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Financial Literacy and Self-Employment

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Financial Literacy and Self-Employment

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Financial Literacy and Self-Employment

Abstract

In this paper, we study the relationship between financial literacy and self-employment. We use established financial knowledge-based questions to measure financial literacy levels. The analysis shows a highly significant and positive correlation between financial literacy scores and self-employment. We address the direction of causality by applying instrumental variable techniques based on information on the education of parents. The results provide support that financial literacy positively affects the probability of being self-employed. As financial literacy is acquirable, findings suggest that entrepreneurial activities might be raised via enhancing financial knowledge.

Keywords: Financial literacy; Financial sophistication; Self-employment; Entrepreneurship;

Instrumental variable estimation

JEL Classification: A20, D03, J23, J24.

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1. Introduction

Standard economic models assume that individuals are well equipped with the skills to manage financial risks and to optimize consumption and savings over the life cycle. However, we know from empirical studies that many individuals lack the skills for basic financial concepts and, thus, are financially illiterate (Lusardi and Mitchell, 2007; Jappelli, 2010; van Rooij et al., 2011a). Several studies show that financially illiterate individuals are more likely to miss making efficient decisions on financial markets, especially when it comes to saving and investment, indebtedness and mortgages, retirement planning and wealth accumulation (Agarwal et al., 2009; Banks et al., 2010; Disney and Gathergood, 2011). While many scholars investigate the importance of financial literacy for households' financial decision making, with the exception of few studies, the interaction of financial literacy and entrepreneurial activity is largely ignored.

The study of entrepreneurship is of gaining interest to scholars and policymakers and a lot of research is devoted to the unique characteristics of entrepreneurs, to factors that affect the entry decision, and to entrepreneurial survival. Several studies reveal that entrepreneurs differ in personality characteristics or preferences from employed people. However, most characteristics as the Big Five personality traits, specific personality characteristics, or risk attitudes, which are found to have an impact on being self-employed, are classified as relatively stable over time and therefore are out of control for policymakers (see Caliendo et al., 2013; Cobb-Clark and Schurer, 2012a; 2012b).

Financial literacy, which is acquirable, has not been focus of the analysis so far, but there is reason to assume that it does play a role for entrepreneurial activity. Besides non-financial and non-economic reasons, other important factors why businesses fail are poor financial management, lack of capital, or misjudgement of risks. Persons who are considering taking the step into self-employment likely are aware about the existence of special challenges and risks of an own business. If persons are uncertain about their ability to handle those challenges and to manage an own business, they might prefer to work as employees. Considering persons who have a business idea, who have the willingness to take risks, and who meet other decisive conditions, we assume that those persons with higher levels of financial literacy are more likely to take the step into self-employment and survive in self-employment than those with lower levels. The reason for this assumption is the idea that people with better understanding of financial products and financial concepts have better opportunities for realizing business ideas and financing their venture. Literature shows that

financially literate persons are more likely to have formal credits, a higher disposability of unspent income, higher rates of return, and are cost efficient concerning saving and investments (Disney and Gathergood, 2013; Jappelli and Padula, 2013; Klapper et al., 2013). If financially literate persons are more efficient on the financial market in private matters, there is reason to assume that literate people are also more aware of sources of information, sources of advice, and sources of capital for entering self-employment. They might also be rather aware of different financing options or financial sponsorships and they might have a better understanding of terms and conditions of financing those options. If literate persons are more likely to develop skills and confidence to become more aware of financial risks and opportunities, they might not only have a better understanding of the profitability of a business, they might also be rather willing to take the step into self-employment than those who do not have a deeper understanding of how to handle challenges, risks, and responsibilities of an own business.

However, causality might also run the other direction: Not being self-employed might lower the incentive to invest into financial skills. In case of positive correlation between financial literacy and self-employment, the question arises if the link runs from financial literacy to self-employment or vice versa.

We are the first attempting to find a link between financial literacy and self-employment. Thereby we make use of the German SAVE data set that allows generating an index for the level of financial literacy based on nine questions on financial concepts. To address the direction of causality, we apply instrumental variable techniques. Moreover, we control for several additional potential determinants and channels of self-employment. The results suggest a positive impact of financial literacy on self-employment. Given that we do not observe any entries and exits into and out of self-employment, we cannot analyse the impact of financial literacy on entrepreneurial performance. However, we contribute to the existing literature in several respects. We are the first who augment the studies on financial literacy beyond financial decision-making by focusing on the role of financial literacy for self-employment. Thereby, we contribute to the entrepreneurship literature and point to a new “characteristic” of entrepreneurs that was not taken into account in previous studies. Consequently, we add to the nature- nurture debate on the characteristics of entrepreneurs. As financial literacy is acquirable, our findings suggest that entrepreneurial activities might be raised via enhancing financial literacy. This finding also adds to the literature suggesting that *what* you learn rather than years of education is important for success in entrepreneurship

(Unger et al. 2011). For example, Elert et al. (2015) show that entrepreneurship education during high school increases the long-term probability of starting a firm as well as entrepreneurial incomes. Unger et al. (2011) find that human capital is most important if it is task-related. Moreover, Martin et al. (2013) show that entrepreneurship education and training have a positive impact in increasing interest and attitudes toward entrepreneurship, and in improving financial performance as entrepreneur.

The next section of the paper gives a brief overview of previous findings on the subject of financial literacy, on the one hand, and of characteristics of entrepreneurs, on the other hand. Section 3 describes the underlying data; we define the index for financial literacy and provide summary statistics. In section 4, we present our identification strategy and the regression results and in section 5, we discuss the results and present several extensions. In the last section, we draw some initial conclusions and discuss potential policy implications.

2. Literature review

Our paper relates to two strands of the existing literature. We briefly review seminal studies on financial literacy and studies that focus on characteristics of entrepreneurs.

First, research on financial literacy analyses the effects of financial literacy on individual behaviour especially concerning financial matters. Results reveal that individuals' net wealth increases with increasing financial literacy level (Disney and Gathergood, 2011; van Rooij et al., 2012; Behrman et al., 2012). This relationship is analysed by Jappelli and Padula (2013) who derive an economic intertemporal consumption model for this outcome. Financial literacy has positive effects on rates of return and on cost efficiency with regard to saving and investments. Higher levels of financial sophistication are correlated with higher interest incomes and lower credit costs (Deuflhard et al., 2015). Individuals with higher levels of financial sophistication are also more likely to have formal credits and a higher disposability of unspent income and they are less likely to have informal credits (Disney and Gathergood, 2013; Klapper et al., 2013). Christiansen et al. (2008), van Rooij et al. (2011a), and Jappelli and Padula (2015) study the impact of financial literacy on stock market participation and they find that individuals with a low level of financial literacy are less likely to hold stocks. Moreover, Guiso and Jappelli (2009) and Jappelli and Padula (2015) find a strong correlation between the level of financial literacy and portfolio decisions. Another channel through which wealth is affected by financial sophistication is retirement planning. Several studies address the link of financial sophistication on retirement planning. In light of

demographic changes and accompanied pension reforms, supplementary private pensions become an important pillar to gain sufficient retirement income. Lusardi and Mitchell (2005; 2007) evaluate how successful individuals plan for retirement. They show that financial literacy is important for planning behaviour that, in turn, increases wealth. Similarly, Bucher-Koenen and Lusardi (2011) demonstrate that financial literacy has a positive impact on retirement planning in Germany and van Rooij et al. (2011b) provide similar evidence for the Netherlands. In turn, successful retirement planning positively affects the individuals' total wealth accumulation (van Rooij et al., 2012). What all these studies have in common is that they link financial literacy and wealth accumulation.

Yet, we know relatively little about the impact of financial literacy on entrepreneurship although a lot of research is devoted to the question what makes an entrepreneur. Fairly and Robb (2009) show that women are less likely to be self-employed. Several personality traits are found to have influence on the decision to make the move into self-employment. Scholars find that the *Big Five* personality traits affect the decision to enter self-employment. Zhao and Seibert (2006) show that entrepreneurs differ from employed managers in terms of neuroticism, openness to experience, conscientiousness, and agreeableness. Caliendo et al. (2013) confirm the results and they find a positive effect of extraversion on the probability of being in self-employment and on the entry probability into self-employment. Furthermore, research results show that entrepreneurs are more willing to take risks. Cramer et al. (2002) find a negative correlation between risk aversion and entrepreneurship. Ekelund et al. (2005) show that risk aversion affects the decision to enter entrepreneurship using psychometric data from the Northern Finland 1966 Birth Cohort Study which collected data on individuals from the prenatal period up to age 31. Caliendo et al. (2009) confirm that individuals with lower risk aversion are more likely to enter self-employment. Another specific personality characteristic is locus of control. The internal locus of control, i.e. the assurance that one's own actions reach rewards, reinforcements, or outcomes in life (see Spector, 1988; Rotter, 1966), is found to be positively correlated with self-employment (Caliendo et al., 2009). Other scholars point out that the need for autonomy and the willingness to trust others drive self-employment (Feldman and Bolino, 2000; Carter et al., 2003; Caliendo et al., 2013). Most of these traits, like Big Five, risk preferences, or locus of control, are shown to be relatively stable over time (Specht et al., 2011; Andersen et al., 2008; Cobb-Clark and Schurer, 2012a; 2012b). These traits are, thus, out of control for

scholars and policy makers. Financial literacy, which is acquirable, has not been focus of research so far.³

3. Data

The German SAVE study

For our empirical analysis, we use the German SAVE study. The representative household panel covers the period 2001-2013 and focuses on saving behaviour and asset accumulation of private households (Boersch-Supan et al., 2009). We draw our main data from the 2009 survey that includes a set of questions on financial knowledge. In the 2009 survey, 2,222 households participated. For our study, we restrict the sample to individuals at the age between 18 and 65 years. We exclude non-working individuals and assisting family members.⁴ This leaves us with 1,039 observations.

One of the key characteristics for our study is the type of employment. The SAVE study queries whether respondents are *Blue-collar worker / White-collar worker / Civil servant / Farmer / Self-employed as member at the respective chamber (e.g. pharmacist, doctor, lawyer) / Other freelancer / Trader or other form of self-employment*. We cluster the first three employment groups (blue-collar worker, white-collar worker, civil servants) as the group of employees.⁵ As in most empirical studies on entrepreneurship, we use self-employment as measurable proxy for entrepreneurship (see Caliendo et al., 2010; Stewart and Roth, 2001).⁶ Since the group of self-employed is a heterogeneous group and likely differs in characteristics (see e.g. Earle and Sakova, 2000), we define a wide and a narrow definition of self-employment. Firstly, we cluster the four subsequent professions (*farmer, self-employed as member at the respective chamber, other freelancer, trader or other forms of self-employment*) as the group of self-employed individuals for a broad definition. Secondly, we exclude types of self-employment that can also be performed in regular employment, i.e. we

³ Only a few studies deal with related subjects. For example, Bruhn and Zia (2013) evaluate business and financial literacy programs in the context of emerging markets. Based on descriptive statistics of 24 observations, findings by Oseifuah (2010) suggest that financial literacy levels among young entrepreneurs in South Africa are above average. Canadian data show that financial literacy leads to more frequent production of financial statements (Wise, 2013). A higher number of financial statements, in turn, leads to a higher probability of loan repayment and a lower probability to involuntary venture closure.

⁴ The term “non-working” here refers to all respondents who state to be *currently not employed / not applicable* when asked about their type of employment.

⁵ Some studies on entrepreneurship exclude civil servants from the sample examined (e.g. Caliendo et al., 2013). As a robustness check we also provide main regression results on a subsample excluding civil servants.

⁶ Regarding Schumpeterian entrepreneurship, several scholars emphasize to focus on measures that adequately capture innovative and growth oriented entrepreneurship (Shane, 2009; Henrekson and Sanandaji, 2014).

drop observations as *farmers*, *self-employed as member at the respective chamber*, and *other freelancers* from the sample and cluster only *trader or other forms of self-employment* as the group of self-employed. The narrow definition of self-employment holds an additional advantage: Parental (self-) employment might affect that of their children (Djankov et al., 2006). This case is more likely to apply to professionals such as lawyers and doctors, who are excluded from the narrow definition. In what follows, we use information about the type of employment for constructing the variables *self-employment (wide)* and *self-employment (narrow)* that are 1 if an individual is self-employed and 0 otherwise.

As controls, we use the age of respondents, gender, marital status, number of children, and a dummy variable for a school-leaving qualification in the former GDR. Education levels are classified in compliance with existing research (e.g. van Rooij et al., 2012) according to ISCED in four groups: Intermediate vocational education, higher vocational education, university education, and a fourth group that captures response categories *no vocational education* and *other vocational education*. We include a proxy for cognitive abilities as control variable. Following existing literature, we make use of answers on mental exercises. The indicator measures the skills for simple numerical calculations; it gives the number of correct answers on three questions.⁷

We further include economic factors. The participants were asked about their earnings from wage and salary in the previous year. Earnings of self-employed are well below earnings of regularly employed respondents. However, literature has shown that particularly for self-employed individuals income levels are measured with error (Fuchs-Schündeln, 2009). Hurst et al. (2014) show that self-employed under-report their income not only to tax authorities but also to household surveys. We additionally control for homeownership. Furthermore, we include a dummy variable for earlier periods of unemployment. Risk attitudes are measured based on self- assessments on the willingness to take risks with respect to the career on a scale of complete unwillingness (0) to complete willingness (10). Following studies on risk attitudes and entrepreneurship, we group answers 0-2 into a low risk-category, answers 3-7 into a medium risk-category, and answers 8-10 into a high risk-category (Caliendo et al., 2009). The evaluation of the socio-demographic and socio-economic characteristics of the total sample and by employment groups is provided in Table 1.

⁷ The precise wording of these questions is given in the appendix.

Table 1. Characteristics of individuals

	Total sample		Self-Employed (Wide)		Employees	
	N	Share/ Mean	N	Share/ Mean	N	Share/ Mean
Male (Dummy)	503	0.48	60	0.58	443	0.47
Female (Dummy)	536	0.52	44	0.42	492	0.53
Age (mean)	1039	45.8	104	47.7	935	45.6
Education						
Intermediate	62	0.06	12	0.12	50	0.05
Higher level	674	0.65	48	0.46	626	0.67
University	116	0.11	9	0.09	107	0.11
Other	187	0.18	35	0.34	152	0.16
Graduation in GDR (Dummy)	293	0.28	36	0.35	257	0.28
Mental exercises						
0 correct answer	56	0.05	8	0.08	48	0.05
1 correct	398	0.38	41	0.39	357	0.38
2 correct	495	0.48	49	0.47	446	0.48
3 correct	90	0.09	6	0.06	84	0.09
Marital status						
Single	206	0.20	22	0.21	184	0.20
Married	649	0.63	67	0.64	582	0.62
Else	184	0.18	15	0.14	169	0.18
Number of children (average)	1039	1.64	104	1.39	935	1.66
Homeowner (Dummy)	1039	0.56	104	0.59	935	0.56
Unemployed (Dummy)	1039	0.61	104	0.65	935	0.61
Risk- career						
Low	489	0.47	33	0.32	456	0.49
Medium	547	0.49	62	0.60	452	0.48
High	36	0.04	9	0.09	27	0.03
Net income (average)	1039	1380	104	642	935	1462
Total	1039	100.0	104	100.0	935	100.0

Note: Shares and means do not sum up to 100% because of rounding.

Measuring financial literacy

The 2009 SAVE survey contains a set of nine questions related to basic numeracy and more advanced concepts of financial knowledge. The first set of financial knowledge-based questions was developed by Lusardi and Mitchell (2005) and applied by most studies on financial literacy (e.g. Alessie et al., 2011; Agnew et al., 2013; Bucher-Koenen and Lusardi, 2011). These questions measure the ability to perform simple calculations (compound interest), the effect of inflation, and risk levels of stocks vs. mutual bonds (diversification).⁸ In 2009 SAVE, six additional financial knowledge-based questions are included. These questions cover additional interest compounding, money illusion, volatility (fluctuations of different assets), stock market, balanced funds, and bond prices.⁹ These questions mainly allow measuring the degree to which individuals have an understanding for concepts and for products of financial markets. We use the responses to the nine questions to construct an

⁸ The precise wording of these questions is given in the appendix.

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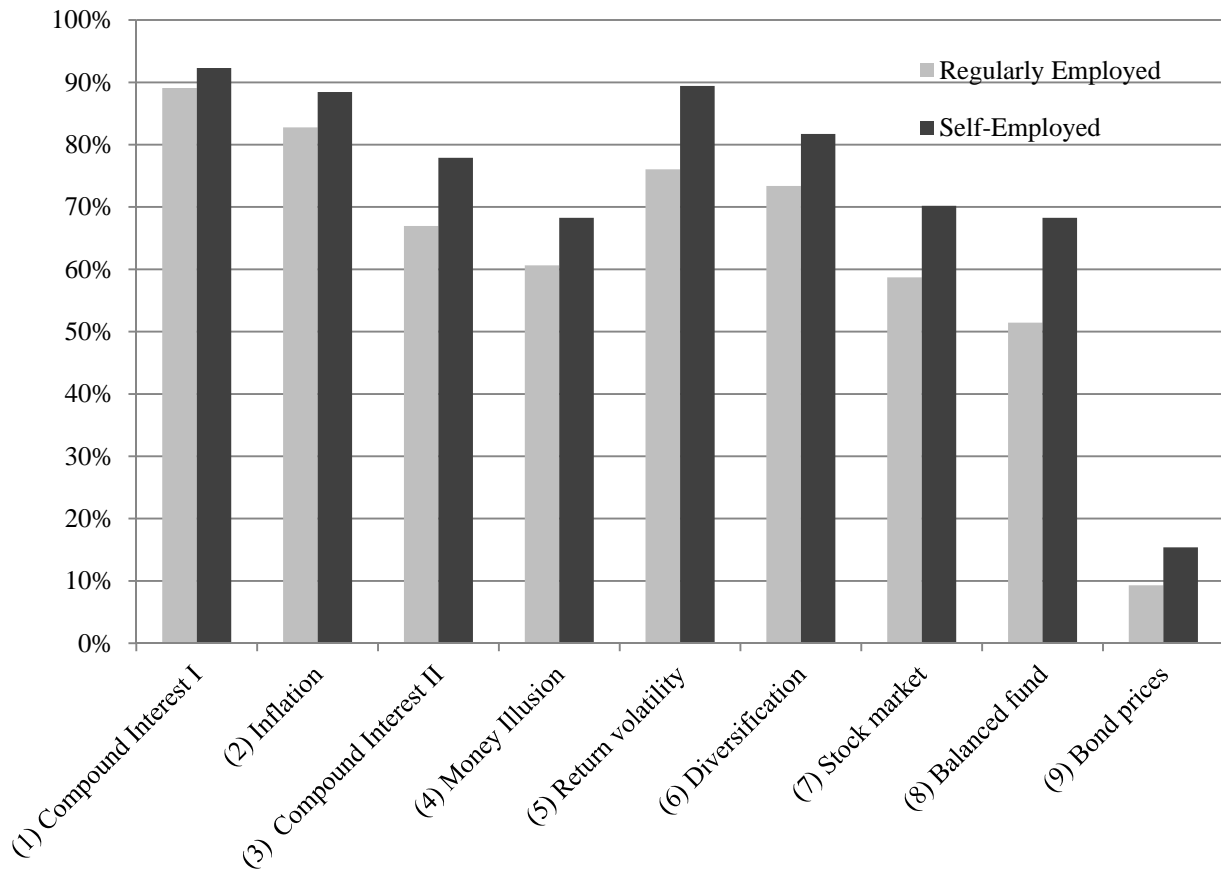
index of financial knowledge. Following existing literature, our financial literacy indicator counts the number of financial knowledge questions answered correctly (e.g.: Alessie et al., 2011; Bucher-Koenen and Lusardi, 2011; Klapper et al., 2013). Previous researchers have measured financial literacy using the first basic financial knowledge questions only, but as the 2009 SAVE data enable to make use of a set of nine financial knowledge-based questions, we exploit the complete potential. Similarly, Lusardi and Mitchell (2009), Behrman et al. (2012), and van Rooij et al. (2011a; 2012) exploit the range of 8 to 16 questions, respectively, available in the underlying data. In the following, our financial literacy index gives the total number of correct answers given on the nine financial knowledge-based questions.

Lusardi and Mitchell (2009) and van Rooij et al. (2011a) apply similar questions to evaluate financial literacy. In both studies the questions *Compound interest I*, *Compound interest II*, *Inflation*, and *Money Illusion* are defined as basic financial literacy questions. The questions *Volatility*, *Risk diversification*, *Stock market*, *Balanced fund*, and *Bond prices* are classified as advanced questions. Following the literature, we evaluate financial literacy in the same way.

The answers to the financial knowledge-based questions by employment groups are provided in Figure 1. A relative high fraction of individuals is able to give correct answers to the basic financial knowledge questions (questions 1- 4). Self-employed individuals are more likely to answer each of these basic questions correctly compared to regularly employed individuals. However, the proportion of correct answers decreases considerably from the first question (89% among regularly employed and 92% among self-employed) to the fourth one (60% and 68% respectively). Questions 5- 9 in Figure 1 refer to more advanced financial literacy topics. We find a similar pattern of response behaviour as before: self-employed individuals gave correct answers to advanced questions more frequently than employees did.

In sum, the average number of correct answers on all financial knowledge-based questions is significantly higher among self-employed individuals (6.5) compared with employed individuals (5.7). The analysis reveals that self-employed individuals tend to be more financially literate than employed individuals are. The results raise the question whether self-employed workers are more literate because of their employment activity or whether more financially literate individuals tend to make the move into self-employment and survive in self-employment rather than less financially literate individuals. In order to address the concern of reverse causality, we resort to instrumental variables estimation that is explained in more detail in the subsequent section.

Figure 1. Correct answers on financial literacy questions.



Note: See Appendix for the exact wording of the questions.

4. Identification strategy and results

In estimating the effect of financial literacy on the probability of being self-employed, we need to address several concerns with regard to endogeneity issues. Self-employment itself might affect financial literacy and bias might arise due to reverse causality. At least in Germany, self-employed individuals are more likely to be confronted with activities that require financial literacy. Engagement in these activities, in turn, might affect the level of financial literacy. Therefore, the estimation model has to take account of this issue. Estimates might be subject to omitted variable bias, too.

To address these concerns, we apply an instrumental variables (IV) approach. To identify the effect of being financially literate on being self-employed, we exploit information on the education of parents, both of the father and the mother. By definition, none of these predetermined variables can be influenced by the entry into self-employment. Furthermore, Lusardi et al. (2010) show that the education of the mother is strongly associated with financial literacy.

Family background itself is frequently used to instrument financial literacy in existing studies (e.g. Alessie et al., 2011; Bucher-Koenen and Lusardi, 2011; Agnew et al., 2013). A number of studies have found that the literacy level of parents is a valid instrument for respondents' financial literacy (van Rooij et al., 2011a). Behrman et al. (2012) use *schooling attainment of the mother* and *schooling attainment of the father* to isolate the causal effect of financial literacy on wealth accumulation. The education of parents is not under the control of respondents, but respondents' financial literacy could be influenced by the parents' education. The 2013 SAVE also contains information on parental schooling attainment. Based on the response categories (no graduation, secondary education (8 grades), high school diploma (10 grades), GDR graduation after 8 or 10 grades, higher education entrance qualification after 12 grades)¹⁰ we generate variables for mother's schooling attainment and father's schooling attainment according to their grades.¹¹ When accounting for family background, we end up with a regression sample consisting of about 580 observations.

Financial literacy and self-employment

In all subsequent regressions, we apply IV techniques.¹² We run IV probit models using maximum likelihood estimation. The dependent variable is always a self-employment dummy variable. Schooling attainment of the mother and schooling attainment of the father serve as instrumental variables for the literacy index.

We are aware of endogeneity concerns due to unobserved variables and we include controls to address these issues. Following Jappelli and Padula (2013), we control for other education variables in order to rule out the possibility that the instrumental variables affect the outcome variable through (unobserved) education factors. Moreover, unobserved factors with regard to cognitive skills might affect the variables of interest, too (van Rooij et al., 2011a; Lusardi and Mitchell, 2014). Therefore, we control for math skills as proxy for cognitive abilities. Furthermore, there is reason to assume that the level of financial literacy might affect the willingness to take risks and therefore entrepreneurial activity. Therefore, we use self-

¹⁰ We treat the response categories "foreign graduation" and "don't know" as missing values.

¹¹ For parents with no school leaving qualification we have no precise information on details of the duration of education. We assign 7 grades to these observations. Results remain stable and robust when varying years of education between 0 and 7.

¹² Similar to the existing literature, we find that the effect of financial literacy is larger in the IV estimation than in an OLS or a Probit specification. This holds for at least 11 recent studies listed by Lusardi and Mitchell (cf. 2014, p. 28). Potential reasons are measurement errors and local average treatment effects in IV estimates versus average treatment effects in OLS.

assessed risk attitudes with respect to the career to control for respondents' risk attitudes. Several additional extensions are discussed in section 5.

Table 2 presents the results from the first-stage regressions. The table displays results of regressions estimating effects of the schooling attainment of the mother (IV A) and the schooling attainment of the father (IV B) on the financial literacy index. In model 1, the broad definition for self-employment is used, in model 2, the narrow definition is used, and in model 3, civil servants are excluded from the sample in model 2.

In all specifications, the instruments have strong predictive power for the financial literacy index. The effects of the schooling attainment of the mother and the father are positively associated with financial literacy and both are statistically significant. Individuals whose parents attended more years of schooling have higher literacy scores. The first-stage results do not only show that our instruments are statistically significant, but also the relatively high values for the F-test of excluded instruments allow rejecting the null hypothesis, that the equations are weakly identified.

Furthermore, regression results show that individuals with higher-level vocational qualification (postsecondary, non-tertiary) compared to individuals with intermediate vocational qualification are more financially literate. This is in line with previous research. Jappelli's (2010) findings suggest that both PISA test scores and college attendance (measured at the national level) are positively correlated with financial literacy. Similarly, other studies show that higher educated individuals are more likely to answer financial literacy questions correctly (Lusardi and Mitchell, 2007; Christelis et al., 2010; van Rooij et al., 2011a, 2011b).

Table 3 presents the main regression results of the effect of the instrumented financial literacy index on the probability of self-employment. With respect to our variables of interest, the results suggest that financial literacy has a positive and highly significant effect on the probability of self-employment. This applies to both specifications with the respective instrumental variable. With higher literacy scores the likelihood of self-employment rises. The effect is robust across all samples.

Table 2

First-stage regressions.

	Financial Literacy (A)			Financial Literacy (B)		
	(1) Broad definition- sample	(2) Narrow Definition- sample	(3) Sample excl. civil servants	(1) Broad definition- sample	(2) Narrow Definition- sample	(3) Sample excl. civil servants
Mother's schooling attainment	0.285*** (0.061)	0.279*** (0.062)	0.320*** (0.065)			
Father's schooling attainment				0.200*** (0.053)	0.194*** (0.054)	0.216*** (0.058)
Age	0.068 (0.085)	0.076 (0.086)	0.077 (0.090)	0.038 (0.086)	0.047 (0.087)	0.032 (0.092)
Age ²	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.000 (0.001)
Male	0.143 (0.208)	0.052 (0.208)	-0.070 (0.225)	0.218 (0.209)	0.134 (0.209)	0.026 (0.229)
Education: Other	-0.192 (0.348)	-0.245 (0.358)	-0.234 (0.358)	-0.253 (0.360)	-0.311 (0.371)	-0.293 (0.371)
Education: Higher level	0.803*** (0.300)	0.731** (0.310)	0.506 (0.317)	0.712** (0.305)	0.636** (0.316)	0.401 (0.327)
Education: University	0.520** (0.242)	0.497** (0.245)	0.273 (0.256)	0.460* (0.247)	0.429* (0.250)	0.218 (0.264)
Education GDR	0.465* (0.257)	0.451* (0.266)	0.564** (0.285)	0.481* (0.259)	0.459* (0.268)	0.563* (0.289)
Unemployed	-0.245 (0.182)	-0.194 (0.183)	-0.277 (0.194)	-0.297 (0.183)	-0.246 (0.184)	-0.310 (0.195)
Mental exercises score: 1	0.378 (0.491)	0.279 (0.480)	-0.081 (0.478)	0.367 (0.483)	0.262 (0.471)	-0.172 (0.469)
Mental exercises score: 2	-0.093 (0.493)	-0.237 (0.483)	-0.644 (0.483)	-0.083 (0.484)	-0.231 (0.473)	-0.701 (0.473)
Mental exercises score: 3	-0.959* (0.580)	-1.188** (0.575)	-1.526*** (0.576)	-0.797 (0.573)	-1.026* (0.567)	-1.385** (0.563)
Marital status: married	0.061 (0.288)	-0.110 (0.289)	-0.147 (0.311)	0.022 (0.288)	-0.157 (0.289)	-0.160 (0.310)
Marital status: other	0.288 (0.360)	0.118 (0.358)	0.121 (0.387)	0.248 (0.363)	0.078 (0.361)	0.122 (0.391)
Number of children	0.077 (0.082)	0.104 (0.083)	0.105 (0.079)	0.066 (0.083)	0.094 (0.084)	0.093 (0.081)
Homeowner	0.393* (0.203)	0.366* (0.207)	0.446** (0.212)	0.325 (0.205)	0.298 (0.209)	0.357* (0.214)
Risk attitude: medium	0.264 (0.182)	0.257 (0.185)	0.203 (0.196)	0.251 (0.183)	0.249 (0.185)	0.199 (0.197)
Risk attitude: high	-0.689 (0.546)	-0.710 (0.540)	-0.738 (0.545)	-0.422 (0.592)	-0.451 (0.584)	-0.473 (0.590)
Ln (Income)	0.123 (1.097)	0.260 (1.123)	1.278 (1.193)	0.435 (1.194)	0.569 (1.228)	1.760 (1.319)
Ln ² (Income)	-0.101 (0.316)	-0.141 (0.322)	-0.470 (0.344)	-0.186 (0.343)	-0.224 (0.352)	-0.602 (0.380)
Ln ³ (Income)	0.012 (0.023)	0.015 (0.023)	0.041 (0.025)	0.017 (0.025)	0.020 (0.025)	0.050* (0.028)
Controls for federal states	Yes	Yes	Yes	Yes	Yes	Yes
Observations	583	560	499	578	555	494
F-statistic first-stage regression	20.57	18.82	22.43	13.25	12.09	13.06

Note: The dependent variable is a financial literacy index counting the number of correct answers on financial knowledge-based questions. Robust standard errors in brackets; ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Table 3

Probability of being self-employed.

	Self-employment (IV A)			Self-employment (IV B)		
	(1) Broad definition- sample	(2) Narrow Definition- sample	(3) Sample excl. civil servants	(1) Broad definition- sample	(2) Narrow Definition- sample	(3) Sample excl. civil servants
Financial literacy	0.408*** (0.109)	0.539*** (0.034)	0.533*** (0.039)	0.422*** (0.125)	0.543*** (0.034)	0.543*** (0.039)
Financial literacy: Marginal Effect	[0.0134]	[0.0144]	[0.0141]	[0.0140]	[0.0151]	[0.0151]
Age	0.141* (0.083)	-0.002 (0.060)	-0.011 (0.066)	0.136 (0.091)	0.000 (0.061)	-0.006 (0.065)
Age squared	-0.001 (0.001)	0.000 (0.001)	0.000 (0.001)	-0.001 (0.001)	0.000 (0.001)	0.000 (0.001)
Male	-0.128 (0.178)	-0.104 (0.170)	-0.057 (0.202)	-0.152 (0.175)	-0.138 (0.168)	-0.092 (0.194)
Education: Other	0.640** (0.313)	0.319 (0.263)	0.267 (0.294)	0.639** (0.317)	0.343 (0.262)	0.289 (0.282)
Education: Higher level	0.438 (0.335)	0.031 (0.220)	0.120 (0.240)	0.411 (0.397)	0.028 (0.234)	0.094 (0.247)
Education: University	0.345 (0.284)	-0.266 (0.201)	-0.064 (0.233)	0.321 (0.322)	-0.259 (0.196)	-0.091 (0.222)
Education GDR	-0.202 (0.209)	-0.374** (0.178)	-0.325 (0.220)	-0.207 (0.209)	-0.373** (0.178)	-0.337 (0.213)
Unemployed	0.271* (0.161)	0.016 (0.141)	-0.008 (0.163)	0.293* (0.159)	0.060 (0.140)	0.041 (0.159)
Mental exercises score: 1	-0.472 (0.361)	-0.113 (0.290)	0.028 (0.350)	-0.465 (0.361)	-0.102 (0.294)	0.033 (0.349)
Mental exercises score: 2	-0.117 (0.366)	0.203 (0.294)	0.373 (0.362)	-0.119 (0.365)	0.217 (0.294)	0.382 (0.354)
Mental exercises score: 3	-0.050 (0.479)	0.451 (0.372)	0.512 (0.459)	-0.057 (0.484)	0.410 (0.377)	0.465 (0.457)
Marital status: married	-0.074 (0.227)	0.285 (0.221)	0.367 (0.267)	-0.060 (0.226)	0.289 (0.217)	0.356 (0.258)
Marital status: other	-0.450* (0.273)	-0.025 (0.255)	-0.025 (0.289)	-0.424 (0.271)	0.016 (0.250)	0.009 (0.280)
Number of children	-0.191*** (0.068)	-0.185*** (0.071)	-0.215*** (0.080)	-0.181** (0.072)	-0.179** (0.076)	-0.200** (0.084)
Homeowner	-0.075 (0.182)	-0.071 (0.178)	-0.045 (0.208)	-0.064 (0.183)	-0.053 (0.183)	-0.034 (0.211)
Risk attitude: medium	0.320* (0.192)	0.231 (0.176)	0.262 (0.183)	0.320 (0.213)	0.234 (0.189)	0.257 (0.191)
Risk attitude: high	1.005** (0.420)	1.001*** (0.366)	1.076*** (0.388)	0.960** (0.456)	0.929** (0.400)	0.998** (0.423)
Ln (Income)	0.807 (0.861)	0.505 (0.802)	0.062 (0.925)	0.785 (0.917)	0.445 (0.851)	-0.062 (0.959)
Ln ² (Income)	-0.264 (0.263)	-0.150 (0.242)	-0.023 (0.281)	-0.256 (0.280)	-0.135 (0.256)	0.013 (0.291)
Ln ³ (Income)	0.017 (0.020)	0.008 (0.018)	-0.002 (0.021)	0.016 (0.021)	0.007 (0.019)	-0.004 (0.021)
Controls for federal states	Yes	Yes	Yes	Yes	Yes	Yes
Observations	583	560	499	578	555	494

Note: The dependent variable is a self-employment dummy variable. The literacy index has been instrumented using variables indicating schooling attainment of the mother (IV A) and the father (IV B). Robust standard errors in brackets; ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

The results also show that the probability of being self-employed generally rises with the willingness to take risks with respect to the career. These results are very much in line with existing studies on determinants of self-employment. The number of children is negatively correlated with being self-employed.

The average marginal effects on the probability of being self-employed for all specifications are depicted in squared brackets in table 3. On average, the probability of self-employment rises by 1.3 to 1.5 percentage points with an additional correct answer. Given nine financial knowledge-based questions, the probability of self-employment increases by 11.7 to 13.5 percentage points when knowing all questions compared to knowing none of these questions.

5. Discussion and Extension

In this section, we investigate the robustness of our results. Thereby we make use of different waves of the SAVE survey and examine several extensions.

The instrumental variables rely on the interaction with parents. These are based on the assumption that the educational levels of parents affect their children's financial literacy levels. There is reason to assume that parents influence their children's literacy through other channels, for instance through their job characteristics or personality traits. Besides, parental type of employment might be correlated with their own education. If parents were self-employed, their choice of employment, in turn, might affect their children's self-employment choice (Lindquist et al. 2015), so that parental education drives children's entrepreneurship decision through their own entrepreneurship. However, studies show, that parental education does not affect entrepreneurship of children when controlling for entrepreneurship of parents (Djankov et al., 2006; Lindquist et al., 2015).

Therefore, we first investigate whether our results are robust once we re-estimate our model using a subsample on East German observations. In the German Democratic Republic (GDR), nearly all firms were owned by the state.¹³ Self-employment was regarded as “unwanted remnant of the capitalist society” (see Fritsch et al. 2010, p. 2). We limit the sample to persons from East Germany and therefore likely observe persons with parents who

¹³ In 1972, the private industry has been completely expropriated, self-employment was permitted only in a few economic fields, and prior to the reunification the rate of self-employed individuals in the GDR was below 2% (Fritsch et al., 2010) compared to 11% in 2012 in the whole of Germany (Mai and Marder-Puch, 2013). The few remaining private companies were strongly controlled by the state, for example, the profits and the size of a company (up to ten employees) were limited by the state.

were not self-employed and who might not affect self-employment decisions of their children by their own self-employment. Due to the sample size, we include both persons that have graduated (general school leaving certificate) in the former GDR and those persons who were living in the federal states of the former GDR in 2009.¹⁴ We are aware that thereby a direct channel from education of parents on self-employment decisions of children is not perfectly excluded, but we come close to exclude an intergenerational transfer of entrepreneurship.

Panel A in Table 4 presents the main regression results of the effect of the instrumented financial literacy index on the probability of being self-employed for the East German- subsample. Although more than two thirds of observations are lost in the restricted sample, the estimates of instrumented financial literacy index remain positive and highly statistically significant.

Secondly, we investigate whether our results are affected once we control for a set of characteristics of parents. In the 2008 survey, respondents were asked whether their mother / father were adventurous persons and whether the parents used to plan for the future. For both questions, the response scales run from 0 (absolutely inapplicable) to 10 (absolutely applicable). We use this information for our regression as control variables for characteristics of parents. The variables serve as proxies for carefulness and risk acceptance, common traits that are likely passed on from parents to children and that could affect investments in financial literacy and employment choice. Moreover, in 2008, respondents were asked whether their parents keep or did keep private accounting records. We include this information as dummy variable that serves as proxy for financial habits of the parents. Finally, we include a dummy variable that indicates whether respondents come from single parent families or whether they did not live together with parents at age 10 (reference: lived together with both parents at age 10). The results are presented in Table 4 (Panel B). When we account for these controls in our regressions, we find that estimates of financial literacy on self-employment are barely affected by the addition of these variables. The first-stage F-statistics and the estimates for financial literacy remain statistically significant, while estimates of other coefficients do not change qualitatively.

Another channel through which parental education might affect self-employment is the wealth of parents. The education of parents likely is correlated to their wealth and individuals

¹⁴ The data do not allow restricting the sample only to those individuals with a school leaving qualification from the former GDR. We observe only 11 self-employed individuals when estimating the IV model (using mother's or father's schooling attainment) and restricting the sample only to individuals with a school leaving qualification from the former GDR.

might benefit from parents' wealth for becoming self-employed. Thus, we now analyse whether our estimates change when controlling for monetary support by relatives. SAVE 2008 provides information on whether respondents received monetary support by parents or children in the previous year. Furthermore, it contains information about regular support payments and occasional support payments in general. Moreover, we can control for inheritance receipts of financial assets and for inheritance receipts of real estate in the past and we control for the self-assessed likelihood of an inheritance receipt in the future. In addition, we include the personal assessment of respondents on the understanding of parents concerning financial matters.

In Table 4 (Panel C), we report IV estimates of the effect of financial literacy on the probability of being self-employed controlling for various wealth and support proxies. We find that regular monetary support and occasional support payments do not matter for self-employment. Similarly, neither the inheritance of both financial assets and real estate, nor the expectancies of an inheritance in the future have an effect on the probability of self-employment. Our estimates of financial literacy, however, are not affected by the additional variables. The estimates of financial literacy remain significant and the first-stage F-statistics remain virtually unchanged.

Other omitted factors that could be correlated to self-employment, financial literacy, and our instruments, are how individuals dealt with money when young or whether they learned to deal with money at all. Grohmann et al. (2014) have shown that the financial socialisation by parents plays a major role for financial literacy. To address this issue we use information on receiving and spending pocket money in childhood. SAVE 2008 provides information on the regularity of receiving pocket money and on statements whether respondents spent this money immediately. Both variables are measured on an eleven- point scale, where 0 indicates absolute inapplicable and 10 indicates absolute applicable. While both variables on pocket money do not affect self-employment, the inclusion of these variables barely changes our regression results (Table 4, Panel D).

Table 4.

Self-employment and the role of social background.

	Self-employment (Narrow definition sample)	
	IV (A)	IV (B)
Panel A: East-Germany sample (education in GDR or living in the newly-formed German states)		
Financial Literacy	0.499*** (0.106)	0.532*** (0.060)
Full set of control variables (see Table 1) – except for graduation in GDR	Yes	Yes
Controls for federal states	Yes	Yes
Observations	160	159
F-statistic first-stage regression	15.13	5.66
Panel B: The role of family background: Characteristics of parents		
Financial Literacy	0.541*** (0.030)	0.541*** (0.029)
Mother adventurous	-0.044 (0.028)	-0.052* (0.027)
Mother- plan for future	-0.009 (0.027)	-0.011 (0.026)
Father adventuresomely	0.018 (0.025)	0.022 (0.023)
Father- plan for future	-0.010 (0.026)	-0.010 (0.025)
Parents- accounting	0.205 (0.148)	0.195 (0.151)
Single-parent/ No parents	-0.320 (0.324)	-0.378 (0.346)
Full set of control variables (see Table 1)	Yes	Yes
Controls for federal states	Yes	Yes
Observations	521	516
F-statistic first-stage regression	15.35	10.01
Panel C: The role of Wealth: Monetary support		
Financial Literacy	0.542*** (0.031)	0.537*** (0.041)
Monetary support previous year	0.020 (0.239)	0.091 (0.268)
Regular support payments, in general	-0.644* (0.334)	-0.773* (0.440)
Occasional support payments	-0.146 (0.148)	-0.165 (0.162)
Inheritance of financial assets	0.116 (0.207)	0.197 (0.276)
Inheritance of real estate	-0.240 (0.352)	-0.352 (0.380)
Likelihood of inheritance	0.002 (0.036)	0.003 (0.041)
Parents' financial understanding	-0.007 (0.112)	-0.009 (0.127)

Table 4. Continued

	Self-employment (Narrow definition sample)	
	IV (A)	IV (B)
Panel C: The role of Wealth: Monetary support (continued)		
Single-parent/ No parents	-0.608 (0.393)	-0.837 (0.512)
Full set of control variables	Yes	Yes
Controls for federal states	Yes	Yes
Observations	483	477
F-statistic first-stage regression	15.61	11.97
Panel D: Pocket money		
Financial Literacy	0.546 ^{***} (0.032)	0.547 ^{***} (0.033)
Received pocket money regularly	-0.017 (0.017)	-0.018 (0.018)
Spent pocket money immediately	0.008 (0.022)	0.005 (0.023)
Full set of control variables	Yes	Yes
Controls for federal states	Yes	Yes
Observations	521	516
F-statistic first-stage regression	14.55	8.59

Note: The dependent variable is a self-employment dummy variable. The literacy index has been instrumented using variables indicating schooling attainment of the mother (IV A) and the father (IV B). Robust standard errors in brackets; ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

6. Conclusion and implications

Recent studies show that financial sophistication has an impact on household financial decision-making, but even beyond financial decisions, it has an impact on individuals' behaviour. It is obvious that entrepreneurial activities require a certain financial sophistication base. This empirical investigation shows a positive relationship between financial literacy and self-employment. Our results are based on German data including a various number of basic and advanced questions on financial matters. We use instrumental variables based on parents' schooling attainment to tackle the problem of endogeneity.

The analysis of the SAVE data documents a relative low level of practical financial literacy beyond simple calculations on interest rates or rates of return. On top of that, employees achieve even lower scores than self-employed respondents. Less financially literate individuals rather work as employees than decide to take the step towards self-

employment. The effect of financial literacy on the probability of self-employment is robust across different specifications. Financial sophistication might lead to more efficient acquisition of fundamental information and processing of information, to confident risk assessments, better opportunities for realizing business ideas, and finally to more entrepreneurial activities.

Our findings add to the nature vs. nurture discussion. Several researchers examined to what extent personality affects the decision to be self-employed and most of the characteristics found to have an impact are found to be relatively stable over time. Our analysis shows that financial literacy, which is acquirable, is positively associated with being self-employed. However, although we have addressed several concerns with regard to endogeneity issues, we cannot prove without doubt that our instruments meet the exclusion criterion. If one is willing to believe that our results are valid, findings suggest that enhancing financial literacy could be a trigger for entrepreneurial activity. Furthermore, several scholars analyse why and how entrepreneurs evaluate potential opportunities to introduce new products, services or business models. While a common idea is, that individuals discover an opportunity prior to their decision to exploit it (Shane and Venkatamaran, 2000), a growing body of research is looking at the bridge between the discovery and the exploitation stage: the opportunity evaluation (Wood and McKelvie, 2015). It is not unlikely that financial literacy is relevant in this stage.

Due to restrictions in our data set, we cannot evaluate transitions into entrepreneurship, survival in entrepreneurship, or success of new businesses separately. Future research should provide further support for the link observed.

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Appendix

Basic Financial Literacy Questions

- 1) "Compound interest I" Suppose you had €100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow? [1] More than €102, [2] Exactly €102, [3] Less than €102, [4] Do not know / Refuse to answer
- 2) "Inflation" Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account? [1] More than today, [2] Exactly the same, [3] Less than today, [4] Do not know / Refuse to answer
- 3) "Compound interest II" Assume that you have €100 in a savings account and the interest rate you earn on this money is 20% a year. If you keep this money in the account for 5 years, how much would you have after 5 years? [1] More than €200; [2] Exactly €200; [3] Less than €200; [4] I can not / I don't want to answer
- 4) "Money illusion" Suppose that in the year 2012, your income has doubled and prices of all goods have doubled too. In 2012, how much will you be able to buy with your income? [1] More than today; [2] As much as today; [3] Less than today; [4] Do not know / Refuse to answer

Advanced Financial Literacy Questions

- 5) "Volatility" Normally, which of the following assets displays the highest fluctuations over time? [1] Savings accounts; [2] Fixed-interest securities; [3] Stocks; [4] Do not know / Refuse to answer
- 6) "Risk diversification" Buying a company stock usually provides a safer return than a stock mutual fund. True or false? [1] True, [2] False, [3] Do not know / Refuse to answer
- 7) "Stock market" Which of the following statements describes the main function of the stock market? [1] The stock market helps to predict stock earnings; [2] The stock market results in an increase in the price of stocks; [3] The stock market brings people who want to buy stocks together with those who want to sell stocks; [4] None of the above; [5] Do not know / Refuse to answer
- 8) "Balanced funds" Which of the following statements is correct? [1] Once one invests in a mutual fund, one cannot withdraw the money in the first year; [2] Mutual funds can invest in several assets, for example invest in both stocks and bonds; [3] Mutual funds pay a guaranteed rate of return which depends on their past performance; [4] None of the above; [5] Do not know / Refuse to answer
- 9) "Bond prices" If the market interest rates fall, what should happen to bond prices? [1] Rise; [2] Fall; [3] Stay the same; [4] None of the above; [5] Do not know / Refuse to answer

Mental Exercise Questions

- 1) The price of a racket and a ball is 110 euro cents. The price of the racket is 100 eurocent higher than the price of the ball. How much does the ball cost?
- 2) 5 machines take 5 minutes to produce 5 products. How long does it take 100 machines to produce 100 products?
- 3) A pond is covered with water lilies. The lily pad grows so that each day it doubles the pond's surface it covers. It takes 48 days for the lily pad to cover the pond completely. How long does it take for the lily pad to cover half of the pond?