falling into the self-employment category (IV model: $\beta=0.388$, $p<0.001$). The effect of labor market experience is positive in its linear term and negative in its squared term. Country effects are important. An F-test on joint significance of the country variables shows a significant result.

Discussion

The advent of the knowledge economy together with the recognition that such an economy requires a prominent entrepreneurial sector (Audretsch and Thurik, 2001; Audretsch, 2007) produced many studies regarding the effect of education on entrepreneurial choice and performance (Van der Sluis et al., 2008). Moreover, of the many factors known to influence entrepreneurial choice and performance (Grilo and Thurik, 2008; Parker, 2009) education is popular among politicians since it can be influenced. Our study contributes to this literature by estimating an IV model to explain the causal effect of education on entrepreneurial choice. We show that education appears to be an endogenous variable regarding the decision to become self-employed, which is why an IV model is needed to estimate its effect. Using such a model, we then show that a higher level of education increases the likelihood of becoming self-employed. Our data set comprises of more than ten thousand individuals from 27 European countries and the US, who are either self-employed or in a paid employment job.

These two main results have a number of important implications for both method and practice: *first*, our results show that a standard Probit (or Logit) model should not be used to estimate the effect of education, since it tends to underestimate the effect of education. An IV approach is needed to find the 'true' effect. In that respect, entrepreneurial choice does not differ from other educational outcome variables such as wage (Angrist and Krueger, 1991; Card, 2001; Van Praag and Van der Sluis, 2004; Webbink, 2005). *Second*, the popularity among politicians to promote education as an important driver of economic growth is supported by the 'second order' effect that education promotes entrepreneurship which itself is a driver of economic growth (Audretsch et al., 2006, 2008; Thurik et al., 2008).

The results of our paper offer several interesting avenues for further research. One avenue would be to analyze whether a higher level of education increases the preference for self-employment as a means to obtain non-monetary benefits (e.g., more flexibility or independence) or whether more education increases the economic returns from self-employment. Another avenue would be to use a more comprehensive dataset which includes more information about the individual's labor market status. Such a dataset would allow estimating the effect of education in a multinomial model, in which not only self-employment and employment exist as alternatives but also non-employment and unemployment (Grilo and Thurik, 2008). Moreover, it would be

interesting to analyze whether the positive effect of education on entrepreneurial choice holds for all types of entrepreneurs alike (e.g., necessity versus opportunity entrepreneurs).[4]

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[4] See Block and Wagner (2010) or Block and Sandner (2009) for a discussion of necessity versus opportunity entrepreneurship.

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Table 1: Description of variables

Variable	Description
Dependent variable	
Self-employment	Dummy = 1 if respondent is self-employed
Variable of interest	
Education	Number of years the respondent has been in full-time education
Instruments [1]	
Father was/is white collar	Dummy = 1 if father of respondent had/has a white collar job
Father was/is blue collar	Dummy = 1 if father of respondent had/has a blue collar job
Father was/is civil servant	Dummy = 1 if father of respondent was/is civil servant
Father was/is without professional activity	Dummy = 1 if father of respondent was/is without professional activity
Mother was/is white collar	Dummy = 1 if mother of respondent had/has a white collar job
Mother was/is blue collar	Dummy = 1 if mother of respondent had/has a blue collar job
Mother was/is civil servant	Dummy = 1 if mother of respondent was/is civil servant
Mother was/is without professional activity	Dummy = 1 if mother of respondent was/is without professional activity
Control variables	
Labor market experience	Age of the respondent minus age when stopped full time education
Male	Dummy = 1 if respondent is male
Father was/is self-employed	Dummy = 1 if father of respondent was/is self-employed
Mother was/is self-employed	Dummy = 1 if mother of respondent was/is self-employed
Rural region	Dummy = 1 if respondent lives in a rural region
Metropolitan region	Dummy = 1 if respondent lives in a metropolitan region
Country dummies	28 Country indicator variables (Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, UK, US)

Note: [1] The instruments do not sum up to 1, since the response categories 'father/mother was/is self-employed' and 'don't know/no answer' are not used as instruments.

Table 2: Descriptive statistics and correlations

		Min.	Max	Mean	Median	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Self-employment	0	1	0.20	0																
2	Education	1	75	13.66	12	-0.01															
3	Labor market experience	0	81	23.02	23	0.11	-0.42														
4	Male	0	1	0.44	0	0.14	0.01	0.02													
5	Father was/is self-employed	0	1	0.24	0	0.16	0.02	0.04	0.03												
6	Mother was/is self-employed	0	1	0.10	0	0.10	-0.00	0.02	-0.01	0.41											
7	Rural region	0	1	0.35	0	0.04	-0.12	0.05	-0.01	0.05	0.05										
8	Metropolitan region	0	1	0.23	0	-0.01	0.14	-0.05	0.01	-0.04	-0.03	-0.40									
9	Country is US	0	1	0.05	0	0.05	0.12	0.00	0.05	0.00	-0.01	-0.02	0.09								
	Instruments																				
10	Father was/is white collar	0	1	0.17	0	-0.02	0.07	-0.08	-0.01	-0.25	-0.10	-0.03	0.05	0.05							
11	Father was/is blue collar	0	1	0.33	0	-0.09	-0.10	0.05	-0.00	-0.39	-0.16	0.04	-0.05	-0.01	-0.32						
12	Father was/is civil servant	0	1	0.18	0	-0.03	0.05	-0.02	-0.01	-0.26	-0.11	-0.09	0.05	-0.05	-0.21	-0.33					
13	Father was/is without professional activity	0	1	0.04	0	-0.01	-0.04	-0.02	-0.01	-0.12	-0.05	0.02	-0.02	-0.01	-0.10	-0.15	-0.10				
14	Mother was/is white collar	0	1	0.14	0	-0.02	0.09	-0.17	-0.03	-0.07	-0.14	-0.02	0.06	0.06	0.31	-0.10	-0.08	-0.06			
15	Mother was/is blue collar	0	1	0.19	0	-0.07	-0.07	0.01	-0.03	-0.16	-0.16	0.01	-0.01	0.00	-0.10	0.36	-0.12	-0.06	-0.19		
16	Mother was/is civil servant	0	1	0.14	0	-0.04	0.08	-0.11	-0.03	-0.11	-0.14	-0.08	0.07	-0.05	-0.06	-0.13	0.38	-0.06	-0.16	-0.19	
17	Mother was/is without professional activity	0	1	0.41	0	0.03	-0.06	0.17	0.06	0.02	-0.28	0.03	-0.06	-0.00	-0.03	-0.00	-0.04	0.16	-0.33	-0.40	-0.33

Notes: N=10,397 obs.; All correlations above r=0.02 have a p-value less than 0.05; We checked estimation results omitting 'outliers' (e.g. observations with education over 30 years): changes in results are minor.

Table 3: Results of standard Probit regression and instrumental variables Probit regression
Dependent variable: Individual is self-employed

	Standard Probit Regression		Instrumental Variables Probit Regression (two step) [1]	
Variables	**Coefficient (SE)**		**Coefficient (SE)**	
Education [a, b]	0.014 (0.003)	***	0.134 (0.030)	***
Labour market experience/10	0.137 (0.038)	***	0.475 (0.094)	***
(Labour market experience/10)^2	0.001 (0.010)		-0.023 (0.010)	*
Male	0.392 (0.030)	***	0.388 (0.032)	***
Father was/is self-employed	0.347 (0.037)	***	0.290 (0.042)	***
Mother was/is self-employed	0.178 (0.050)	***	0.203 (0.054)	***
Rural region [c]	0.169 (0.035)	***	0.279 (0.046)	***
Metropolitan region [c]	0.051 (0.040)		-0.042 (0.049)	
Country dummies [d]	27 categories (p<0.001)		27 categories (p<0.001)	
Intercept	-1.999 (0.151)	***	-3.945 (0.512)	***
N	10,397		10,397	
Minus Log pseudolikelihood	4656.61			
Pseudo R^2	0.083			
Wald Chi² (df)	765.11 (35) ***		683.44 (35) ***	

* p<0.05 ** p<0.01 *** p<0.001
SE=Robust standard errors (standard Probit regression)

Notes:
[a] Instruments for education: 'father was/is white collar', 'father was/is blue collar', 'father was/is civil servant', 'father was/is without professional activity', 'mother was/is white collar', 'mother was/is blue collar', 'mother was/is civil servant', 'mother was/is without professional activity' (F-test for significance of the instrument: F(8, 10,392)=39.56***; R^2=0.026
Wald-test of exogeneity: p<0.001
Validity of the instruments: Amemiya-Lee-Newey minimum chi² statistic: 10.837 (p=0.146)
[b] When excluding outliers (education is more than 30 years), the coefficients are β=0.131 *** (IV model) and β=0.014 *** (Standard Probit Model). We also tested for a non-linear effect of education on entrepreneurial choice but found no evidence of such an effect.
[c] Reference category is 'other town/urban centre'.
[d] Reference category is 'US'.