


Financial Literacy, Human Capital and Stock Market Participation in Europe

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Abstract

AQ1 Households' stock market participation has significant effects on savings and on an economy's financial development and performance. Yet participation into capital markets is limited and quite heterogenous both among and within several countries. This phenomenon represents an empirical puzzle whose understanding is rather incomplete. In this work, we exploited a combination of datasets for nine European countries and used different econometric specifications that allow to control for endogeneity of financial literacy and human capital, to assess the role of several variables in affecting the probability to participate in the stock market in year 2010. Besides socio-demographic variables, we found that financial literacy has a positive and significant effect on stock market participation, together with the level of human capital and social interaction. Country level differences are explained by such institutional factors as the effectiveness of the education system and by the attractiveness of the stock markets.

Keywords Stock market participation · Financial literacy · Social interaction · Education quality · Europe

Introduction

Individuals across the globe have become increasingly active in financial markets in the last decades. The move from defined-benefit to defined-contribution pension plans and the decline of publicly provided pension benefits have shifted the responsibility of adequate saving-for-retirement from the government and employers to private individuals¹. These trends, together with the availability of new technology and information have contributed to raise stock market participation. However, although increased, participation rates are still relatively low in many countries and show a substantial variability across the globe. In countries like Sweden or the US over 50% of households participate in stock market while in Southern Europe the same proportion of households does not exceed 20% (Campbell 2006; Christelis et al. 2013;

Dimmock and Kouwenberg 2010; Guiso et al. 2008). These studies confirm that only a minority of the population join the stock market, besides representing an empirical puzzle is a source of major concern to policymakers.

In fact, several authors have pointed out that in the long-run there can be considerable welfare loss in non-participation of individuals, in the form of reduction of returns to household saving and lower asset accumulation (see, for example, Bagliano et al. 2014). From the perspective of the financial system, a higher participation rate could favour a greater breadth and depth of capital markets, which is an important determinant of the equity premium and of the stock market volatility (Brav et al. 2002; Thomas et al. 2014; Thomas and Spataro 2016).

¹ Also the significant increase of employee financial plans, either directly through employee share ownership (ESO) or indirectly through intermediaries like Employee stock ownership plans (ESOP) or profit sharing (PS) have provided a relevant support to individuals' demand for risky assets. These financial plans, also linked to defined contribution schemes, have empirically proven to favor higher productivity, strengthen corporate governance and competitiveness of firms (Kaarsemaker et al. 2006; Soppe and Houweling 2014). Most importantly, these financial plans have also improved the financial outlook of workers, equipping them with more sophisticated financial techniques and thus resulting in better financial decisions in terms of savings, risky asset participation and retirement planning.

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Given that the well-being of households will increasingly depend on the individuals' ability to deal with complex choices over instruments for portfolio differentiation, a growing body of literature has tried to unveil the determinants of stock market participation and to remove the barriers that might prevent such investment opportunity.

Empirical evidence of industrialized countries documents that stock market participation depends on a variety of factors, such as household financial wealth (which supports the entry costs thesis; see Alan 2006; Guiso et al. 2003) age and education (Bertaut 1998), risk aversion (Campbell and Cochrane 2000), trust in financial institutions (Georgarakos and Pasini 2011), social interaction (Hong et al. 2004), home ownership (Vestman 2010) and social capital (Guiso et al. 2004).

Some recent works have put much emphasis on the role of financial literacy (Arrondel et al. 2012; Guiso and Jappelli 2005; Van Rooij et al. 2011; Yoong 2011) and human capital investment (Bertaut and Starr-McCluer 2002; Cole and Shastry 2008) in affecting individuals' attitude towards financial markets.

The present work adds to such a growing literature on the determinants of stock market participation, by making two main contributions. First, by using The Survey of Health, Ageing and Retirement in Europe (SHARE² hereafter) database, we aimed to provide new evidence about the determinants of households' stock market participation in nine European countries in year 2010. Second, we developed an empirical model encompassing, under a unified framework, the relationship between stock market participation and human capital and financial literacy, along with other socio-economic and institutional factors.

More precisely, we drew from the existing literature by including most of the socio-demographic and economic variables explored in related studies at both country level (Cole and Shastry 2008; Van Rooij et al. 2011; Yoong 2011) and at cross-country level (Christelis et al. 2010). We also acknowledged the fact that financial literacy is endogenous and we

used some of the instruments used by Christelis et al. (2010) and Jappelli and Padula (2013) to deal with such an issue. In fact, the literature (Jappelli 2010; Jappelli and Padula 2013) acknowledged that the correlation between financial literacy and investment behaviour seems at least partly driven by reverse causality. For instance, a positive relation between participation in the stock market and an investor literacy as in Van Rooij et al. (2011) is consistent with the argument that, on one hand, financial literacy helps alerting individuals about the excess returns on stocks/bonds, which in turn induces them to invest and, on the other hand, investing in advanced financial products, could provide some kind of financial literacy training, enabling respondents to answer more questions correctly. Additionally, this positive correlation may reflect the fact that financial literacy is not distributed randomly in the population and those who possess high levels of literacy are likely to have certain characteristics, often unobservable, such as talent, ability, or patience that may lead also to "better" financial decisions. Finally, we followed the existing literature by including human capital, social interaction and financial incentives as the most important predictors of stock market participation.

However, we departed from previous empirical literature in that we allowed for the possibility that both human capital and financial literacy acquisition are endogenous. To the best of our knowledge, this has never been done so far³ Hence, we allowed investment in general and financial education to be driven by both individual-related abilities and by economic/financial incentives that were present at the very early stages of life (such as the attractiveness of the financial market). By doing this, we also offered a possible explanatory argument to the findings of Malmendier and Nagel (2011), as to why also past stock market returns may affect the current decision to participate or not in the stock market.

Finally, we also adopted a measure of the effectiveness/quality of the education system (namely cohort/country specific student–teacher ratios at individuals' young age) in order to explain possible country and cohort level differences in the observed attitude towards financial markets. For doing this, we based our analysis on the rich information provided by SHARE, which contains both current and retrospective information that are necessary to test our empirical approach, together with other datasets.

The paper proceeds as follows. The next section we review the main contributions on the topic of stock market participation and then we present our main source of data, (i.e.,) SHARE, showing the features of the variables used in the regressions. Then we examine the results of the empirical estimates under the assumption of no endogeneity of human

³ Among few theoretical exceptions, see the model developed by Spataro and Corsini (2017).

² This paper uses data from SHARE wave 4 release 1.1.1, as of March 28th 2013 (<https://doi.org/10.6103/SHARE.w4.111>), and SHARELIFE release 1, as of November 24th 2010 (<https://doi.org/10.6103/SHARE.w3.100>). The SHARE data collection has been primarily funded by the European Commission through the 5th Framework Programme (Project QLK6-CT-2001-00360 in the thematic programme Quality of Life), through the 6th Framework Programme (Projects SHARE-I3, RII-CT-2006-062193, COMPARE, CIT5-CT-2005-028857, and SHARELIFE, CIT4-CT-2006-028812) and through the 7th Framework Programme (SHARE-PREP, N° 211,909, SHARE-LEAP, N° 227,822 and SHARE M4, N° 261,982). Additional funding from the US National Institute on Aging (U01 AG09740-13S2, P01 AG005842, P01 AG08291, P30 AG12815, R21 AG025169, Y1-AG-4553-01, IAG BSR06-11 and OGHA 04-064) and the German Ministry of Education and Research as well as from various national sources is gratefully acknowledged (see <http://www.share-project.org> for a full list of funding institutions)."

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133 capital and financial literacy. Next, we discuss the case of
 134 determinants of stock market participation under a multiple
 135 endogeneity framework. Conclusions will end the study.

136 Literature Review

137 In recent years, several studies have been focussing on the
 138 determinants of stock market participation. A growing body
 139 of works has pointed out that stock market participation is
 140 correlated with characteristics such as investor cognitive
 141 skills, financial literacy⁴ and education. For example, Guiso
 142 and Jappelli (2005), using the 1995 and 1998 Bank of Italy
 143 Surveys of Household Income and Wealth (SHIW), found
 144 that lack of financial awareness among Italian households
 145 was a primary reason for the limited participation (for more
 146 recent works see Arrondel et al. 2012; Van Rooij et al. 2011;
 147 Yoong 2011). As for human capital, Campbell (2006) and
 148 Haliassos and Bertaut (1995) showed that the college edu-
 149 cated were more likely to own stocks than less educated indi-
 150 viduals were. Cole and Shastry (2008) argued that 1 year of
 151 schooling increased the probability of financial market par-
 152 ticipation by 7–8%. Other empirical studies on stock hold-
 153 ing have shown that controlling for educational attainment
 154 did enhance the significance of the variable financial lit-
 155 eracy (Behrman et al. 2012; Lusardi and Scheresberg 2013;
 156 Van Rooij et al. 2011) underlying the observation that both
 157 general knowledge (education) and specialized knowledge
 158 (financial literacy) contributed for financial decision-making
 159 in countries such as Denmark, Netherlands and US.

160 As for other individual economic variables, the overall
 161 conclusion of previous literature was that higher levels of
 162 wealth were associated with a greater likelihood of partici-
 163 pation, also due to the presence of participation costs (Calvet
 164 and Sodini 2014; Fagereng et al. 2017).

165 A relatively new literature on the role of social-interaction
 166 or social networks is worth mentioning. This recent literature
 167 has conjectured that social interactions and social capital
 168 positively affects the financial decisions of individuals like
 169 wealth accumulation, retirement decisions, stock market
 170 participation (Brown et al. 2008; Brown and Taylor 2007;
 171 Liu et al. 2014).

172 As for the role of market returns, Dimson et al. (2002)
 173 found that, coupled with fixed participation costs and inves-
 174 tor home bias, variations in Sharpe-ratios across coun-
 175 tries could contribute to explain the differences in the

176 participation. Hurd et al. (2011) observed that the move-
 177 ments of stock market prices were correlated with expec-
 178 tations of Dutch and American investors, and optimistic
 179 beliefs based on the past return data improved the prob-
 180 ability to participate in stock markets. Arrondel et al. (2012)
 181 uncovered that stock ownership strongly correlated with
 182 both expectations and realizations of stock market returns,
 183 and was robust to the inclusion of measures of financial lit-
 184 eracy, ability or trust. Finally, Malmendier and Nagel (2011)
 185 provided evidence those cohorts who experienced high stock
 186 market returns throughout their life and recently were more
 187 likely to participate in the stock market.

188 In the light of this literature, in this paper we aim at pro-
 189 viding new evidence on the determinants of participation to
 190 stock markets in some European countries, by controlling
 191 for possible endogeneity of both human capital and finan-
 192 cial literacy and for the role of some institutional and socio-
 193 economic variables, both at individual and country level.

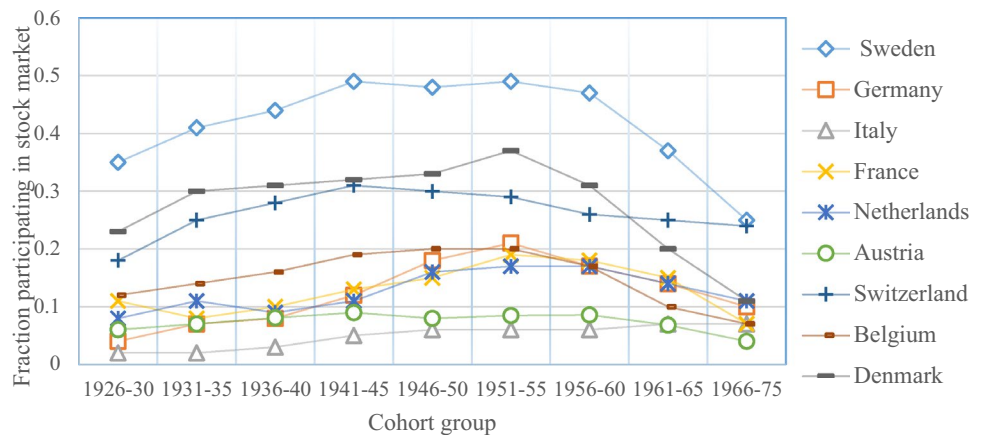
Data Description 194

195 The data were drawn from Wave 3 and Wave 4 of SHARE,
 196 a representative sample of the adult population in several
 197 European countries. The survey covers various aspects of the
 198 well-being of the elderly population ranging from socio-econ-
 199 omical, mental and health conditions. Wave 4 refers to year
 200 2010 and we focused on individual information from nine
 201 selected European economies (Austria, Belgium, Denmark,
 202 Germany, Italy, France, Switzerland, Sweden and Nether-
 203 lands). Wave 3 is known as SHARELIFE, which records
 204 the life histories of half of the respondents of Wave 4. More
 205 precisely, Wave 4 comprises 32,337 observations, while the
 206 life history information provided in Wave 3 for the individu-
 207 als re-interviewed in Wave 4 amounts to 17,533 individual
 208 records (although with several missing data). Given the
 209 lack of retrospective information for most of observations
 210 in previous waves, we carried out our analysis by focusing
 211 on Wave 4 only. Moreover, our analysis also used country-
 212 level data from International Historical Statistics and Global
 213 Financial database, which concerns the nine countries above.
 214 The variables used in the model and their sources are listed
 215 in Appendix 1.

216 The dependent variable in our model was participation in
 217 the stock market, a binary variable which takes value 1 if the
 218 worker was participating in the stock market in year 2010
 219 or 0 otherwise (or the probability to participate in the stock
 220 market in the case of probit regressions). More precisely,
 221 we used a standard measure of stock market participation
 222 (as done, among others, by Vestman 2010) which consists
 223 in stock ownership. The measure excludes stock market
 224 participation through mutual funds, pension plans or man-
 225 datory retirement accounts. In Wave 4 16.84% of workers

⁴ In the recent years there has been burgeoning research on the meas-
 4FL01 urement of financial literacy and its effects on household behaviour
 4FL02 especially on retirement planning (Lusardi and Mitchell 2011; Van
 4FL03 Rooij et al. 2012 among others) on savings and portfolio decisions
 4FL04 (Jappelli and Padula 2013; Lusardi et al. 2017). For a review see Jap-
 4FL05 pelli (2010).
 4FL06

Fig. 1 Fraction participating in stock market by cohort group and country. Source: Authors' calculation using SHARE database. Data are provided for 5-year cohort groups (apart from 1966 to 1975, due to low number of observations)



226 participated in the stock market and invested in risky assets,
227 in line with the evidence provided by existing studies.

228 Figure 1 shows the fraction of individuals born in dif-
229 ferent cohorts and in different countries participating in the
230 stock market. Individuals were grouped into nine 5-year
231 cohort groups. For each cohort group we computed the frac-
232 tion of people participating in stock market by dividing the
233 number of participants by the total number of individuals
234 belonging to the same cohort group.

235 We note that not only was there a significant difference
236 in the country-level participations rates, but, especially for
237 some countries, also a visible age effect. More precisely,
238 lower participation rates characterize Southern European
239 countries, while a common trait is that participation rates
240 displayed an inverse U shape, already documented in previ-
241 ous studies, probably due to the combination of different
242 effects,⁵ with higher propensity to join the financial markets
243 associated with middle-aged individuals. In fact, in our sam-
244 ple stock market participation was concentrated in the age
245 interval 54–70.

246 Individual Explanatory Variables

247 The first independent variable in our model was current level
248 of individual's financial literacy, which has been extensively

249 used in the literature. Several studies both in United States
250 and other countries found out that more financially literate
251 individuals are also more likely to participate in stock
252 markets (Arrondel et al. 2012; Van Rooij et al. 2011; Yoong
253 2011).

254 As for the measurement of such a variable, following
255 Jappelli and Padula (2013) we used the index provided by
256 SHARE, whereby each individual of Wave 4 is presented
257 with four financial and numerical questions and the answers
258 are imputed to obtain a value ranging from 1 to 5. Details
259 of the actual questions and the construction of this indica-
260 tor are given in the Appendix 2 and have been discussed in
261 Christelis et al. (2010).

262 In Fig. 2, we report the fraction of individuals participat-
263 ing in stock markets across different levels of financial lit-
264 eracy and different countries. The Figure clearly shows that
265 stock ownership increases sharply with financial literacy: in
266 fact, participation in the stock market is concentrated among
267 individuals with high literacy (fourth and fifth scores), while
268 only 3 and 9% of respondents in the first and second scores
269 were in the stock market in 2010, respectively.

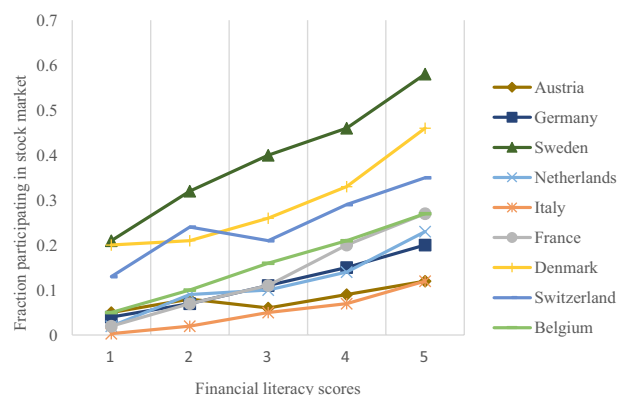
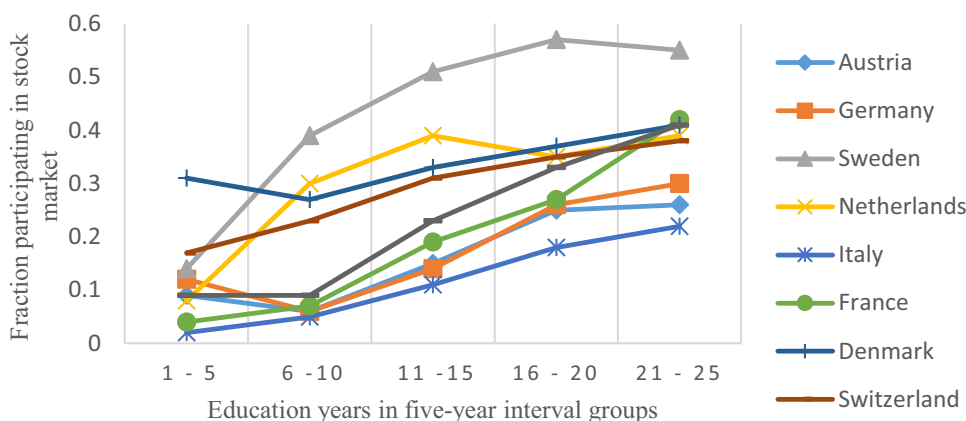


Fig. 2 Fraction participating in stock market by financial literacy scores and country. Source: Authors' calculation using SHARE database. For details on financial literacy groups Appendix 2

5FL01 ⁵ Such differences among countries in stockholding could also arise
5FL02 from differences in cultural norms which are likely to be associated
5FL03 with apparent differences in risk tolerance levels or perception of
5FL04 the risk of the financial options. Additionally, changes in participa-
5FL05 tion rates in risky asset markets could be influenced by the nature of
5FL06 society the worker belongs to. For example, in collectivistic societies,
5FL07 respondents are likely to receive financial assistance from their family
5FL08 and social networks; Pyles et al. (2016) showed that in these societies
5FL09 the perceived risk in financial decisions is lower than in individual-
5FL10 istic societies (such as the Denmark, Sweden), where individuals are
5FL11 more likely to be left to fend for themselves. In the empirical analysis
5FL12 we take these issues into account by using control variables at both
5FL13 individual and cohort/country level.

Fig. 3 Fraction participating in stock market by schooling years and country. Source: Authors' calculation using SHARE database



270 The second explanatory variable used in our analysis
 271 was human capital, proxied by years of schooling (stock of
 272 education). It is widely noted in the literature that human
 273 capital/education affects cognitive ability, which in turn
 274 increases participation (Bertaut and Starr-McCluer 2002;
 275 Cole and Shastry 2008). Figure 3 shows the fraction of indi-
 276 viduals who invested in stock market, by schooling years.
 277 Education years were stratified into five groups and the fig-
 278 ure clearly shows increasing probability to invest in the stock
 279 market as schooling years increase.

280 The next independent variable was individual income,
 281 measured by income-quintiles at country level. Total income
 282 was calculated by adding wages for employed workers and
 283 income from self-employment for the self-employed work-
 284 ers. As for retired workers, income was calculated from
 285 social security entitlements. Next, income was divided into
 286 quintiles at country level in order to take care of the coun-
 287 try-differences in purchasing power.⁶ We created two dum-
 288 mies for medium income group (second and third quintiles)
 289 and high income group (fourth and fifth) respectively. We
 290 expected a positive relationship between income groups and
 291 participation in stock market as suggested, for example, by
 292 Bertaut and Starr-McCluer (2002) and Brown et al. (2008),
 293 who argued that higher income respondents are more likely
 294 to have access to financial advice and information, which
 295 in turn facilitate stock ownership. In fact, Fig. 4 shows that
 296 income and the participation to stock market are positively
 297 correlated.

298 In line with earlier studies, we also used wealth as a
 299 possible relevant predictor of stock market participation.
 300 The overall conclusion of previous literature (e.g., Calvet
 301 and Sodini 2014; Fagereng et al. 2017) was that changes
 302 in wealth are associated with a greater likelihood of

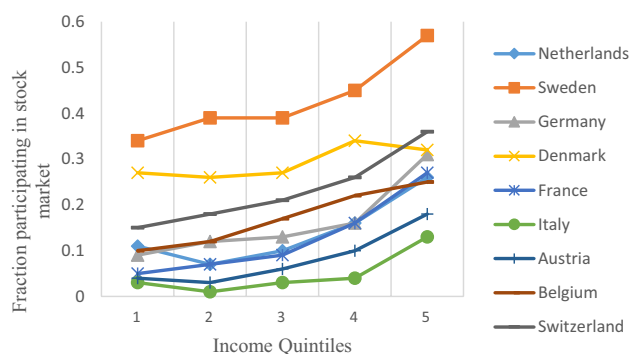


Fig. 4 Fraction participating in stock market and income quintiles, by country. Source: Authors' calculation using SHARE database. Income quintiles are country-specific

303 participation, also due to the presence of participation costs.
 304 The expected positive correlation between wealth quintiles
 305 computed for each country and stock market participation
 306 emerges from Fig. 5. Further, observing the participation
 307 rates across different wealth levels suggested a remarkable
 308 difference across Europe. For example, among the high-participation
 309 countries (Sweden, Denmark and Switzerland),
 310 households belonging to third and fourth quintiles of wealth
 311 exhibit twice as high participation rates, relative to low level
 312 participating countries.

313 Furthermore, following previous literature (Brown
 314 and Taylor 2007; Brown et al. 2008; Liu et al. 2014) and
 315 available data in SHARE, we employed a set of variables
 316 to investigate the role of social interaction in influenc-
 317 ing the decision to join financial markets. Specifically, we
 318 used three dummy variables which take value 1 if a per-
 319 son attended some voluntary/charity activity, if she was
 320 a member of any club, if she was involved in political
 321 or organisational activity, respectively. The total number
 322 of people in the network was also added as a variable to
 323 capture the effect of the size of the network.

⁶ FL01 We also tried to capture the difference in wages across different
 FL02 sectors; however, large number of missing values has forced us to
 FL03 drop the exercise.

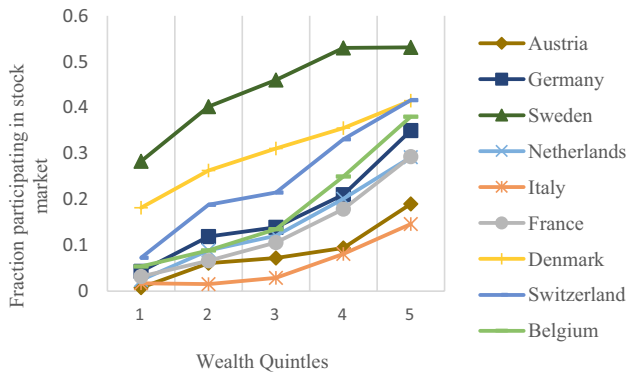
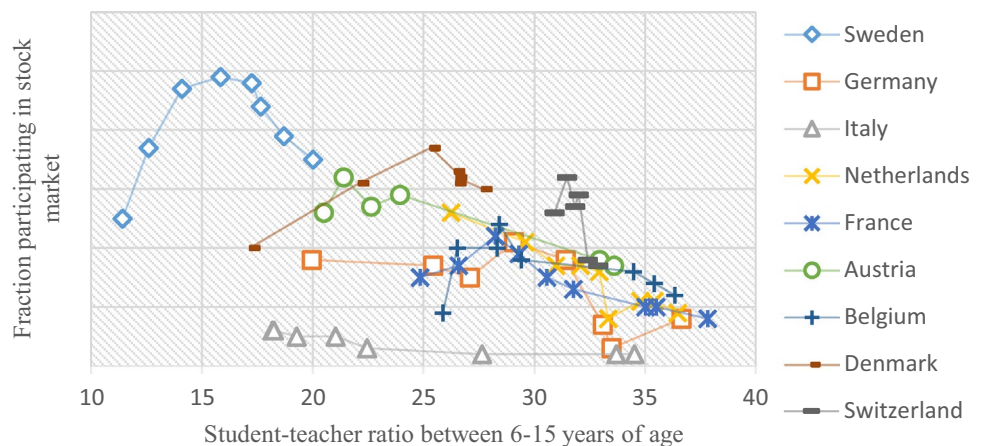


Fig. 5 Fraction participating in stock market and wealth quintiles, by country. Source: Authors' calculation using SHARE database. Wealth quintiles are country-specific

324 One of the striking features of the empirical data on
 325 financial literacy is the large and persistent gender differ-
 326 ence and this is also reflected in the economic decision
 327 to participate in stock market. Previous studies showed
 328 shown that women as less likely to enter the stock market
 329 (Croson and Gneezy 2009; Fonseca et al. 2012). Hence,
 330 we expected a negative relationship between female indi-
 331 viduals and stock market participation. In fact, the statis-
 332 tics of our sample showed a correlation between sex
 333 (1 if female, zero otherwise) and stock holding equal
 334 to -0.1041 . Demographic variables such as age, age-
 335 squared, number of children in the family, marital-status
 336 were also included in the model and used as controls in the
 337 regressions. These variables were aimed at capturing some
 338 life-cycle features that could influence individuals' atti-
 339 tude towards risky investments. Additionally, we included
 340 a dummy for retired respondents to account for households
 341 who might have been in the decumulation phase of their
 342 life-cycle.

Fig. 6 Fraction participating in stock market in 2010 by country and student-teacher ratio at early ages (6–15 years of age). Source: Authors' calculation using International Historical Statistics. X axis: 5-year average student-teacher ratio for 5-year cohort groups at age 6–15 (some older cohorts were merged with others in case of low number of observations or lack of data). Y axis: fraction of individuals participating in the stock market for each cohort and country



Country Specific and Country-Cohort Specific Variables

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345 As for institutional variables at country-level, we assessed
 346 the role of the effectiveness of the education system in influ-
 347 encing stock market participation. Following Ostroff and
 348 Schmitt (1993), effectiveness of schooling was proxied by
 349 student-teacher ratio. As for empirical support, we hinged
 350 on few studies which identified the effects of teacher-student
 351 ratio in a range of outcomes, including improvement in test
 352 scores (Arum 1996), increased years of educational attain-
 353 ment (Bound and Turner 2007) and higher lifetime earnings
 354 (Card and Krueger 1996).

355 In this work, we argue that the effectiveness of educa-
 356 tion could be treated as a country-level institutional variable,
 357 which may exert a positive externality in the decision to
 358 participate in stocks or in the attitude towards risky finan-
 359 cial decisions. The construction of the variable was performed
 360 by first dividing the age groups into ten different cohort
 361 groups. From the International Historical Statistics on Edu-
 362 cation database, the 10-year average student-teacher-ratio
 363 was calculated for each individual belonging to a specific
 364 cohort and country. The years taken into account were those
 365 in which the members of each cohort group were within
 366 the age interval of compulsory schooling years (6–15). For
 367 each cohort group and country, we calculated the fraction of
 368 individuals participating in the stock market and the associ-
 369 ated student-teacher ratio (although data are not available
 370 for all cohorts present in the SHARE database). Figure 6
 371 shows that, with few exceptions, irrespective of the differ-
 372 ent levels of student-teacher ratio featuring different coun-
 373 tries, the fraction of individuals holding stocks tends to decline
 374 as the student-teacher ratio increases.

375 In our empirical investigation, we also included a coun-
 376 try-level financial incentive measure proxied by the Sharpe-
 377 ratio (Appendix 3 for details on these data). In this respect,
 378 it is probably true that most people did not observe and/or

379 understand such a complex financial index as the Sharpe-ratio
 380 when deciding whether to take part in stock market or not.
 381 However, we assumed, as it is reasonable, that they did observe
 382 financial cycles through print and visual media and the Sharpe-
 383 ratio is a proxy of the market performance experienced and
 384 perceived by households in each country. Moreover, it is a
 385 well-documented fact that there is a significant home-bias in
 386 the stock market participation, so that we assumed that people
 387 living in a country had more information on the financial status
 388 of their own country of residence and they primarily tended to
 389 observe and analyse the financial attractiveness of the country
 390 of residence when deciding to make a financial investment. In
 391 this respect, we followed the argument made by Kaustia and
 392 Knüpfer (2008) and Malmendier and Nagel (2011) on the rel-
 393 evance of observed returns in the decision of making financial
 394 decisions including direct stock participation.

395 More precisely, in this paper we argued that the effect of
 396 the attractiveness of the stock market on the decision to join
 397 it is twofold. First, *current* (or recent) financial incentives as
 398 measured by the Sharpe-ratio may affect the *current* deci-
 399 sion to invest in the stock market. Second, *previous* financial
 400 incentives are likely to have affected the decision to invest in
 401 financial literacy and human capital, a decision that in fact
 402 happens early in life.

403 As for the first channel, for each individual we computed
 404 a 5-year average of Sharpe-ratios at country level between
 405 2006 and 2010. Overall, these data showed that the cor-
 406 relation between Sharpe-ratios observed in 2006–2010 and
 407 participation rates in stock markets was 0.08 and significant.
 408 The second channel (Sharpe-ratios observed at young ages)
 409 is discussed in the identification strategy under the endog-
 410 enous framework.

411 Finally, we added the country dummies (three country-
 412 group dummies), namely high participation countries (Swe-
 413 den, Denmark and Switzerland), medium-participation
 414 countries (Germany, Belgium, France and Netherlands)
 415 and low-participation countries (Austria and Italy⁷) to cap-
 416 ture the country-level effects (due to, for example, taxation,
 417 openness of the economy, economic freedom, generosity of
 418 pension arrangements and other cultural elements) which
 419 were not captured by other socio-economic and institutional
 420 variables otherwise. We kept medium-participation country
 421 group as the benchmark. The statistics for the full set of
 422 variables and instruments used in the empirical exercise are
 423 reported in Table 1.

424 To sum up, in light of the above discussion, in this work
 425 we argued that there are different channels through which
 426 individual and country/cohort specific variables may affect
 427 the decision to invest in stocks.

428 As for individual variables, apart from usual socio-
 429 demographic variables used in previous studies like age,
 430 marital status, gender, household size, income and wealth,
 431 we focused on financial literacy and human capital (meas-
 432 ured by the number of years of schooling). By doing so we
 433 assumed that investing in risky assets requires both general
 434 level of education and a specific human capital investment
 435 (financial literacy). Moreover, we controlled for possible
 436 endogeneity of the latter variables: more precisely, sharing
 437 insights with Grohmann et al. (2015) and a fresh and yet
 438 growing strand of literature, we argued that early endow-
 439 ments might be strong predictors of late life acquisition of
 440 financial literacy and general education. We also assumed
 441 that such level of acquisition could be affected by specific
 442 economic country/cohort variables like financial attractive-
 443 ness of the stock market when the individual was in his/her
 444 adolescence.

445 As for other individual variables potentially affecting the
 446 decision to invest in stocks, we explored the role of social
 447 interaction and social capital variables: in fact, individuals
 448 with low social interactions are likely to have low familiarity
 449 with risky markets, overestimate financial risks and, thus,
 450 abstain from stock markets.

451 Finally, we focused on the role of country/cohort level
 452 factors, such as effectiveness/quality of education at young
 453 ages and performance of financial markets in previous years.

454 Empirical Model

455 The econometric analysis followed a two steps strategy. In
 456 the first step, variables like financial literacy and human
 457 capital were considered as exogenous and we implemented
 458 both an OLS and a probit model to have a baseline model. In
 459 the second step, we allowed for the endogeneity of financial
 460 literacy and human capital. In fact, in the presence of mul-
 461 tiple endogeneity, the probit approach yields biased results
 462 as suggested by Cameron and Trivedi (2010) and therefore
 463 we resorted to control function (CF) approach, which will be
 464 discussed in detail in the later part of this section. Finally, as
 465 a check, we used an IV two-stage regression when consider-
 466 ing the endogenous model.

467 OLS and Probit Models

468 The first empirical model was obtained as a simple OLS
 469 and probit model. Both estimations had the following
 470 specification:

⁷ The classification is based on direct stockholding percentages. Italy
 7FL.01 and Austria are low participating countries with less than 7% of the
 7FL.02 respondents holding stocks. The medium participation country group
 7FL.03 represents countries whose direct participation levels are between
 7FL.04 8–20% and the high participating countries ranges from 21 to 40%.
 7FL.05 Broadly speaking stockholding increases from Southern to Northern
 7FL.06 Europe, with Switzerland as an exception.
 7FL.07

Table 1 Sample statistics of the variables used in the regressions

Variable	Observations	Mean	SD	Min	Max
Individual level variables					
Participation to Stock Market (dependent variable)	32,337	0.168	0.374	0	1
Financial literacy	32,337	3.461	1.145	1	5
Number of years in school	32,337	10.341	4.608	0	25
Age at interview date	32,337	43.33	10.520	31	86
Age squared	32,337	4448.552	1431.787	961	7396
Dummy for married	32,337	0.845	0.3610	0	1
Number of children	32,337	2.175	1.414	1	17
Dummy for female	32,337	0.558	0.496	0	1
Dummy for medium income group	32,337	0.3999	0.4899	0	1
Dummy for high income group	32,337	0.3999	0.4899	0	1
Dummy for medium wealth group (base level: wealth low)	32,337	0.3867	0.48701	0	1
Dummy for high wealth group (base level: wealth low)	32,337	0.3861	0.4867	0	1
Dummy for retirement	32,337	0.5299	0.4991	0	1
Dummy for participation in charity/voluntary activities	31,664	0.23021	0.4210	0	1
Dummy for participation in political/organisational activities	31,664	0.07080	0.2565	0	1
Dummy for membership in a club	31,664	0.33043	0.47037	0	1
Total individuals in network	30,773	2.6196	1.5505	0	7
Cohort/country level variables					
Sharpe-ratio (5-year average for 2006–2010)	32,337	0.0222	0.0504	−0.101	0.068
Dummy for low participation countries	32,337	0.2742	0.4461	0	1
Dummy for high level participation countries	32,337	0.2466	0.4310	0	1
Student–teacher ratio	32,337	27.696	5.751	10.366	37.822

471

$$\begin{aligned} \text{Stock Y [1, 0]} = & \alpha_1 + \beta_1 \text{FL} + \beta_2 \text{HC} + \beta_3 \text{Age} + \beta_4 \text{Agesq} + \beta_5 \text{MS} + \beta_6 \text{CH} \\ & + \beta_7 \text{FE} + \beta_8 \text{IN_M} + \beta_9 \text{IN_H} + \beta_{10} \text{WEALTH_M} + \beta_{11} \text{WEALTH_H} + \beta_{12} \text{RE} + \beta_{13} \text{CHA} \\ & + \beta_{14} \text{POL} + \beta_{15} \text{CLUB} + \beta_{16} \text{NET} + \beta_{17} \text{SH} + \beta_{18} \text{DUM_HIGH} + \beta_{19} \text{DUM_LOW} + \beta_{20} \text{EQ} + \varepsilon \end{aligned}$$

472 where Stock is, in the case of OLS regression, the depend-
473 ent variable which takes value 1 if the worker participated in
474 the stock market in year 2010 or 0, while, in the case of the
475 probit model, is the probability of participating in the stock
476 market in the same year. The individual level variables are
477 the financial literacy score (FL) and the number of years
478 of schooling (HC). The socio-demographic characteristics
479 such as age (Age), age-squared (Agesq), dummy for married
480 (MS), number of children (CH), dummy for female (FE) and
481 dummy for retired (RE) were also included in the model.

482 The economic variables included income groups
483 (IN_M and IN_H are dummies for individuals belong-
484 ing to the medium and high-income groups, respectively)
485 and WEALTH_H and WEALTH_M are high wealth and
486 medium wealth groups. The social interaction terms
487 included a dummy for participation in voluntary/charity
488 activities (CHA), a dummy for participation in political and
489 organisational activities (POL), for membership in a club

(CLUB), and the number of persons in individual's social
490 network (NET). 491

492 The country-level variables comprised SH, that is the
493 current (5-year average) country-level Sharpe-ratio. Addi-
494 tionally, we included country-group dummies for high par-
495 ticipation countries (DUM_HIGH) and low participation
496 countries (DUM_LOW). The country/cohort group level
497 variable EQ is the student/teacher-ratio at cohort-country
498 level when individuals were within their 6–15 age interval.
499 ε is error term.

500 Empirical Results Based on OLS and Probit Models

501 Table 2 reports the results of regressions carried out under
502 two different specifications: OLS and probit. The empirical
503 results of these baseline regressions show that all the explan-
504 atory variables used in this study were significant across
505 all specifications and displayed the expected signs, with the
506 only exception of the interaction term of low participation

Table 2 Multivariate regression using OLS (Model 1) and Probit model (Model 2, associated marginal effects in column 3)

Variables	OLS	Probit	Marginal effects
Individual level variables			
Financial literacy	0.0232*** (0.000)	0.0213*** (0.022)	0.0261*** (0.002)
Schooling years	0.0048*** (0.000)	0.1271*** (0.010)	0.0044*** (0.000)
Age	0.0171*** (0.002)	0.0848*** (0.014)	0.0174*** (0.002)
Age-squared	-0.00009*** (0.000)	-0.0005*** (0.000)	-0.0001*** (0.000)
Number of children	-0.0074*** (0.001)	-0.0537*** (0.007)	-0.0110*** (0.001)
Dummy for married	-0.0431*** (0.006)	-0.2071*** (0.027)	-0.0462*** (0.006)
Dummy for female	-0.0395*** (0.004)	-0.1697*** (0.020)	-0.0353*** (0.004)
Dummy for medium income group	0.0202*** (0.005)	0.1169*** (0.030)	0.0244*** (0.006)
Dummy for high income group	0.0654*** (0.005)	0.3180*** (0.029)	0.0678*** (0.006)
Dummy for medium-wealth group	0.0548*** (0.004)	0.4295*** (0.032)	0.0935*** (0.007)
Dummy for high-wealth group	0.1682*** (0.005)	0.8906*** (0.032)	0.2034*** (0.007)
Dummy for retirement	-0.0227*** (0.005)	-0.0679** (0.027)	-0.0141** (0.005)
Dummy for participation in charity/voluntary activities	0.0184*** (0.005)	0.0987*** (0.022)	0.0200*** (0.004)
Dummy for participation in political/organisational activities	0.0369** (0.009)	0.1213*** (0.033)	0.0262*** (0.007)
Dummy for membership in a club	0.0343*** (0.004)	0.1470*** (0.020)	0.0311*** (0.004)
Total persons in the network	0.0069*** (0.001)	0.0390*** (0.006)	0.0073*** (0.001)
Cohort/country variables			
Sharpe-ratio (years 2006-10)	0.1511** (0.035)	0.8021** (0.239)	0.1651** (0.049)
Dummy for low-participation countries	-0.1267*** (0.010)	-0.6662*** (0.035)	-0.1166*** (0.005)
Dummy for high-participation countries	0.1028*** (0.007)	0.3590*** (0.028)	0.0824*** (0.007)
Student-teacher ratio	-0.008*** (0.000)	-0.0335*** (0.028)	-0.0069*** (0.000)
Constant	-0.570*** (0.089)	-4.554*** (0.046)	
Observations	28,847	28,847	28,847
R-squared	0.145		
Pseudo R ²			0.17

Standard errors in brackets. Dependent variable: binary variable in case of OLS – 1 if participating in the stock market in year 2010, 0 otherwise; probability to invest in stock market in the case of probit regression model

**p < 0.01, *p < 0.05, †p < 0.10

507 country groups. The OLS and the probit regressions (marginal effects) provided similar results. The likelihood ratio (L-R tests) for overall variables' relevance [probit model; 508 LR (χ^2) (20) = 4573.01 with prob > (χ^2) = 0.00] shows that 509 the hypothesis that all parameters are equal to zero could be 510 rejected at 1% level of significance. 511

512 In both specifications, financial literacy and human capital (proxied by number of years of schooling) showed a positive effect on stock market participation and coefficients were significant at 1% level. The marginal effects suggested an independent, economically important estimate of these two variables. More financially literate individuals were more likely to invest in stocks by 2.6%, while a unit change in the years of schooling added a marginal 0.4% increase in the probability to enter stock markets. The above effects are net of various demographics, household resources, country/cohort wide differences and are economically important given that the average participation rate in our sample did not exceed 17%. 525

526 Based on the probit specification we found that the variable dummies for medium and high-income groups were significant and positive and that one standard deviation of these variables was associated with a 2.4 and 6.7% increase in the probability to own stocks, respectively. 530

531 When we distinguished households by median net wealth levels, we found significant effects among those with more than medium and high levels of wealth in both regressions (low wealth group is the baseline). The estimated marginal effects of the medium wealth and high wealth holders displayed a higher probability of stock participation of 9.3 and 20.3% respectively, compared to the low wealth group. 537

538 As for demographic characteristics, married individuals turned out to have a lower probability to participate in the stock market, by 4.6% (significant at 1%). Conversely, higher number of children and being female reduced the probability of stock holding. As for gender effect, if the dummy for female changed from 0 to 1, the probability to participate in the stock market would decrease by 3.5%, pointing to 544

the presence of a gender gap already documented in previous studies. Moreover, the regressions indicated that direct stockholding increased with age, thus showing that the U shape form in Fig. 1 is a combination of both age and cohort effects. The retired individuals were less likely to participate in the stock market.

As for social interaction variables, we observed that they were significant and positive at 1% level, showing that both the size (total number of individuals in the social network) and the quality of the social networks did matter. The social interaction variables, like dummies for charity/voluntary activities, for political/ organisational participation and for club membership showed a positive marginal effects of 2.0, 2.6, and 3.1% respectively. Finally, a standard deviation in the number of persons in networks increased the probability to participate in the stock market by 0.7%. The latter findings confirmed the presence and the relevance of peer-effects through social interaction.

When different groups of countries were considered, the respondents from high participation countries were 8.2% more likely to participate. In contrast, the low participation countries were 11.6% (significance level 1%) less likely compared to the baseline medium participation countries.

Student–teacher ratio at schooling years (that is when individuals were in their 6–15 years of age) demonstrated a negative effect, suggesting that, as education quality gets worse in a country, social capital deteriorates as well, so that both quality of own education is lower and there are lesser possibilities to find individuals in the same cohort group that are engaged in stock markets. According to our findings, respondents belonging to higher student–teacher ratio cohort-groups were 0.6% less likely to participate in asset markets.

Finally, the current financial attractiveness of the market proxied by the 5-year average Sharpe-ratio revealed a positive and significant marginal effect. We observed that a unit change in this variable made respondents 16.5% more likely to enter stock markets.⁸

Empirical Model under Endogenous Framework

Identification Strategy

This section illustrates the identification strategy used to correct for the potential endogeneity of some of the independent variables. Although these variables will be referred as instruments, one should be aware that the estimation method

adopted here differs from the standard two-stage instrumental variable method (see next section for details). As already mentioned, we allowed for the possibility that both human capital and financial literacy investments are endogenous. Our identification strategy was based on two assumptions: (1) Early endowments in the form of talent and ability are strong predictors of financial literacy and schooling years (Grohmann et al. 2015); (2) The current stock holding decisions are shaped by history in the sense that they are not only based on current variables but are also transmitted slowly over time and have early-life influences.

Therefore, the endogeneity could arise from the fact that the current level of financial literacy is influenced by the “endowment” (starting or initial conditions) before the worker enters the labour market. SHARE retrospective data (SHARELIFE) provide a plausible measure of this endowment. Survey participants reported their mathematical ability at age 10 in response to the question: “How did you perform in Maths compared to other children in your class? Did you perform much better, better, about the same, worse or much worse than the average?” While mathematical ability does not span exactly the same domain of financial literacy, ongoing research shows that there is a close correlation between the two concepts of literacy. We used this instrument as suggested by Jappelli and Padula (2013) who exploited Wave 1 and Wave 2 of the SHARE database to explore the effect of financial literacy on the saving decisions of workers.

Moreover, we also suspected human capital, which we measured through years of schooling, to be endogenous. As pointed out by Lam and Schoeni (1993), an omitted variable like the individual ability/talent of the worker which is correlated to schooling in the wage equation could overestimate the schooling’s true effect on wages, because it has captured some of the wage effect of ability. In other words, differences in the initial endowments of the individual at younger ages can also induce unobserved compensatory behaviour among workers in their economic and financial decisions, and therefore the probability to participate in stock market based on only the observed human capital investment would surely provide biased results.

Additionally, taking a cue from the literature examining cognitive abilities and academic achievement (Männamaa and Kikas 2010; Marton 2008; Van der Sluis et al. 2004) academic performance in the school years computed from proficiency in maths and language was regarded as a strong predictor of academic achievements. Also following Kern and Friedman (2009), who argued that reading ability is generally associated with positive baseline characteristics such as higher IQ and higher schooling years, we included a measure of language skills at young age of the respondents as an instrument capturing the talent/endowment. The participants reported their language skills at age 10 in response to the questions: “How did you perform in language compared to other children in

⁸ Interactions of country dummies with Sharpe-ratios were also attempted, although they were not significant. In fact, Sharpe-ratios are country-specific and the latter, together with the country—group dummies and student–teacher ratios (cohort/country level) already capture the between-country variability in participation rates.

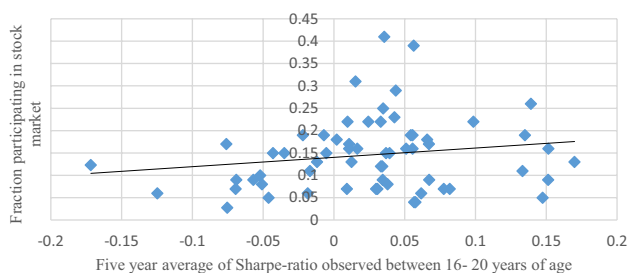


Fig. 7 Fraction participating in stock market and sharpe-ratio at age 16–20 by cohort groups and countries. Source: Authors’ calculation using Global Financial Database. X axis: 5-year averages of Sharpe-ratios for each 5-year cohort-groups and countries. Y axis: fractions of individuals participating in the stock market for each cohort group and country

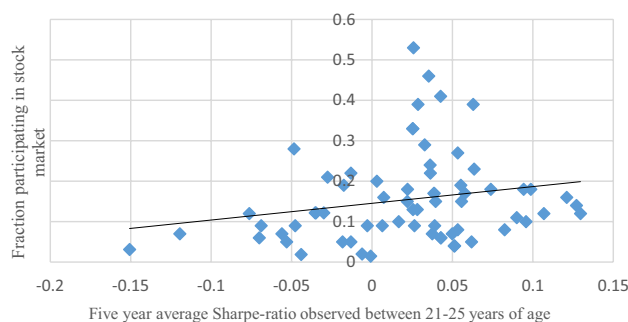


Fig. 8 Fraction participating in stock market and sharpe-ratio at age 21–25 by cohort groups. X axis: 5-year average Sharpe-ratios for each 5-year cohort-groups and countries. Y axis: fractions of individuals participating in the stock market for each cohort group and country

642 your class? Did you perform much better, better, about the
 643 same, worse or much worse than the average?” The complete
 644 statistics of the instruments are provided in Appendix 4.

645 To validate our assumptions that financial incentives are
 646 likely to have affected the decision to invest in financial liter-
 647 eracy and human capital, a decision that in fact happens
 648 early in life, we computed and included the 5-year-average
 649 Sharpe-ratios at cohort-group/country level, observed when
 650 each worker in Wave 4 was between 16 and 20 years old
 651 and 21–25 years old respectively.⁹ The computed values and
 652 the associated fractions of participation in stock markets are
 653 plotted in Figs. 7 and 8 respectively. From both figures, it
 654 emerges that the fraction of individuals participating in the
 655 stock market for each cohort tends to increase when the
 656 Sharpe-ratio observed at young ages increases. However,
 657 correlations were weak and not significant, so that it is likely
 658 that the effect of the Sharpe-ratios observed at early stages
 659 of life on stock market participation was indirect, possibly
 660 via financial literacy and human capital accumulation. More
 661 precisely, in our framework the Sharpe-ratios observed by
 662 individuals at younger ages influence the decision to acquire
 663 more education and financial literacy and thus indirectly
 664 facilitate their decision to join stock markets in the later
 665 period of time (in terms of lower costs to take track of their
 666 investments, to acquire relevant information and so on).

667 In order to check the robustness of our assumptions we
 668 run the control function regressions by using additional
 669 instruments concerning family background variables,
 670 including occupation of father when respondent was aged
 671 10 (Model 2 in Table 4) and initial conditions like number
 672 of rooms in the accommodation at age 10, number of books
 673 in the house besides parents’ occupation at the age of 10
 674 (Model 3 in Table 4).

Multiple Endogeneity and Estimations Based on Control Function Approach

675
676

677 One of the approaches to deal with an endogenous regressor
 678 is the linear probability model using two-stage least squares
 679 (2SLS) with a valid and strong set of instruments. Given the
 680 dichotomous nature of the independent variable, we resorted
 681 to a control function (IVprobit). The latter procedure can
 682 be based on either the maximization of the likelihood
 683 function associated with a system of equations or a two-
 684 step procedure when MLE is difficult to obtain (for details
 685 see Wooldridge 2002, pp. 474–477). Given that the latter
 686 approaches produce the same results, we used the IVprobit-
 687 MLE approach and include 2SLS regression as a check.

688 To test whether financial literacy and human capital
 689 are endogenous to the participation in stock market we
 690 employed the Wald test of endogeneity. The null hypothesis
 691 corresponds to the exogeneity case of the regressor under
 692 scrutiny. The Wald test computation (bottom of Table 4)
 693 of different specifications led us to reject the null hypothesis
 694 of exogeneity of the regressors and therefore justified the use
 695 of approaches that correct for endogeneity.

696 In this background, we instrumented both financial liter-
 697 eracy and schooling years on a set of exogenous variables,
 698 which were correlated with the endogenous variables, and
 699 not correlated with stock participation at later age. The OLS
 700 estimates (not shown here for brevity reasons) showed that
 701 maths score at 10 and language skills at 10 were strong pre-
 702 dictors of financial literacy and schooling years,¹⁰ and that
 703 the latter had no significance on stock market participation,

¹⁰ The relative mathematical ability at age10 shows almost equal effect on financial literacy and school years, while relative score of language skills at age 10 is a better predictor of school years rather than financial literacy.

10FL01
10FL02
10FL03
10FL04

⁹ We recall that in SHARE database education years range from age zero to 25 (see Table 1).

⁹FL01
⁹FL02

Table 3 First stage regressions of control function (Model 1 of Table 4) to correct endogeneity of schooling years and financial literacy

Endogenous variable	Schooling years	Financial literacy
Age	0.0415 (0.064)	0.0150 (0.015)
Age squared	-0.0006 (0.004)	-0.0002* (0.000)
Number of children	-0.1165*** (0.027)	-0.0145** (0.006)
Dummy for married	-0.5806*** (0.011)	0.0299 (0.021)
Dummy for female	-0.5840*** (0.078)	-0.2737*** (0.018)
Dummy for medium income group	-0.1010 (0.099)	0.0035 (0.023)
Dummy for high income group	1.2963*** (0.104)	0.1568*** (0.024)
Dummy for medium-wealth group	0.2619** (0.100)	0.1390** (0.023)
Dummy for high-wealth group	1.4022*** (0.1031)	0.2707*** (0.024)
Dummy for retirement	-0.0357 (0.0952)	0.0392* (0.023)
Dummy for participation in charity/voluntary activity	0.2497** (0.08)	0.0895*** (0.020)
Dummy for participation in Political/ organisational activity	0.8112*** (0.143)	0.0968** (0.034)
Dummy for membership of a club	0.0331 (0.07)	0.0914*** (0.018)
Total persons in the network	0.1552*** (0.024)	0.0189** (0.005)
Sharpe-ratio (years 2006-10)	-7.3873 *** (0.910)	-0.1417 (0.217)
Dummy for low-participation countries	-4.9853*** (0.151)	-0.2131*** (0.036)
Dummy for high-participation countries	-2.3941*** (0.115)	0.2031*** (0.027)
Student-teacher ratio	-0.1080*** (0.009)	-0.0014 (0.002)
Instruments		
Maths at age 10	0.4086*** (0.043)	0.2350*** (0.010)
Language at age 10	0.7001*** (0.043)	0.0706*** (0.010)
Sharpe-ratio at age 16-20	3.9154*** (0.810)	0.5989** (0.193)
Sharpe-ratio at age 21-25	5.641 *** (0.842)	0.5028** (0.200)
Constant	11.47 (0.527)	2.17 (0.533)
Observations	12,291	12,291
R-squared	0.273	0.190

Robust standard errors are reported in parentheses

** $p < 0.01$, * $p < 0.05$, † $p < 0.10$

704 thus convincingly ruling out any direct effect of these two
705 instruments on the dependent variable. Second, we also
706 argued that the Sharpe-ratios observed by individuals at
707 their young ages (16–25) influenced the decision to acquire
708 more education and financial literacy and thus indirectly
709 facilitated their decision to join stock markets in the later
710 period of life; hence, these variables entered the regression
711 framework as instruments. OLS estimates (not reported
712 here) confirmed that Sharpe-ratios at young age were good
713 predictors of financial literacy and schooling years. As a
714 formal measure, we used the tests of overidentifying restric-
715 tions and we observed that the null hypothesis could be
716 rejected (Amemiya–Lee–Newey (ALN) test for exogeneity
717 and Hansen J test Table 4), indicating that the exclusion
718 restrictions for these instruments were appropriate.

719 The first stage results reported in Table 3 showed that
720 self-rated maths and self-rated language skills at age 10,
721 a proxy for talent (ability)/endowment, exerted a positive
722 effect on both financial literacy and human capital accumu-
723 lation. Moreover, the financial attractiveness of the market

724 observed at young ages showed a positive correlation with
725 the latter variables. Hence, not only variables proxying tal-
726 ent, but also the positive correlation of the Sharpe-ratios
727 observed between 16 and 25 suggested that a good per-
728 formance of financial markets in the host country at one's
729 young age is likely to induce individuals to invest more in
730 schooling years and in financial literacy, in view of better
731 future opportunities and returns from such investments.

732 As for the relevance of the instruments (signifying the
733 fact that they influence the suspected endogenous regressors)
734 we observed that the F-statistics are high and above the value
735 recommended to avoid the weak instrument problem (Staiger
736 and Stock 1997) as reported in the first stage regression
737 (Table 3). Finally, in order to test whether the set of instru-
738 ments are valid, we exploited the Amemiya–Lee–Newey
739 (1978) test. The null hypothesis was that the instruments
740 are jointly valid, that is, they are uncorrelated with the
741 error term in the structural equation and the instruments are
742 correctly excluded from the estimated equation. With the
743 aforementioned instruments for the vector of endogenous

Table 4 Marginal effects from different specifications under control function approach (Models 1–3) and IV two-stage approach (Model 4)

Variables	(1) IVprobit MLE	(2) IVprobit MLE	(3) IVprobit MLE	(4) IV2SLS
Individual level variables				
Financial literacy	0.06209** (0.019)	0.0690** (0.020)	0.0711** (0.018)	0.041** (0.021)
Schooling years	0.0123** (0.005)	0.008* (0.004)	0.0072* (0.004)	0.0194** (0.006)
Age	0.02614*** (0.006)	0.0274*** (0.006)	0.0279*** (0.006)	0.0302*** (0.006)
Age-squared	−0.0001*** (0.000)	−0.0001*** (0.000)	−0.0001*** (0.000)	−0.0001*** (0.000)
Number of children	−0.0113** (0.002)	−0.0114*** (0.002)	−0.0117*** (0.002)	−0.0070** (0.002)
Dummy for married	−0.0398*** (0.010)	−0.0445*** (0.010)	−0.0457*** (0.010)	−0.0367*** (0.011)
Dummy for female	−0.0416*** (0.008)	−0.0441*** (0.008)	−0.0569*** (0.008)	−0.0486*** (0.008)
Dummy for medium income group	0.0231** (0.009)	0.0221** (0.011)	0.0213** (0.010)	0.0252** (0.009)
Dummy for high income group	0.0428*** (0.011)	0.0458*** (0.011)	0.0482*** (0.010)	0.0400*** (0.011)
Dummy for medium wealth group	0.0690*** (0.011)	0.0669*** (0.011)	0.0659*** (0.011)	0.0467*** (0.010)
Dummy for high wealth group	0.1501*** (0.012)	0.1523*** (0.012)	0.1529*** (0.011)	0.1353*** (0.011)
Dummy for retirement	−0.0186** (0.009)	−0.0204** (0.009)	−0.0271** (0.005)	−0.0310** (0.009)
Dummy for participation in charity/voluntary activities	0.0219** (0.007)	0.0231** (0.007)	0.0243*** (0.002)	0.0206** (0.008)
Dummy for participation in political/organisational activities	−0.0041 (0.012)	−0.0019 (0.008)	−0.0011 (0.012)	−0.0029 (0.014)
Dummy for membership in a club	0.0352*** (0.007)	0.0341*** (0.007)	0.0343*** (0.007)	0.0414*** (0.007)
Total Persons in network	0.008*** (0.002)	0.0091*** (0.002)	0.0099*** (0.002)	0.0071** (0.002)
Cohort/country level variables				
Sharpe-ratio (years 2006–2010)	0.2148** (0.106)	0.195* (0.105)	0.1745** (0.104)	0.1907** (0.102)
Dummy for high participation countries	0.0828*** (0.020)	0.0736*** (0.019)	0.0671*** (0.018)	0.1245*** (0.022)
Dummy for low participation country	−0.1219** (0.032)	−0.1360*** (0.028)	−0.0146*** (0.025)	−0.0648** (0.032)
Student–teacher ratio	−0.0087*** (0.001)	−0.0093*** (0.001)	−0.0097*** (0.001)	−0.0095*** (0.001)
Observations	12,291	12,068	11,939	12,291
Wald test	24.88	25.28	30.03	
P value	0.00	0.00	0.00	
ALN Test	0.29	0.30	0.50	0.14
Hansen J Statistic				8.18
Chi sq P value				0.16
Durbin Wu–Hausman test				27.59
P value				0.00
F statistics	105.21	105.24	105.30	105.21

Standard errors in parentheses. Dependent variable: probability to invest in the stock market

**p < 0.01, *p < 0.05, †p < 0.10

744 variables, Table 4 shows that the Amemiya-Lee-Newey
745 minimum χ^2 p-values is 0.29, 0.30, 0.50 respectively in all
746 specifications and therefore we rejected the null hypothesis
747 of endogeneity of the instruments.

748 We can conclude that throughout all the empirical specifi-
749 cations we used and several robustness checks carried out by
750 adding other instruments (see next subsection), we consist-
751 ently found confirmation that both performance of financial
752 markets observed at early stages in life and self-reported
753 results in maths and language skills at age of 10, while not
754 significantly correlated with stock holdings, provided more

incentives for respondents to invest in general education and
in financial literacy.

Empirical Results Based on the Endogenous Model

755
756
757
758 As for the regression of stock market participation, in
759 Table 4 four specifications are reported. Models (1), (2) and
760 (3) use a control function (CF) approach (IVprobit-MLE)
761 with different specifications, Model (4) is the 2SLS model,
762 added as a check. Model (1) was our benchmark model,
763 where only four instruments displayed in Table 3 were used.

764 Model (2) adds to Model (1) father's occupation at age of 10
 765 as an instrument and Model (3) adds initial conditions like
 766 number of books and number of rooms at the residence when
 767 the respondent was 10 years old. After pursuing a variety
 768 of robustness checks, as mentioned above, in all the speci-
 769 fications we found consistent results and the value of the
 770 endogenous coefficient gained more strength as the number
 771 of instruments increased. Given that the results did not vary
 772 significantly across specifications, the presentation and the
 773 discussion of results are mainly based on Model (1).

774 The regressions showed that the endogenous variables,
 775 namely financial literacy and years of schooling, contributed
 776 significantly to direct stock participation, with a more pro-
 777 nounced effect than in the baseline probit model. In line with
 778 the existing literature, more financial literate respondents
 779 across the whole sample were 6.2% more likely to partici-
 780 pate in the stock market, while a one unit change in the years
 781 of schooling increased the probability for stock participation
 782 by 1.2% (1% level significance). These findings suggested
 783 again that the baseline probit coefficients of financial lit-
 784 eracy and human capital were downward biased (Table 2,
 785 Model 2).

786 As far as exogenous variables are concerned, we observed
 787 that income and wealth quintiles continued to remain as
 788 important predictors of stock participation. The estimated
 789 coefficient of dummy for medium and high income groups
 790 revealed that one standard deviation of these income groups
 791 was associated with 2.3 and 4.2% increase in the probability
 792 to own stocks, respectively. The estimated marginal effects
 793 of wealth revealed that members of the medium and high
 794 wealth-groups were more likely to participate in stock mar-
 795 kets than individuals belonging to the low-wealth group, by
 796 6.9 and 15%, respectively. This result was in line with pre-
 797 vious findings on the relevant role of wealth and pointed to
 798 the presence of entry and management costs for investors in
 799 financial markets.

800 Moving to the socio-demographic variables, results
 801 were similar to those stemming from the baseline model
 802 (Table 4, Model 1) and the changes were concerned with
 803 the magnitude of the marginal effects of some variables,
 804 not even the sign. Married respondents had a lower prob-
 805 ability to participate in stock markets and the estimated
 806 coefficient was around 3.9% (significance level 1%). On
 807 the other hand, the dummy variable for female was sig-
 808 nificant at 1% level and showed a negative effect (gender
 809 gap) as anticipated from the earlier studies (marginal effect
 810 -4.1%). The number of children also affected negatively
 811 the stock market participation and was significant at 5%
 812 level, with a marginal effect of -1.1% . If a respondent
 813 moved to the retirement phase, then his/her probabili-
 814 ty to participate in risky assets would decline by 1.8%.
 815 Finally, age and age-square were both significant, showing

that stock holding, when purged out from cohort effects,
 increased with age.

As for social interaction, we found that all variables
 were significant and with the expected signs, with the only
 exception of participation to political and organisational
 activities, which was not significantly different from zero.
 More precisely, all specifications showed that the size of
 the social network did matter, in that the latter positively
 affected the decision of participating in financial markets
 with a marginal effect of 0.8%. Moreover, also the qual-
 ity of social interaction was found to play a significant
 and differentiated role. Interestingly enough, individuals
 that were involved in charity/voluntary activities, although
 more prone to join the stock market if compared with
 those not involved in such activities (marginal effect of
 2.1%), displayed a lower propensity to participate in the
 stock market relative to those who were members of clubs
 (marginal effect of 3.5%). This finding is possibly due to
 differences in attitude/values towards self-interest, risky
 activities or business in general featuring the members of
 these two different groups of individuals. Overall, we can
 say that our work confirmed the evidence of a relevant role
 played by social interaction variables.

The country level effects in the CF approach showed
 that a person belonging to a high participation country
 group was 8.2% more likely to enter stock markets rela-
 tive to the benchmark (medium-participation countries),
 while we observed a negative effect for low participation
 country group relative to the benchmark group (-12.1%).
 These differences were possibly due to different attitude
 towards risk, culture, functioning of capital markets, level
 of investor protection and other unobserved institutional
 factors. However, the analysis of this an unexplained resid-
 ual was beyond the scope of our study and was left for
 future research.

Turning to financial attractiveness of the host country,
 the estimated coefficients revealed that the contribution of
 current financial attractiveness proxied by 5-year average
 Sharpe-ratios was positive and significant, with a marginal
 effect of 21.4%.

Finally, as for the student–teacher ratio, such country-
 cohort group variable, meant to capture the effect that a
 better education system exerted on participation in stock
 markets through externalities, had a negative sign, as
 expected, and its marginal effect increased up to 0.8% in
 Model 3.

Conclusions

In this work, we shed new light on the determinants of
 stock market participation under an endogenous frame-
 work for nine European countries in year 2010, which is a

866	major issue both for researchers and policymakers. Using	education (lower student–teacher ratio) is also positively	911
867	different database and different econometric specifications,	associated with stock market participation at country level.	912
868	we estimated the effects of such variables as financial lit-	Our analysis is not devoid of limitations. The inclusion	913
869	eracy, human capital, effectiveness of the education sys-	of risk preferences of individuals, the sector of employment	914
870	tem, social-interaction and financial attractiveness of the	and the field of study in the SHARE database could further	915
871	markets on the probability to invest in stocks, together	improve the quality of the database for future research on	916
872	with the effects of other socio-demographic individual	the field of financial related decisions at the European level.	917
873	characteristics and institutional/country level variables.	However, in the light of our findings, some policy impli-	918
874	Our study contributes to the existing literature on sev-	cations follow: the enhancement of financial literacy, human	919
875	eral respects.	capital and the quality of education at both individual and	920
876	From a quantitative point of view, we quantified the	country level is crucial for ensuring higher participation in	921
877	marginal effects of financial literacy and human capital	capital markets. Moreover, since the latter were found to be	922
878	(schooling years) on the probability to participate in the	strongly affected by starting conditions, policies aimed at	923
879	stock market in Europe (about 6.2 and 1.2% respectively).	restoring equality in opportunities among young individuals	924
880	From a methodological point of view, we showed that	should be designed to increase financial market participa-	925
881	not controlling for endogeneity of both financial literacy	tion. Finally, much effort should be put in filling the gender	926
882	and human capital produces results that are negatively	gap, and improving institutional factors such as the effec-	927
883	biased. Among other relevant determinants of stock mar-	tiveness of the education system and the efficiency of finan-	928
884	ket participation, we found that both wealth and income	cial markets (e.g., by favouring the presence of institutional	929
885	play a significant and positive role in shaping participation	investors such as pension funds, or reducing entry costs).	930
886	rates across countries.	Acknowledgements We are grateful to the participants at the Semi-	931
887	Interestingly enough, as for social interaction, we	nar at Department of Economics and Management, University of Pisa,	932
888	observed that both its size and quality do matter, in that	at the «13th Workshop on Pension, Saving and Insurance, Paris», at	933
889	the former exerted a positive effect on the probability to	the «Institutional and Individual Investors: Saving for old age» Con-	934
890	invest in risky assets, and the latter showed that individu-	ference, University of Bath, at GRASS IX Workshop, IMT Lucca,	935
891	als that were involved in charity/voluntary activities were	at XXIV MBF Rome Conference, at 52nd TIES conference, IIM	936
892	more likely to invest in the stock market, although to a	Kozhikode, Michael Haliassos, Maurizio Fiaschetti, Angela Parenti,	937
893	lesser extent than members of clubs. Finally, our estimates	Davide Fiaschi, Thomas Renström and Valeria De Bonis, Alessandro	938
894	provide evidence of gender gap, which deserves further	Belmonte, Nebojsa Dimic for helpful insights and suggestions on a	939
895	analysis in future research.	previous version of this paper. The usual disclaimer applies.	940
896	Another interesting result of our work is that both past	Compliance with Ethical Standards	941
897	and present financial incentives at cohort-country level sig-	Conflict of interest The authors declare that they have no conflict of	942
898	nificantly influence the participation of individuals in stocks.	interest.	943
899	However, we have provided new evidence on the different	Ethical Approval This article does not contain any studies with human	944
900	channels of action of such financial incentives, by show-	participants or animals performed by any of the authors.	945
901	ing that past market performances affected the decision to		
902	join the stock market indirectly, that is, by influencing the		
903	decision to invest in financial education and human capital.		
904	We also found that participation rates varies across country	Appendix	946
905	groups, possibly due to differences in attitude towards risk,		
906	culture, functioning of capital markets and fiscal policies,	Appendix 1	947
907	level of investor protection and other unobserved institu-		
908	tional factors. The exploration of such unexplained differ-	See Table 5.	948
909	ences represents an interesting avenue for future research.		
910	Finally, we found confirmation that higher effectiveness of		

Table 5 Description of variables used in the study and their source

Variable	Description	Source
STOCK	Participation to stock market (Dummy)	SHARE
FL	Financial Literacy Score	SHARE
HC	Schooling years	SHARE
AGE	Age at the time of the interview	SHARE
AGESQ	Age squared	SHARE
FE	Dummy for Female	SHARE
CH	Number of children	SHARE
MS	Dummy for married	SHARE
IN_H	Dummy for medium income group	SHARE
IN_L	Dummy for high income group	SHARE
WEALTH_MED	Medium wealth holding group	SHARE
WEALTH_HIGH	High wealth holding group	SHARE
CHA	Dummy for participating in voluntary or charity	SHARE
POL	Dummy for participating in political and organisational activities	SHARE
CLUB	Dummy for membership in a club	SHARE
TOT_NET	Number of persons in the social network	SHARE
SH (2006–2010)	Five year average of the lag of the Sharpe-ratio from the date of the interview	Global Financial Statistics Country level
DUM_HIGH	Dummy for high participation country group	SHARE/Country group
DUM_LOW	Dummy for low participation country group	SHARE/country group
EQ	Student–teacher ratio	International Historical Statistics Individual/country level
Instruments		
MATHS_10	Relative position of maths when aged 10	SHARE
LANGUAGE_10	Relative position of language skills when aged 10	SHARE
FATHER_OCCU	Occupation of the main bread winner at age 10	SHARE
INITIAL_CON	Rooms at house at age of 10	SHARE
BOOKS_10	Books at shelf when aged 10	SHARE
SHARPE_16	Sharpe-ratio when aged between 16 and 20	Global Financial Statistics Country/cohort group level
SHARPE_20	Sharpe-ratio when aged between 21 and 25	Global Financial Statistics Country/cohort group level

949 Appendix 2: Financial Literacy in SHARE

950 The questions used to construct the financial literacy indica-
951 tor are set out below. Possible answers are shown on cards
952 displayed by the interviewer who is instructed not to read
953 them out to respondents:

- 954 1. If the chance of getting a disease is 10%, how many
955 people out of 1000 can be expected to get the disease?
956 The possible answers are 100, 10, 90, 900 and another
957 answer.
- 958 2. In a sale, a shop is selling all items at half price.
959 Before the sale a sofa costs 300 euro. How much will it
960 cost in the sale? The possible answers are 150, 600 and
961 another answer.
- 962 3. A second hand car dealer is selling a car for 6000
963 euro. This is two-thirds of what it costs new. How much

did the car cost new? The possible answers are 9000, 964
4000, 8000, 12,000, 18,000 and another answer. 965

4. 4. Let's say you have 2000 euro in a savings account. 966
The account earns 10 per cent interest each year. How 967
much would you have in the account at the end of the 968
second year? The possible answers are 2420, 2020, 969
2040, 2100, 2200, 2400. 970

If a person answers (1) correctly she is then asked 971
(3) and if she answers correctly again she is asked (4). 972
Answering (1) correctly results in a score of 3, answer- 973
ing (3) correctly but not (4) results in a score of 4 while 974
answering (4) correctly results in a score of 5. On the other 975
hand, if she answers (1) incorrectly she is directed to (2). 976
If she answers (2) correctly she gets a score of 2 while if 977
she answers (2) incorrectly she gets a score of 1. 978

Table 6 Variables and detailed methodology used to compute Sharpe-ratios from Global Financial Database. Source: Global Financial Database

Variable	Description	Years
CDAXD	Germany CDAX Total return index (Stocks)	Monthly from Dec 1869 to Dec 1969 and daily from Jan 1970 to May 2014
TRSBF250D	France CAC All tradable Total return index	Monthly from Jan 1895 to Jan 1991 and daily from Jan 1991 to Mar 2014
BCIPRD	Italy BCI Global return Index	Monthly from Dec 1924 to Dec 1972 and daily from Jan 1973 to May 2014
BCSHD	Brussels All share Return index	Monthly from Dec 1950 to Dec 1984 and daily from Jan 1985 to May 2014
SSHID	Swiss performance index	Monthly from Jan 1966 to Aug 1987 and daily from Sep 1987 to May 2014
TRNLDSTM	Netherlands Total Return Stock Index	Monthly from Dec 1950 to Apr 2014
OMXSBGD	OMX Stockholm Benchmark Gross Index	Monthly from Dec 1918 to Jun 1995 and daily from Jul 1995 to May 2014
OMXCGID	OMX Copenhagen All share gross index (Denmark)	Monthly from Dec 1969 to Jul 1989 and daily from Aug 1989 to May 2014
ATXTRO	Vienna SE ATX Total return Index (Austria)	Monthly from Dec 1969 to Jan 1996 and daily from Jan 1996 to May 2014
TRDEUGVM	Germany 10 year government bond return index	Monthly from Dec 1923 to Apr 2014
TRFRAGVM	France 10 year government bond return index	Monthly from Dec 1796 to Apr 2014
TRITAGVM	Italy 10 year government bond return index	Monthly from Oct 1807 to Apr 2014
TRBELGVM	Belgium 10 year government bond return index	Monthly from Nov 1831 to Apr 2014
SDGTD	Switzerland TR Government bond index	Monthly from Jan 1915 to Jan 1996 and daily from Jan 1996 to May 2014
TRNLDGVM	Netherlands 10 year government bond return index	Monthly from Dec 1813 to Apr 2014
RXTBD	Sweden Government bond return index	Monthly from Jul 1868 to Dec 1989 and daily from Jan 1990 to May 2014
TRDNKGVM	Denmark 10 year government bond return index	Monthly from Aug 1788 to Mar 2014
TRAUTGVM	Austria 10 year government bond return index	Monthly from Jun 1923 to Apr 2014

979 The questions were asked in national languages like
 980 German, Italian, Swedish, Danish and Dutch. As for the
 981 Austria, the language used was German. The respondents
 982 from Belgium questions were provided in French or Flem-
 983 ish and for the Switzerland, the questionnaires were pro-
 984 vided in Italian, German or French.

985 The actual range of responses were as follows: For
 986 question 1, the range of response is five, question 2 has
 987 three alternative answers, question 3 have six responses
 988 and finally question 4 has seven responses.

989 Appendix 3

990 See Table 6.

991 The detailed methodology of calculating the Sharpe-
 992 ratios is the following. The data on the return index is
 993 computed from Global Financial Database. The returns
 994 on risky assets and safe asset returns are calculated sepa-
 995 rately from the return index by applying the formula

$$996 \frac{Y_1}{Y_0} - 1$$

997 where Y_1 is the current return index value and Y_0 is the
 998 base return index. Then we calculate the average returns

by subtracting the return of the risky asset (R_f) from the
 return from safe asset (R_0): $\frac{R_f - R_0}{stdev(R_f)}$. 999 1000

Finally, the average returns are divided by the standard
 deviation of risky assets that is annualised by multiplying
 by $\sqrt{2}$ of the respective years. 1001 1002 1003

Appendix 4

See Table 7. 1004 1005

Table 7 Ranking based on skills of father's occupation at respondent's age of 10 provided by SHARE Wave 3

Occupation of the father	Rank based on skill
Legislator, senior official or manager	1
Professional	2
Technician or associate professional	3
Clerk	4
Armed forces	5
Service, shop or market sales worker	6
Skilled agricultural or fishery worker	7
Craft or related trades worker	8
Plant/machine operator or assembler	9
Elementary occupation	10

1006 **Appendix 5**

1007 See Table 8.

Table 8 Sample Statistics of the instruments for financial literacy and schooling years used in Section “Multiple Endogeneity and Estimations Based on Control Function Approach”

Variable	Observations	Mean	SD	Min	Max
Relative score of maths at 10 (ranked 1–4)	17,533	3.326	0.906	1	5
Relative score of language at 10 (ranked 1–4)	17,473	3.359	0.892	1	5
Father’s occupation (ranked from 1 to 10)	17,475	4.803	2.393	1	10
Number of rooms at home at 10	175,93	4.130	2.157	1	50
Number of books at home at 10 (ranked 1–4)	17,631	2.212	1.257	1	5

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