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FINANCIAL LITERACY, NUMERACY AND SCHOOLING: EVIDENCE FROM DEVELOPED COUNTRIES

by Sara Lamboglia* and Massimiliano Stacchini*

Abstract

Financial literacy is low among young people and their uninformed choices may have costly and long-lasting consequences. This paper uses information on approximately 52,000 fifteen-year-old students participating in the 2018 OECD Programme for International Student Assessment (PISA) to provide fresh evidence on two drivers for youth financial skills: maths skills and students' exposure to financial education at school. Our results are threefold. First, mathematical skills have a positive impact on financial skills, and to a greater extent than reading skills. Second, an extension based on the 2012 wave of PISA suggests that the transfer of competences from mathematics to financial literacy can be enhanced when teaching strategies focus more on stimulating "cognitive activation". Third, we show how the percentage of students having the chance to receive financial education at school varies widely across countries, and how having such an opportunity positively influences financial achievements.

JEL Classification: G53, H52.
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The views expressed herein are those of the authors and should not be interpreted as those of the Bank of Italy.

1 Introduction[1]

The importance of financial literacy as a driver of personal well-being is known among scholars and policy makers (Lusardi and Mitchell (2014)). Recently, the Covid-19 pandemic has shown how financial illiteracy can enhance household vulnerability to financial shocks (Lusardi et al. (2020); Rapporto-Edufin (2021)). The digital acceleration also calls for up-to-date financial skills for a responsible use of digital financial instruments (Hong et al. (2020)).

Financial skills are relevant for young people as their choices have long-lasting consequences and their working lives are likely to develop in a context of less stable jobs and less generous security systems than those faced by previous generations (OECD (2020a)); hence, for young people making informed choices is even more important than in the past. Despite its relevance, financial literacy is often reported as inadequate by scholars[2], especially for young people and for reasons not entirely understood. This paper contributes to this investigation by reconsidering two drivers of young peoples' financial skills.

First, we revisit the link between mathematical abilities and financial literacy. Numeracy is fundamental to grasp notions such as interest rates or inflation (see Lusardi (2012)) and often associates with socially desirable behaviors, such as loan repayment (Gerardi et al. (2013)). This paper takes advantage of the release of the 2018 wave of the OECD's Program for International Student Assessment to offer fresh evidence on the relation between mathematics and financial literacy. The role of math is further explored by shading a light on teachers' "practices". In fact, while it has been noted that a variety of teaching styles can be useful when dealing with students having different abilities (OECD (2016a)), evidence shows that teaching styles that stimulate "cognitive activation" strongly influence the math scores (Echazarra et al. (2016)). Along this line, we test whether the way math is thought is also relevant for financial skills and for the transfer of competencies between math and financial literacy. To explore the issue we resort to the 2012 wave of PISA.

Second, we investigate the role of financial education[3] at school and how it influences

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[2]See Lamboglia and Travaglino (2022) for a review of the sources and methods for assessing financial literacy.

[3]See De Bonis et al. (2022) for an introduction to financial education.

financial achievements. Several studies document the importance of learning financial topics early in life (Lusardi (2015)) and the role of financial education at school (OECD (2020b)) has been emphasised since the early 2000s.[4] This paper illustrates financial education at school in a cross-country perspective, and it contributes to the growing literature about its link with the performance in financial literacy.

As far as identification is concerned, we rely on multivariate empirical models augmented with either country- or school-level dummies. For instance, in analyzing the link between financial and mathematical skills, we abstract from school differences by focusing on the variation in math skills among the students of the same school. Further, our results on the link between financial education and students' performance are robust to strategies controlling for individual heterogeneities as done by Cordero and Pedraja (2019).

We find that math skills influence financial literacy. An increase of 10 points in the math score translates in an increase of around 6 in the financial literacy score. The evidence also shows a gender gap in the financial literacy score which penalizes female students by around 7 points[5]. With regard to the link between teachers' strategies and student outcomes, we show that math teaching strategies focused on stimulating "cognitive activation" can be valuable for financial skills as they increase the transfer of competencies from math to financial literacy.

As far as financial education at school is concerned, around 50% of students encounter financial topics as a part of their math lessons and 27% during other lessons. Financial education at school also varies across the countries: with regard to topics presented during math classes, students' participation reaches a maximum in the US (52%) and a minimum in Italy (36%). Finally, econometric analysis shows that students attending financial education at their school achieve better results in financial literacy.

The structure of the paper is the following. Section 2 presents a review of the literature. Section 3 illustrates the empirical analysis. Section 4 concludes.

[4]In 2005 an OECD resolution recommended member states to educate citizens for their personal and social well-being. Principles on National Strategies for Financial Education have been subsequently developed by the OECD and its International Network for Financial Education (INFE). In 2012, the principles have been endorsed by G20 countries. The Principles support the development of national approaches to financial education and almost all countries with a national strategy are introducing forms of financial education in schools. Recently, the ECB called for incorporating financial education into the school curricula (de Guindos et al. (2020)). A similar proposal has been made by the Bank of Italy (see " Indagine conoscitiva sui mercati finanziari al servizio della crescita economica", Banca d'Italia, 2021).

[5]A gender gap, equal to about 10 points, also exists with regard to the (unconditional distribution of the) score in math abilities.

2 Literature review

Our paper contributes to two strands of literature. The first considers the link between mathematical and financial skills, whereas the second relates to financial education at school and its effects on financial achievements.

Math abilities help to capture concepts such as interest rate, inflation and thereby to answer to the (well-known) big three [6] or big five questions correctly (Lusardi and Mitchell (2007, 2014)). Financial literacy is often proxied by numeracy (see Romiti and Rossi (2012), Jappelli and Padula (2013) and Gousia (2014)) and evidence shows that mathematical abilities can influence financial choices. Math skills are likely to mitigate default on subprime loans, increase the likelihood of holding stocks, adopting pension plans and accumulating wealth (see Gerardi et al. (2013), Christelis et al. (2010), Hilgert et al. (2003), Lusardi and Mitchell (2011), Lusardi et al. (2010) and Klapper and Panos (2011)). We further explore the transmission of competencies from math to finance by characterising country differences and shading light on the role played by teaching strategies.

With regard to financial education, so far available evidence on its effects on financial skills is mixed and the issue continues to be debated. Positive effects are highlighted for the US, Italy, Brazil, the Netherlands and Spain (see Bernheim et al. (2001), Romagnoli and Trifilidis (2013), Bruhn et al. (2012), Amagir et al. (2019) and Cordero and Pedraja (2019)). According to meta-analyses, financial education explains a low percentage of the variation of financial knowledge (Fernandes et al. (2014)) and influences positively some behaviours, such as savings, and negatively others, such as loan default (Miller et al. (2015)). Recently, a meta-analysis conducted by Kaiser et al. (2020), considered 76 randomized experiments and showed that the effects of financial education can be three times larger than those documented by earlier works. Finally, studies using previous waves of PISA show that financial education exerts a positive, even if small, influence on the students' financial score in some countries, particularly when it is carried out in the context of business, economic or mathematics classes (Salas-Velasco et al. (2020); Cordero et al. (2020)). We contribute to this literature by offering fresh evidence on the presence of financial education in schools in advanced economies and its effects on financial literacy.

[6] The big three questions are: Question (1) "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?" A) More than $102; B) Exactly $102; C) Less than $102; D) Don't know; E) Refuse to answer. Question (2) "Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, with the money in this account, would you be able to buy. . . " A) More than today; B) Exactly the same as today; C) Less than today; D) Don't know; E) Refuse to answer. Question (3) "Do you think the following statement is true or false? Buying a single company stock usually provides a safer return than a stock mutual fund." A) True; B) False; C) Don't know; D) Refuse to answer.

3 Empirical analysis

3.1 Data description and the econometric model

We use data on financial literacy among students from the 2018 Programme for International Student Assessment (PISA). PISA is a triennial survey that assesses the ability of 15-years-old students in applying their knowledge in Mathematics, Reading and Science (core domains) to problems faced in everyday life. Financial literacy was introduced as an optional domain in 2012. The content of the tests is related to four areas: money and transactions, planning and managing finances, risk and reward, and the financial landscape.

The original survey on financial skills was completed by around 117,000 students representing 13.5 million of 15-years-old based in 13 OECD countries, plus 7 partner countries. We focus on OECD economies and investigate the survey on approximately 52,000 individuals. The list of countries includes Estonia, Finland, Canada, Poland, USA, Portugal, Latvia, Lithuania, Spain, Slovak Republic, Italy, Chile[7].

PISA includes information from questionnaires submitted to students, their parents and the principals of the attended schools. The matching of these data offers a rich picture for investigating links existing between students' financial literacy and their cognitive abilities[8].

The variables we use are described in Table 1. We start by highlighting some information about statistical distributions of our main indicators (Table 2). The performances in financial literacy (FLIT), mathematics (MATH) and reading (READ) are constructed in order to have mean equal to 500 and standard deviation equal to 100 across all countries. Table 2 shows that our sample of students has a FLIT and READ mean slightly higher than 500 whereas MATH mean is 12 points below. It also presents information on variables proxying attitudes toward financial awareness or responsibility, such as possession of a current account with a bank, building society, post office or credit union (BANKACC) and a credit (or debit) card (PAYCARD). Around 47 per cent of students owns an account and 36 per cent a debit or credit card. Further, the table presents some indicators on students' attitudes and socioeconomic background, which we use as controls. We consider indicators of self-estimated difficulty of the test (PISADIFF), feelings associated to the fear of failure (GFOFAIL) and attitude declared toward education (ATTLNACT). The students' socioeconomic background is captured by the indicator ESCS. Finally, Table 2 includes information about some school-level indicators that might correlate with the presence of

[7]Our analysis does not include Australia since data were not available for this country.

[8]PISA 2018 provides 10 "plausible values" for each skill. The values are returned by a G.Rasch-type procedure. Standard errors are calculated according to the methodology described in the OECD's Analysis Manual. We resort to the *repest* rountine (Avvisati and Keslair (2020)) for summary statistics and econometric analysis.

financial education at school, such as the availability of some form of career guidance.

Moving to a breakdown by country (Table 3 and Figure 1), the data highlight some heterogeneities. Higher financial scores are observed for Estonia (553 points), Finland (546) and Canada (541) while lower figures relate to countries such as Italy (485) and Chile (460)[9]. The first column of Table 3 and Figure 1 suggest that countries having higher score in financial literacy also rank among the best in mathematics.

As far as the empirical model is concerned, we refer to the following general equation:

$$Y_{ics} = \delta X_i + \beta Z_s + \alpha_c + \varepsilon_{ics} \tag{1}$$

The variable Y_{ics} indicates the outcome under investigation, for instance the score in financial literacy achieved by student i attending the school s based in country c. X_i includes an array of student-level characteristics, such as math or reading abilities; it also includes the indicator on the students' socioeconomic background; the term Z_s includes either dummies or school characteristics; the term α_c represents a vector of country-level fixed effects, used to control for components that are specific to the country under investigation, such as the institutional environment. In our more severe specifications, country fixed effects are replaced by school dummies to fully absorb school differences in the analysis of the link between math and financial skills.

3.2 Financial literacy is linked to math skills

Table 4 presents the estimates returned by models considering only MATH and READ among the covariates. The R-squared shows that MATH explains 77 per cent of the variation of financial literacy; the explanatory power of READ is also relevant even if lower (70 per cent). The model including both MATH and READ broadly confirms the explanatory power of these terms (80 per cent of variation).

Similar results are obtained for our baseline model (Table 5), which includes student-level variables among regressors. In terms of magnitude, an increase of 10 points in mathematics is associated with a gain of around 6 in financial literacy. Results indicate that reading abilities are also significant; however its marginal effect is about half of the previous one. These results are qualitatively in line with those highlighted by Montanaro and Romagnoli (2016) for the 2012 wave of PISA, even if we find a larger effect for mathematical skills relative to reading abilities.

[9]Country averages might slightly differ from the figures reported by OECD as our computations include students reporting non-missing data for all the variables used in regressions.

Our estimates indicate that financial scores of female students are significantly lower than those of their peers by around 7-8 points. As far as the socioeconomic variable is concerned, column (1) shows a positive and significant coefficient for ESCS. The coefficients preserve the sign across all specification and lower its statistical significance once countries or school dummies are added. It indicates that, before accounting for country and school differences, disadvantaged students from disadvantaged families obtain a lower score in financial literacy with respect to their peers.

Finally, Table 5 shows positive and significant coefficients for BANKACC and PAYCARD. It might indicate a positive relation between the use of financial instruments and the confidence with financial issues.

3.2.1 Exploring heterogeneities

This section analyzes whether the link between mathematical and financial skills varies across levels of financial literacy. Heterogeneities are also explored at the country level and, finally, with regard to Italian students. Italy is a country whose literacy levels have been traditionally below the OECD averages and for which we have more granular information.

We estimate our baseline model through a quantile regression framework. Figure 2 shows that the relation between MATH and FLIT holds all along the considered percentiles; the intensity of the link is less sizable for students with lower levels of literacy.

In exploring cross-country heterogeneities, we cluster economies according to their position relative to the OECD average. We interact the MATH variable with the dummy LOWFLIT that is equal to 1 for countries whose (aggregate) performance in financial literacy is lower than the OECD average (Table 19). Table 6 shows that the coefficient of MATH*LOWFLIT is significantly negative; hence, the relation between mathematics and financial knowledge is attenuated in countries where financial literacy is lower.

Table 7 contrasts Italy with the rest of the OECD economies. We interact the dummy ITA with the students' main cognitive abilities under investigation. The parameter of MATH*ITA is negative and statistically significant; it indicates that the influence of MATH on financial literacy is lower for students based in Italy. A similar picture emerges from the parameter of ITA*READ, which is negative and significant. The evidence presented above is consistent with INVALSI (2019), who shows that Italian students perform worse than their peers even in countries having similar math and reading scores. With regard to Italy, we exploit granular data to capture heterogeneities at the local level (North, Center, and South) and by type of secondary school (lyceum, technical school, professional school and vocational training). In regressions not presented here, but available upon request, estimates do not highlight the presence of significant effects. Finally, the coefficient for ITA*FEMALE is not significant and it does not highlight country specific patterns once

we control for our set of baseline covariates.

All in all, the estimates shows that the transfer of competencies from math to finance is heterogeneous across the countries and, specifically, that its intensity is shallow at poory literate countries, such as Italy. Cross-country heterogeneities in the transfer of math competencies have already been detected. For instance, Scherer and Beckmann (2014)) show that math and science competencies significantly contribute to problem solving skills even if country specific characteristics can confound the empirical evidence.

3.2.2 Do teaching styles influence math effectiveness? A look at PISA 2012

So far we have shown how math skills enhance students' financial literacy. We also highlighted how the influence of math can be heterogeneous across students and countries (Tables 6 and 7). This paragraph explores whether these heterogeneities might be linked to teaching styles. This relates to an open debate about how students should be exposed to mathematics and the way math problems should be presented (see Echazarra et al. (2016) and references therein, Carimali (2018), OECD (2016b))[10].

Without establishing rankings between math teaching styles, whose boundaries are also difficult to track, a study by OECD (Echazarra et al. (2016)) finds that math teaching strategies focused on the "cognitive activation" of learners exhibit a strong positive association with students' mathematics scores, facilitate the development of critical thinking attitudes, and provide spillovers for addressing problems encountered in multiple contexts (even outside the school environment). Cognitive activation stems, among others, from practices placing higher emphasis on cross-fertilization in searching for solutions, from deeper discussions about mistakes, or from challenging students by requiring them to apply notions to solve real world's problems.

We explore whether teaching styles focused on "cognitive activation" can shape the transfer of competencies from math to finance. We consider the PISA assessment conducted in 2012 that includes questions asked to students about their math teachers and the work during lessons. Specifically, we use the standardised index COGNACT, which synthetically summarizes the relevance of "cognitive-activation" strategies followed by teachers. The variable is a standardized indicator based on nine questions posed to students about their math classes. For example, students are asked whether they are requested to apply what

[10] A distinction envisaged by educationalists broadly distinguishes between "teacher-directed" and "student oriented" approaches to teaching. The former mainly characterizes 'traditional' lessons; the teacher is the only one in charge of the lesson, plans and delivers the content to the class according to prefixed schemes. Recently, educationalists have invited teachers to consider the use of more "student-oriented" practices in order to give students a more active role in the learning process. Even if the perimeter of the two approaches should not be considered as tight, empirical evidence suggests that 'teacher-directed' instructions are dominant; some studies also show that "student-oriented" practices can positively affect the PISA mathematics scores.

they have learned to different contexts, or to choose their own procedures for solving problems[11].

Teaching practices can vary both across and within the countries. While in our regressions we use student-level data, Figure 4 aggregates information at the country level and shows the relevance of "cognitive activation" styles among the OECD countries. Five out of seven of the top performing countries have levels of "cognitive activation" above the OECD average.

Turning to multivariate analysis, we first re-run our baseline model to verify the link between math and financial skills for students participating to the PISA 2012 assessment[12]. Then, we introduce the COGNACT term in our multivariate model to explore whether the link between math and financial skills depends on teaching styles. Table 8 shows that math has a significant influence on financial skills measured in 2012. The estimates also indicate that the marginal effect of math varies among the 14 OECD countries. Specifically, and similarly to Table 6, results show that the marginal effect of math is lower for countries having (aggregate) financial scores lower than the OECD average (LOWFLIT=1).

As far as teaching is concerned, the first column of Table 9 shows that COGNACT is positively correlated with the financial score. We go on by re-estimating the interaction between MATH and ITA through 2012 data, and through the same model adopted for column (1) of Table 7. The results confirm that math efficacy is lower for Italian students compared with their peers. Column (3) adds to that model the interaction MATH*COGNACT. The coefficient is positive and statistically significant at the 10 per cent; hence, the higher the level of COGNACT, the greater the influence of MATH on financial skills. With regard to magnitude, the marginal effect of math is equal to 0.5 at values of COGNACT equal to -2, and it increases by 20 percent (to 0.6) at levels of cognitive activation equal to 2, where the range of COGNACT varies from -3.8 to 3.2. Column (4) considers the same regression with controls for school characteristics and country dummies; regressions not reported (but available upon request) confirm the results even when school dummies are included.

To summarize, our results suggest that teaching styles aimed at stimulating "cognitive activation" of students might foster the transfer of competencies from math to finance among 15-years-old of advanced economies.

[11]The list of questions is available in the PISA 2012 Technical Report.

[12]The countries used for this test include the Flemish Community (Belgium), Estonia, Australia, New Zealand, Czech Republic, Poland, Latvia, United States, France, Slovenia, Spain, Israel, Slovak Republic, Italy.

3.3 Financial education at school

This section presents evidence on the role of financial education at school. We use information collected through the financial literacy questionnaire administered to the students participating to the PISA 2018 wave. We present statistics on the presence of financial activities at school by country, investigate some school-level factors correlated with the presence of financial education, and the link between students' participation to financial education and the performance in financial literacy.

The presence of financial education at school is captured by the following question[13]: "Have you encountered these types of problems during the following classes or activities?" referring to two exercises taken from the PISA financial literacy test. The questionnaire discriminates whether a student is exposed to financial education during math classes (FLDM), in other classes (FLAC), with external visitors (FLOV) or in the context of extracurricular modules (FLOS). An additional question is asked: "Have you ever learned how to manage your money in a course?". Here the breakdown distinguishes the case of a specific course (FLASFE) from that of other courses (FLAS). We define the dummy FLatSCH, which captures whether a student is exposed to any type of financial education at school. It equals 1 if the student responds positively to at least one of the questions listed above.

Table 10 presents descriptive statistics. At a glance, students are exposed to financial education at school mainly during math classes (53 per cent). Lower figures refer to the case of other classes (27 per cent) or activities with external visitors (16 per cent). Table 10 also shows that the percentage of students exposed to financial education varies across countries. For example, with regard to math classes, the percentage of students exposed to financial education varies from 65 per cent (Estonia) to 36 per cent (Italy).

3.3.1 Financial education at school and school characteristics

Financial education can be incorporated into school curricula or, alternatively, can be introduced in school based on the initiatives of the teaching staff. We explore the relevance of variables that might potentially correlate with the presence of financial education at school.

Specifically, we consider CARRGUIDANCE, which captures the presence of career guidance provided to students by the school. It might be a proxy for the importance that the teaching staff places on preparing students for working life, and hence might correlate with a higher propensity to propose financial education at school. The variable

[13] We assume that answers provided by students are informative about the presence of financial education at school. Potential measurement errors are assumed to be uncorrelated with residuals of regressions controlling for our set of student level abilities and attitudes

EDUSHORT measures whether the quality of learning is hindered by the lack of (or by poor) educational resources. Finally, POORTEACHING is a dummy indicating whether the quality of learning is hampered by teachers not adequately preparing their lessons.

In Table 12 we report our results. We find that the presence of financial education is higher at schools offering career guidance to their students as well as in those whose teachers plan their lessons adequately. This result holds for both our dependent variables FLatSCH and FLDM. Further, we find that financial education activities in the context of math lessons are less likely to be offered in schools lacking of adequate resources and educational material.

3.3.2 Financial education at school and students' achievements

We investigate whether financial education at school influences financial literacy. The exercise does not constitute a full-fledged causal evaluation of the effects of initiatives on financial education, which requires well-defined treatment and control groups. Our evidence should be interpreted as an exploratory analysis carried out through information available in the PISA dataset. The issue of causality is addressed through a formal exercise presented in Section 3.3.3.

To begin with, we consider model (1) by introducing the variable FLatSCH, which is equal to 1 for students exposed to any kind of financial education at school. Afterwards, we disentangle the contexts in which student has participated to financial education activities. We consider financial education conducted during math classes, other lessons, extra curricular activities or lessons with external visitors. Models include country- or school-level fixed effects, student-level math and reading skills, and variables capturing attitudes; hence, the exercise compares the financial literacy of a student facing financial topics at school with that of a student not exposed to financial education, who has similar characteristics, lives in the same country (Tables 13) and is enrolled in the same school (Table 14).

Tables 13 and 14 present our results. The coefficient for FLatSCH is positive and statistically significant in all specifications. The estimates show that financial education presented in the contexts of math classes and other curricular courses influences students' scores in financial literacy.

Students are also asked whether they use textbooks which include parts on financial topics. The question is: "Have you had a text book on some other subject that discusses money matters?". The answers to this question are captured by the binary dummy TEXTMM (=1, if yes). Table 15 reports the results of regressions on the link between the variable TEXTMM and students' performance in financial literacy. In all three regressions we observe a positive association between use of textbooks which include parts on money

matters and financial score.

We verify whether the effects of financial education at school are homogeneous across the individuals. We consider the distribution of students ordered by their financial score through a quantile regression framework. Figure 3 shows that the magnitudes of the effects of financial education are stable across the percentiles; statistical significance is also obtained at 95 per cent for students in the interval from the 30th to the 80th percentiles; at 90 per cent for the rest of the distribution.

Finally, we provide a focus on financial education for students based in Italy. Table 10 showed that the presence of financial education is lower in Italy with respect to the OECD average. Table 16 displays the results on the influence of financial education on financial achievement. The coefficient for FlatSCH is positive and statistically significant. We expand the model to disentangle the context in which financial education is provided. We find that the effect is significant when financial education is conducted during both math lessons and other courses.

3.3.3 A difference-in-difference setup for PISA

In studying the effect of financial education on financial skills, a typical concern relates to endogeneity. This might potentially arise if the model did not properly control for individual characteristics correlated with both financial education and financial literacy. In the regressions presented so far, we have considered several student characteristics as control variables, and dealt with school heterogeneity through school controls and fixed effects. To further limit this concern, we carried out an analysis in the spirit of Cordero and Pedraja (2019). These authors adapted the Difference-in-Difference (DiD) methodology to the structure of PISA dataset to analyze the link between financial education at school and financial achievements. Instead of comparing pre-post individual outcomes - which are not available in PISA - Cordero and Pedraja (2019) considered the difference in two outcomes exhibited by the same individual, such as the performances in financial and reading skills. Such a difference, purged of individual effects, was compared among individuals who were exposed to financial education and those who were not. This strategy was originally employed by Jürges, Schneider, and Büchel (2005) to analyse the effects of central exams in Germany and by Bietenbeck (2014) and Schwerdt and Wuppermann (2011) to establish a link between teaching methods and students performances using TIMSS data.

Formally, denoting by FLIT the performance in financial literacy for the i-th student, μ_i the individual components and X_i a vector of controls, we consider the following model:

$$
\begin{aligned}
\text{FLIT}_i &= \mu_i + \text{X}_i\beta + \delta\text{FLatSCH}_i + \varepsilon_i^{FLIT} \\
\text{READ}_i &= \mu_i + \text{X}_i\gamma + \varepsilon_i^{READ} \\
\text{D}_i &= \text{FLIT}_i - \text{READ}_i = \text{X}_i(\beta - \gamma) + \delta\text{FLatSCH}_i + \varepsilon_i^{FLIT} - \varepsilon_i^{READ}
\end{aligned} \tag{2}
$$

This methodology rests on the assumption that financial education activities are likely to improve mainly financial skills rather than other abilities such as reading. Before estimating model (2), we check whether observables are similar across students exposed to financial education and those who are not. As far as balancing properties are concerned, Table 17 illustrates our statistics. The two groups are equivalent in a statistical sense as for mathematical and reading skills, and with respect to their attitudinal (observed) characteristics. This suggests that other individual (unobservable) characteristics, potentially responsible for confoundedness, are likely to be uncorrelated with students' exposure to financial education.

Table 18 shows the estimates of an equation having D=FLIT-READ as a dependent variable and, separately, FLatSCH and FLDM as main covariates. The coefficients for FLatSCH and FLDM are always statistically significant and show an impact of financial education that varies between 3 and 6 points.

4 Conclusions

The importance of financial skills for personal well-being is established among scholars and policymakers. However financial illiteracy is quite common and it may be severe among young people who, on the contrary, will be called to make informed choices in contexts characterized by uncertainty.

This paper exploits the 2018 wave of the OECD's Programme for International Student Assessment (PISA) to offer fresh evidence on two important drivers of the development of financial skills among young people.

We first revisit the link between mathematical and financial skills. Numeracy facilitates understanding of notions such as interest and inflation, and can foster the development of attitudes toward financial planning. The paper shows a sizable relation between financial literacy and math skills. Such a relation, which is higher than the one between financial and reading skills, attenuates in countries characterized by lower levels of financial literacy. Further, ad importantly, we conduct an extension aimed at identifying instructional practices that contribute to increase achievements. We use detailed information from PISA 2012 to show that math instructional approaches that stimulate cognitive functioning can be valuable for financial literacy as they favor the transfer of competencies from math to

finance. The abilities of these 'cognitive activation' strategies to magnify the spill-over effects of mathematics can be worthwhile especially in those countries where financial literacy of students is low.

Secondly, we analyze financial education at school in developed countries. Financial education is crucial to ensure people have the skills to make informed choices and its importance has being underlined since the 2000s. Our paper shows that countries varies widely in terms of chances offered to students to attend financial education at school. We also show that having such an opportunity is valuable as it improves the performance in financial literacy.

References

Amagir, A., W. Groot, H. M. van den Brink, and A. Wilschut (2019). Savewise: The design of a financial education program in the netherlands. *Citizenship, Social and Economics Education 18*(2), 100–120.

Avvisati, F. and F. Keslair (2020). Repest: Stata module to run estimations with weighted replicate samples and plausible values.

Bernheim, B. D., D. M. Garrett, and D. M. Maki (2001). Education and saving: The long-term effects of high school financial curriculum mandates. *Journal of public Economics 80*(3), 435–465.

Bietenbeck, J. (2014). Teaching practices and cognitive skills. *Labour Economics 30*, 143–153. Special Section articles on "What determined the dynamics of labour economics research in the past 25 years?" edited by Joop Hartog and and European Association of Labour Economists 25th Annual Conference, Turin, Italy, 19-21 September 2013 Edited by Michele Pellizzari.

Bruhn, M., A. Legovini, and B. Zia (2012). Financial literacy for high school students and their parents: Evidence from brazil. *World Bank Working Paper*.

Carimali, L. (2018). La scuola come palestra: allenare il pensiero matematico. *Psicologia dell'educazione* (1).

Christelis, D., T. Jappelli, and M. Padula (2010). Cognitive abilities and portfolio choice. *European Economic Review 54*(1), 18–38.

Cordero, J. M., M. Gil-Izquierdo, and F. Pedraja-Chaparro (2020). Financial education and student financial literacy: A cross-country analysis using PISA 2012 data. *The Social Science Journal 0*(0), 1–19.

Cordero, J. M. and F. Pedraja (2019). The effect of financial education training on the financial literacy of spanish students in PISA. *Applied Economics 51*(16), 1679–1693.

De Bonis, R., M. Guida, A. Romagnoli, and A. Staderini (2022). Educazione finanziaria: presupposti, politiche ed esperienza della banca d'italia. *Bank of Italy Occasional Paper, No. 726 (only in italian)*.

de Guindos, L., F. Panetta, and I. Schnabel (2020). Europe needs a fully fledged capital markets union – now more than ever. ECB blog, 2 september 2020.

Echazarra, A., D. Salinas, I. Méndez, V. Denis, and G. Rech (2016). How teachers teach and students learn. *OECD Education Working Papers* (130).

Fernandes, D., J. G. Lynch Jr, and R. G. Netemeyer (2014). Financial literacy, financial education, and downstream financial behaviors. *Management Science 60*(8), 1861–1883.

Gerardi, K., L. Goette, and S. Meier (2013). Numerical ability predicts mortgage default. *Proceedings of the National Academy of Sciences 110*(28), 11267–11271.

Gousia, K. (2014). Financial literacy and long-term care insurance coverage.

Hilgert, M. A., J. M. Hogarth, and S. G. Beverly (2003). Household financial management: The connection between knowledge and behavior. *Fed. Res. Bull. 89*, 309.

Hong, C. Y., X. Lu, and J. Pan (2020). Fintech adoption and household risk-taking. *NBER Working Paper* (28063).

INVALSI (2019). *OCSE PISA 2018 Financial Literacy: i risultati degli studenti italiani*.

Jappelli, T. and M. Padula (2013). Investment in financial literacy, social security and portfolio choice. Technical report, CFS Working Paper.

Kaiser, T., A. Lusardi, L. Menkhoff, and C. J. Urban (2020). Financial education affects financial knowledge and downstream behaviors. Technical report, National Bureau of Economic Research.

Klapper, L. and G. A. Panos (2011). *Financial literacy and retirement planning: the Russian case*. The World Bank.

Lamboglia, S. and F. Travaglino (2022). Statistical sources for assessing financial literacy. *Bank of Italy Occasional Paper, No. 725*.

Lusardi, A. (2012). Numeracy, financial literacy, and financial decision-making. Technical report, National Bureau of Economic Research.

Lusardi, A. (2015). Financial literacy skills for the 21st century: Evidence from PISA. *Journal of consumer affairs 49*(3), 639–659.

Lusardi, A. and O. S. Mitchell (2007). Baby boomer retirement security: The roles of planning, financial literacy, and housing wealth. *Journal of monetary Economics 54*(1), 205–224.

Lusardi, A. and O. S. Mitchell (2011). Financial literacy and planning: Implications for retirement wellbeing. Technical report, National Bureau of Economic Research.

Lusardi, A. and O. S. Mitchell (2014). The economic importance of financial literacy: Theory and evidence. *Journal of economic literature 52*(1), 5–44.

Lusardi, A., O. S. Mitchell, and V. Curto (2010). Financial literacy among the young. *Journal of consumer affairs 44*(2), 358–380.

Lusardi, A. M., A. Caretta, D. Costa, P. Colombo, F. D. Leo, A. D. Marchi, C. Rampazzi, A. Romagnoli, and P. Soccorso (2020). Emergenza COVID 19-gli italiani tra fragilità e resilienza finanziaria.

Miller, M., J. Reichelstein, C. Salas, and B. Zia (2015). Can You Help Someone Become Financially Capable? A Meta-Analysis of the Literature. *The World Bank Research Observer 30*(2), 220–246.

Montanaro, P. and A. Romagnoli (2016). La financial literacy in PISA 2012: Un'analisi dei risultati e il ruolo delle famiglie in italia (financial literacy of italian teens and family's background: Evidence from PISA 2012). *Bank of Italy Occasional Paper, No. 335*.

OECD (2009). *PISA Data Analysis Manual: SAS, Second Edition*.

OECD (2012). *PISA 2012 Technical report*.

OECD (2016a). *Ten Questions for Mathematics Teachers... and How PISA Can Help Answer Them*.

OECD (2016b). *Why Access to Mathematics Matters and How it Can be Measured*.

OECD (2020a). *PISA 2018 Results (Volume IV)*.

OECD (2020b). Recommendation of the council on financial literacy.

Rapporto-Edufin (2021). Rapporto edufin 2021. L'educazione finanziaria come anticorpo alla vulnerabilità economica. http://www.quellocheconta.gov.it/export/sites/sitopef/modules/quaderni_ricerca/Rapporto-Edufin-2021.pd. Technical report.

Romagnoli, A. and M. Trifilidis (2013). Does financial education at school work? Evidence from Italy. *Bank of Italy Occasional Paper, No.155*.

Romiti, A. and M. Rossi (2012). Housing wealth decumulation, portfolio composition and financial literacy among the European elderly. Technical report.

Salas-Velasco, M., D. Moreno-Herrero, and J. Sánchez-Campillo (2020). Teaching financial education in schools and students' financial literacy: A cross-country analysis with PISA data. *International Journal of Finance & Economics*.

Scherer, R. and J. Beckmann (2014). The acquisition of problem solving competence: evidence from 41 countries that math and science education matters. *Large-scale Assess Educ 2, 10*.

Schwerdt, G. and A. C. Wuppermann (2011). Is traditional teaching really all that bad? a within-student between-subject approach. *Economics of Education Review 30*(2), 365–379.

Appendix-Tables and figures

Table 1: Description of variables

	Description
Student characteristics	
FLIT	Score in Financial Literacy (Range:129-866)
MATH	Score in Mathematics (Range: 150-837)
READ	Score in Reading (Range: 125-858)
REPEAT (0,1)	Dummy equal to 1 if student repeated school year
BANKACC (0,1)	Dummy equal to 1 if student holds an account at a bank, building society, post office or credit union
PAYCARD (0,1)	Dummy equal to 1 if student has a credit or debit card
PISADIFF	Perceived difficulty of PISA test (Standardised index)*
ATTLNACT	Attitude towards learning activities (Standardised index)*
ESCS	Family (socio-economic and cultural) background (Standardised index)*
Student encountered financial topics at school	
FLDM (0,1)	Dummy equal to 1 if during math class
FLAC (0,1)	Dummy equal to 1 if during a non-math class
FLOV (0,1)	Dummy equal to 1 if during activities with external visitors
FLOS (0,1)	Dummy equal to 1 if during 'extra-curricular' activities
FLASEF (0,1)	Dummy equal to 1 if student learned money management in a dedicated course at school
FLAS (0,1)	Dummy equal to 1 if student learned money management as part of another course or subject
FLatSCH (0,1)	Dummy equal to 1 if student encountered financial topics at school (any type)
TEXTMM (0,1)	Dummy equal to 1 if student has a textbook that includes a section on money matters.
School characteristics	
EDUSHORT	Poor quality or lack of educational material and buildings (Standardised index)*
POORTEACHING(0,1)	Dummy equal to 1 if learning is hindered by teachers not well prepared for classes (as reported by the school principal)

CARRGUIDANCE (0,1)	Dummy equal to 1 if some form of career guidance is available at school (as reported by the school principal)
Institutional characteristics	
FLCURR (0,1)	Dummy equal to 1 if financial education is included in school curricula. It is equal to 1 for Canada, Estonia, Lithuania, Latvia, Finland and Slovak Republic (it is assumed to be 0 for the US due to heterogeneities among the states).

*Standardised indexes have mean and standard deviations equal to 0 and 1, respectively. Source: our elaboration on OECD data (PISA 2018).

Table 2: Descriptive statistics

	mean	sd	p10	p25	p50	p75	p90
Student characteristics							
FLIT	508.30	97.29	380.25	441.95	510.15	575.49	632.93
MATH	488.06	88.89	371.22	426.92	489.20	549.75	602.71
READ	506.94	102.66	371.47	436.85	509.35	579.39	637.75
REPEAT	10%						
BANKACC	47.36%						
PAYCARD	36.23%						
PISADIFF	-.05	.98	-1.278	-1.278	.278	.278	1.198
GFOFAIL	.13	1.04	-1.28	-.69	.11	.82	1.89
ATTLNACT	.19	.99	-1.15	-.69	.47	1.08	1.08
ESCS	.05	1.01	-1.32	-.67	.13	.85	1.27
School characteristics							
EDUSHORT	-.31	.98	-1.42	-1.42	-.27	.39	.88
POORTEACHING	10.8%						
CARRGUIDANCE	93%						

Statistics refer to the 12 OECD countries under investigation (see Table 19). Source: our elaboration on OECD data (PISA 2018).

Table 3: Descriptive statistics by country: averages

CNT	FLIT	MATH	READ	ESCS	BANKACC	PAYCARD
CAN	540.60	522.09	536.10	0.49	65%	67%
CHL	459.52	425.51	462.44	-0.52	36 %	27%
ESP	500.12	494.68	489.64	-0.05	55 %	19%
EST	552.93	526.61	527.58	0.09	59 %	75%
FIN	545.50	513.77	531.25	0.31	89%	78%
ITA	485.27	496.07	484.94	-0.18	43%	41%
LTU	504.62	487.85	481.52	0.03	44%	41%
LVA	505.74	500.65	486.64	-0.01	60 %	54%
POL	524.78	518.42	517.11	-0.16	34 %	26%
PRT	512.11	500.26	501.47	-0.38	45%	24%
SVK	488.03	496.13	469.22	-0.12	50%	41%
USA	510.68	483.71	511.56	0.13	47%	36%

Source: our elaboration on OECD data (PISA 2018).

Table 4: Mathematics, reading and financial literacy

	(1) Only Math	(2) Only Math	(3) Only Math	(4) Only Read	(5) Math&Read	(6) Math&Read	(7) Math&Read
MATH	0.960***	0.972***	0.969***		0.644***	0.681***	0.690***
	(0.00952)	(0.00920)	(0.0109)		(0.0172)	(0.0168)	(0.0173)
READ				0.791***	0.334***	0.302***	0.294***
				(0.0118)	(0.0145)	(0.0143)	(0.0147)
R2-Adj.	0.769	0.785	0.790	0.696	0.810	0.817	0.819
School FE			YES				YES
Country FE		YES				YES	
Obs.	52000	52000	52000	52000	52000	52000	52000

The dependent variable is the score in Financial Literacy (FLIT). See Table 1 for variable description. Standard errors in parentheses ***p<0.01, **p<0.05, *p <0.10. Source: our elaboration on OECD data (PISA 2018).

Table 5: Baseline regressions

	(1) Baseline I	(2) Baseline I	(3) Baseline I	(4) Baseline II	(5) Baseline II	(6) Baseline II
MATH	0.608***	0.649***	0.658***	0.603***	0.644***	0.653***
	(0.0175)	(0.0168)	(0.0171)	(0.0177)	(0.0170)	(0.0172)
READ	0.336***	0.303***	0.297***	0.339***	0.306***	0.299***
	(0.0154)	(0.0148)	(0.0156)	(0.0152)	(0.0146)	(0.0153)
FEMALE	-8.726***	-7.315***	-7.070***	-8.716***	-7.308***	-7.108***
	(1.740)	(1.687)	(1.717)	(1.752)	(1.699)	(1.715)
ESCS	1.997***	1.196	1.241	0.826	0.0771	0.193
	(0.766)	(0.782)	(0.895)	(0.747)	(0.766)	(0.851)
BANKACC				7.482***	7.369***	7.615***
				(1.489)	(1.550)	(1.554)
PAYCARD				3.678**	3.806**	3.994**
				(1.744)	(1.832)	(1.832)
R2-Adj.	0.815	0.821	0.823	0.817	0.823	0.825
Countries FE		YES			YES	
School FE			YES			YES
Obs.	52000	52000	52000	52000	52000	52000

The dependent variable is the score in Financial Literacy (FLIT). The regressions include controls for PISADIFF, GFOFAIL, ATTLNACT and REPEAT. See Table 1 for variables description. Standard errors in parentheses ***p<0.01, **p<0.05, *p <0.10. Source: our elaboration on OECD data (PISA 2018).

Table 6: Model interacting MATH and countries with low financial literacy

MATH	0.646***
	(0.0186)
MATH*LOWFLIT	-0.0908***
	(0.0145)
READ	0.313***
	(0.0145)
GENDER	-7.749***
	(1.721)
ESCS	0.242
	(0.752)
LOWFLIT	29.84***
	(7.662)
R2-Adj.	0.822
Obs.	52000

The dependent variable is the score in Financial Literacy (FLIT). LOWFLIT is a dummy equal to 1 for countries whose (average) financial literacy is lower than the OECD average (see Figure 6). The regression includes the variables PISADIFF, GFOFAIL, ATTLNACT and REPEAT. The omitted group includes countries whose financial literacy is higher than (or statistically equivalent to) the OECD average. See Table 1 for variables description. Standard errors in parentheses ***p<0.01, **p<0.05, *p <0.10. Source: our elaboration on OECD data (PISA 2018).

Table 7: Model interacting MATH and Italy

	(1) MATH	(2) READ	(3) FEMALE
MATH	0.646***	0.635***	0.634***
	(0.0173)	(0.0164)	(0.0166)
READ	0.313***	0.322***	0.316***
	(0.0152)	(0.0158)	(0.0153)
FEMALE	-7.947***	-7.936***	-7.918***
	(1.717)	(1.706)	(1.795)
MATH*ITA	-0.103***		
	(0.0162)		
READ*ITA		-0.0906***	
		(0.0153)	
FEMALE*ITA			-1.029
			(2.726)
ITA	27.23***	20.19**	-23.37***
	(8.738)	(7.868)	(1.968)
R2-Adj.	0.820	0.820	0.820
Obs.	52000	52000	52000

The dependent variable is the score in financial literacy (FLIT). Italy is a dummy equal to 1 for students based in Italy. The regressions include the variables PISADIFF, GFOFAIL, ATTLNACT and REPEAT. See Table 1 for variables description. Standard errors in parentheses ***p<0.01, **p<0.05, *p <0.10. Source: our elaboration on OECD data (PISA 2018).

Table 8: Model interacting MATH and countries with low financial literacy - PISA 2012

MATH	0.580***
	(0.0227)
MATH*LOWFLIT	-0.194***
	(0.0187)
READ	0.406***
	(0.0211)
LOWFLIT	84.399***
	(9.475)
FEMALE	-8.010***
	(2.2716)
ESCS	4.1567***
	(1.1416)
R2-Adj.	0.766
Obs.	22084

The dependent variable is the score in Financial Literacy (FLIT). LOWFLIT is a dummy equal to 1 for countries whose (average) financial literacy is lower than the OECD average (see Table 20). The omitted group includes countries whose financial literacy is higher than (or statistically equivalent to) the OECD average. See Table 1 for variables description. Standard errors in parentheses ***p<0.01, **p<0.05, *p <0.10. Source: our elaboration on OECD data (PISA 2012).

Table 9: Model interacting MATH and 'cognitive activation' - PISA 2012

	(1)	(2)	(3)	(4)
MATH		0.563***	0.557***	0.550***
		(0.0267)	(0.0262)	(0.0276)
COGNACT	4.644**		-8.050	-8.146
	(2.225)		(5.193)	(5.457)
COGNACT*ITA			0.699	1.317
			(1.761)	(1.720)
MATH*ITA		-0.214***	-0.214***	-0.151***
		(0.0274)	(0.0276)	(0.0359)
COGNACT*MATH			0.0177*	0.0180*
			(0.0104)	(0.0109)
R2-Adj.	0.0213	0.768	0.765	0.771
Country FE	YES	YES	YES	YES
School characteristics				YES
Obs.	13570	13570	13570	13570

The dependent variable is the score in Financial Literacy (FLIT). Standard errors in parentheses ***p<0.01, **p<0.05, *p <0.10.
Source: our elaboration on OECD data (PISA 2012).

Table 10: Financial education at school by country: percentages

	FLDM	FLAC	FLOV	FLOS	FLAS	FLASFE	FLatSCH
ALL	53.08%	27.59%	16.43%	18.16%	41.69%	35.04%	77.87%
CAN	53%	29%	18%	17%	47%	37 %	76%
CHL	44%	20%	12%	13%	27%	26%	64%
ESP	50%	26%	12%	11%	32%	31%	73%
EST	65%	36%	24%	33%	51%	38%	87%
FIN	54%	46%	12%	16%	56%	50%	86%
ITA	36%	25%	15%	14%	26%	25%	66%
LTU	62%	41%	27%	23%	42%	39%	83%
LVA	59%	40%	18%	23%	42%	46%	84%
POL	60%	29%	25%	16%	29%	30 %	78%
PRT	44%	24%	13%	11%	21%	18 %	64%
SVK	45%	24%	21%	24%	41%	41 %	78%
USA	52%	26%	16%	19%	44%	37 %	76%

See Table 1 for variables description. Source: our elaboration on OECD data (PISA 2018).

Table 11: School characteristics by country: percentages

	POORTEACHING	CARRGUIDANCE	TEXTMM	EDUSHORT
CAN	9%	99.7%	27%	-0.58
CHL	26%	95%	26%	-0.17
ESP	17%	99.7%	30%	0.08
EST	6%	99.8%	42%	0.10
FIN	5%	100%	43%	0.13
ITA	20%	66%	31%	0.29
LTU	5%	100%	29%	0.08
LVA	6%	98.3%	46%	-0.14
POL	8%	99.1%	29%	-0.18
PRT	20%	95.6%	30%	0.54
SVK	8%	93.6%	22%	0.41
USA	8%	94.8%	23%	-0.48

Source: our elaboration on OECD data (PISA FL 2018). See Table 1 for variables description.

Table 12: Financial education at school and school characteristics

	(1) FLatSCH	(2) FLDM
POORTEACHING	-0.0295**	-0.0285**
	(0.0126)	(0.0127)
CARRGUIDANCE	0.100***	0.128***
	(0.0181)	(0.0165)
EDUSHORT	-0.00198	-0.0102**
	(0.00400)	(0.00463)
Obs.	53133	53133

The dependent variables are FLatSCH, a binary dummy equal to 1 if student encountered financial topics at school (any type), and FLDM, a binary dummy equal to 1 if student encountered financial topics at school during math classes. See Table 1 for variables description. The regressions include controls for FEMALE, ESCS, ATTLNACT and the (country level) term FLCURR. Standard errors in parentheses ***p<0.01, **p<0.05, *p <0.10.

Table 13: Financial education at school and students' achievements (within-country variation)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MATH	0.648***	0.647***	0.648***	0.649***	0.649***	0.649***	0.650***
	(0.0169)	(0.0168)	(0.0169)	(0.0168)	(0.0168)	(0.0168)	(0.0168)
READ	0.303***	0.303***	0.304***	0.304***	0.303***	0.304***	0.305***
	(0.0150)	(0.0149)	(0.0149)	(0.0149)	(0.0149)	(0.0150)	(0.0149)
FEMALE	-7.226***	-7.265***	-7.245***	-7.271***	-7.310***	-7.271***	-7.196***
	(1.693)	(1.690)	(1.684)	(1.688)	(1.678)	(1.689)	(1.682)
ESCS	1.149	1.138	1.145	1.140	1.192	1.168	1.179
	(0.780)	(0.773)	(0.780)	(0.778)	(0.782)	(0.781)	(0.786)
FLatSCH	3.180*						
	(1.642)						
FLDM		2.693**					
		(1.349)					
FLAC			2.540*				
			(1.309)				
FLOS				1.579			
				(1.677)			
FLOV					0.160		
					(1.788)		
FLAS						1.782	
						(1.459)	
FLASEF							2.848*
							(1.548)
R2-adj.	0.821***	0.821***	0.821***	0.821***	0.821***	0.821***	0.821***
Country FE	YES	YES	YES	YES	YES	YES	YES
Obs.	52000	52000	52000	52000	52000	52000	52000

The dependent variable is the score in Financial Literacy (FLIT). The regressions include controls for PISADIFF, GFOFAIL, ATTLNACT and REPEAT. See Table 1 for variables description. Standard errors in parentheses ***p<0.01, **p<0.05, *p <0.10. Source: our elaboration on OECD data (PISA 2018).

Table 14: Financial education at school and students' achievements (within-school variation)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MATH	0.657***	0.656***	0.657***	0.657***	0.658***	0.658***	0.658***
	(0.0172)	(0.0171)	(0.0172)	(0.0172)	(0.0171)	(0.0171)	(0.0173)
READ	0.297***	0.296***	0.297***	0.297***	0.297***	0.297***	0.298***
	(0.0157)	(0.0156)	(0.0157)	(0.0157)	(0.0157)	(0.0158)	(0.0158)
FEMALE	-6.982***	-7.013***	-7.010***	-7.006***	-7.057***	-7.047***	-6.992***
	(1.728)	(1.725)	(1.717)	(1.715)	(1.702)	(1.718)	(1.714)
ESCS	1.175	1.153	1.165	1.155	1.230	1.221	1.215
	(0.890)	(0.884)	(0.895)	(0.890)	(0.892)	(0.891)	(0.897)
FLatSCH	3.030*						
	(1.671)						
FLDM		2.898**					
		(1.422)					
FLAC			2.351*				
			(1.426)				
FLOS				1.943			
				(1.775)			
FLOV					0.348		
					(1.906)		
FLAS						0.902	
						(1.391)	
FLASEF							2.016
							(1.543)
R2-Adj.	0.823***	0.823***	0.823***	0.823***	0.823***	0.823***	0.823***
School FE	YES	YES	YES	YES	YES	YES	YES
Obs.	52000	52000	52000	52000	52000	52000	52000

The dependent variable is the score in Financial Literacy (FLIT). The regressions include controls for PISADIFF, GFOFAIL, ATTLNACT and REPEAT. See Table 1 for variables description. Standard errors in parentheses ***p<0.01, **p<0.05, *p <0.10. Source: our elaboration on OECD data (PISA 2018).

Table 15: Financial education at school and students' achievements: textbooks containing sections on money matters

	(1)	(2)	(3)
MATH	0.606***	0.647***	0.656***
	(0.0177)	(0.0169)	(0.0171)
READ	0.336***	0.304***	0.297***
	(0.0155)	(0.0149)	(0.0155)
FEMALE	-8.788***	-7.326***	-7.065***
	(1.732)	(1.668)	(1.687)
ESCS	1.869**	1.027	1.025
	(0.763)	(0.783)	(0.903)
TEXTMM	2.541*	3.517**	3.327**
	(1.520)	(1.530)	(1.578)
R2-Adj.	0.815***	0.821***	0.823***
School FE			YES
Country FE		YES	
Obs.	51576	51576	51576

The dependent variable is the score in Financial Literacy (FLIT). The regressions include controls for PISADIFF, GFOFAIL, ATTLNACT and REPEAT. See Table 1 for variables description. Standard errors in parentheses ***p<0.01, **p<0.05, *p <0.10. Source: our elaboration on OECD data (PISA 2018).

Table 16: Financial education at school and students' achievements: a closer look at Italy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MATH	0.565***	0.566***	0.573***	0.568***	0.567***	0.567***	0.568***	0.566***
	(0.0236)	(0.0235)	(0.0215)	(0.0235)	(0.0237)	(0.0236)	(0.0237)	(0.0235)
READ	0.281***	0.281***	0.292***	0.278***	0.279***	0.281***	0.279***	0.282***
	(0.0211)	(0.0210)	(0.0226)	(0.0209)	(0.0216)	(0.0212)	(0.0213)	(0.0214)
FEMALE	-7.905***	-7.828***	-9.749***	-7.940***	-7.933***	-7.850***	-7.846***	-7.858***
	(2.014)	(1.992)	(2.066)	(1.989)	(2.008)	(1.992)	(2.006)	(1.982)
FLatSCH	5.073**							
	(2.504)							
FLDM		5.079*						4.620*
		(2.644)						(2.565)
FLAC			5.645***					3.850*
			(2.161)					(2.213)
FLOS				0.303				-1.827
				(2.838)				(3.157)
FLOV					0.755			-1.357
					(2.707)			(3.065)
FLASFE						2.082		0.825
						(3.265)		(3.330)
FLAS							2.387	1.411
							(2.819)	(2.857)
R2-adj.	0.728	0.728	0.719	0.728	0.728	0.728	0.728	0.729
School FE	YES	YES	YES	YES	YES	YES	YES	YES
Obs.	8135	8135	8135	8135	8135	8135	8135	8135

The dependent variable is the score in Financial Literacy (FLIT). All regressions include the variables PISADIFF, REPEAT, ATTLNACT, GFOFAIL, ESCS. See Table 1 for variables description. Standard errors in parentheses ***p<0.01, **p<0.05, *p <0.10. Source: our elaboration on OECD data (PISA 2018).

Table 17: Characteristics of students attending financial education at school and of their peers

	FLatSCH= 0		FLatSCH= 1			
Variables	Mean	Std.Dev.	Mean	Std.Dev.	Diff.	t-test
FLIT	504.94	92.60	509.25	98.56	4.31	0.16
MATH	487.46	85.41	488.23	89.85	.77	0.79
READ	508.85	99.82	506.39	103.45	-2.46	0.41
PISADIFF	-0.05	0.99	-0.05	0.97	0.01	0.82
REPEAT	0.1	0.29	0.10	0.30	0.01	0.44
POORTEACHING	0.11	0.31	0.11	0.31	0	0.86
EDUSHORT	-0.28	1	-0.32	0.98	-0.04	0.27

See Table 1 for variables description. Source: our elaboration on OECD data (PISA 2018).

Table 18: A difference-in-difference setup for PISA data

	(1)	(2)	(3)	(4)	(5)	(6)
MATH		0.0372***	0.0475***		0.0359***	0.0465***
		(0.0130)	(0.0150)		(0.0131)	(0.0152)
PISADIFF		3.629***	3.817***		3.719***	3.856***
		(1.024)	(1.070)		(1.019)	(1.066)
ATTLNACT		-2.469**	-2.203**		-2.373**	-2.124*
		(1.028)	(1.085)		(1.062)	(1.120)
GFOFAIL		-6.415***	-6.292***		-6.523***	-6.366***
		(1.038)	(1.097)		(1.038)	(1.098)
REPEAT		7.289**	6.695**		7.270**	6.644**
		(3.019)	(3.121)		(3.003)	(3.101)
ESCS		0.827	1.448		0.847	1.467
		(0.997)	(1.185)		(0.992)	(1.186)
FLatSCH	5.524**	6.111***	5.123**			
	(2.278)	(2.193)	(2.156)			
FLDM				3.224*	3.198*	3.068*
				(1.769)	(1.734)	(1.804)
Country FE		YES			YES	
School FE	YES		YES	YES		YES
Obs.	51871	52000	51871	51871	52000	51871

The dependent variable is D = FLIT-READ. See model (2) and Table 1 for variables description. Standard errors in parentheses ***p<0.01, **p<0.05, *p <0.10. Source: our elaboration on OECD data (PISA 2018).

Table 19: Financial literacy by country: averages

FLIT score	Country
547	Estonia
537	Finland
532	Canada
520	Poland
506	USA
505	Portugal
501	Latvia
498	Lithuania
492	Spain
481	Slovak Republic
476	Italy
451	Chile

The gray area includes countries whose aggregate score in financial literacy is higher than (or statistically equivalent to) the OECD average; the white area includes countries whose aggregate score in financial literacy is lower than the OECD average. Source: our elaboration on OECD data (PISA FL 2018).

Table 20: Financial literacy by country: averages - PISA 2012

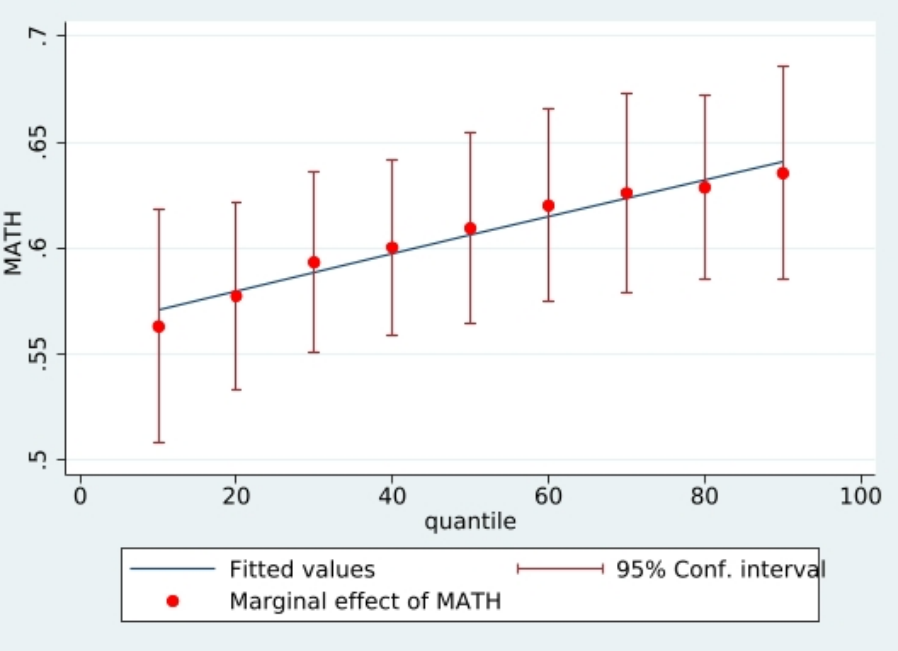
FLIT score	Country
541	Belgium(Flamish community)
529	Estonia
526	Australia
520	New Zealand
513	Czech Republic
510	Poland
501	Latvia
492	USA
486	France
484	Spain
476	Israel
470	Slovak Republic
466	Italy

The gray area includes countries whose financial literacy is higher than (or statistically equivalent to) the OECD average; the white area includes countries whose financial literacy is lower than the OECD average. Source: our elaboration on OECD data (PISA 2012).

Figure 1: Financial literacy and mathematics by country: averages

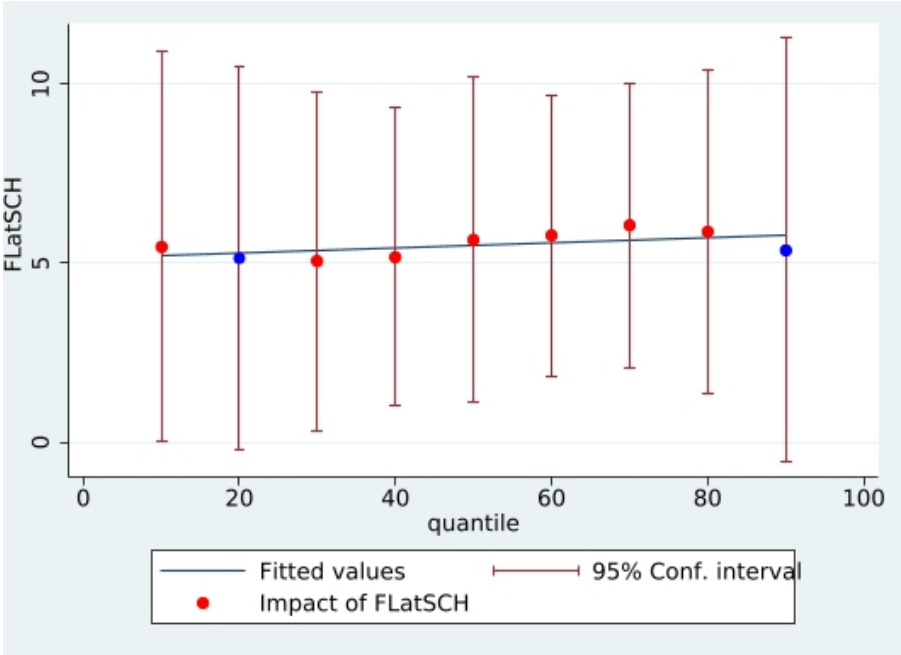
Averages include students based in the specific country (histograms) and in all OECD countries (red line), see OECD (2009). Source: our elaboration on OECD data (PISA 2018).

Figure 2: Marginal effects of mathematics by quantiles of financial literacy



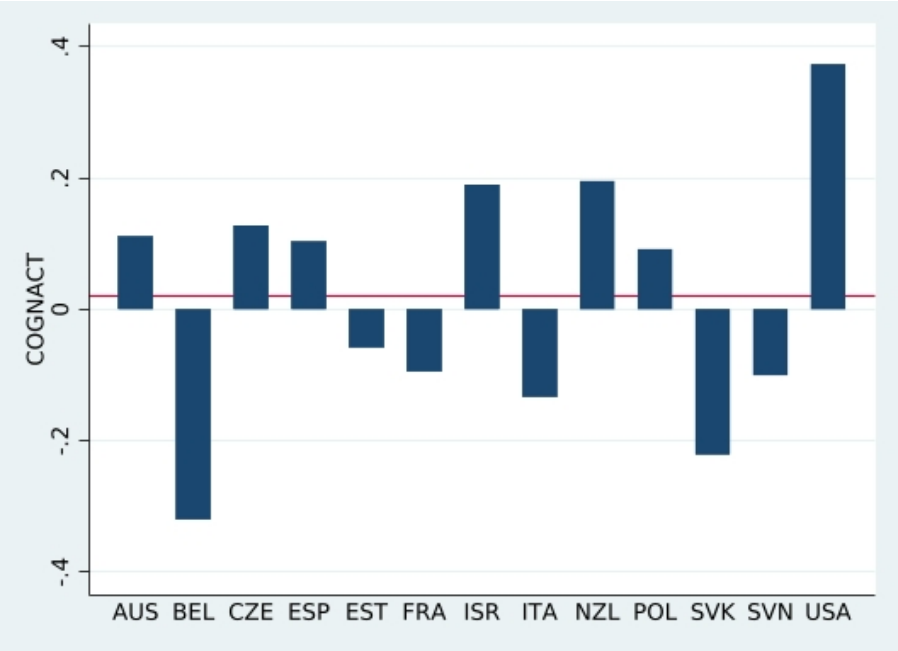
Marginal effects are the coefficients of MATH obtained in a quantile regression of FLIT on MATH controlling for the covariates in Table 5. All estimates are significant at 95 per cent. Source: our elaboration on OECD data (PISA 2018).

Figure 3: Marginal effects of participation to financial education at school by quantiles of financial literacy



Marginal effects are the coefficients obtained for FLatSCH in a quantile regression of FLIT on FLatSCH controlling for MATH, READ and GENDER. Red (blue) dots indicate significance at 95 (90) per cent. Source: our elaboration on OECD data (PISA 2018).

Figure 4: Intensity of styles of teaching based on 'Cognitive activation' by country



The figure illustrates the standardized index COGNACT that summarizes nine pieces of information related to 'Cognitive activation' styles of teaching mathematics. A detailed description of such information is available in the PISA 2012 technical report OECD (2012). Data are aggregated at the country level. The red line indicates the OECD average. Source: our elaboration on OECD data (PISA 2012).