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Can problem-solving attitudes explain the gender gap in financial literacy? Evidence from Italian students' data

Sergio Longobardi[1] · **Margherita Maria Pagliuca**[1] · **Andrea Regoli**[1]

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Abstract Recent results from the OECD PISA (Financial literacy assessment framework. Australian Council for Educational Research. ACER, Australia, 2012) highlight that Italy is the only surveyed country where, among 15-year-old students, boys perform significantly better than girls in terms of financial literacy. This gap is relevant because financially literacy is crucial to make sound financial decisions and, consequently, it is likely to impact strongly on well-being of women. The main findings reveal that students' performance in financial literacy is most strongly influenced by some personality traits, such as perseverance and openness to solving complex problems, and, at same time, by the school career and the type of school attended. Their effects are larger among low-performing students than in the upper tail of the score distribution. A decomposition exercise of the gender gap in financial literacy confirms the role played by motivational and attitudinal factors and, at the same time, highlights that putting males and females on an even footing with respect to personal characteristics does not suffice to close the gap.

Keywords Problem-solving attitude · Financial literacy · Gender gap · Unconditional quantile regression · Decomposition analysis

JEL Classifications I21 · I28 · J24

✉ Margherita Maria Pagliuca
pagliuca@uniparthenope.it

Sergio Longobardi
sergio.longobardi@uniparthenope.it

Andrea Regoli
regoli@uniparthenope.it

[1] Department of Quantitative and Business Studies, University of Naples "Parthenope", Via Generale Parisi 13, Naples, Italy

1 Introduction[1]

The globally integrated nature of modern economies has increased the complexity of the socio-economic context that individuals experience, particularly with reference to economic and financial issues. Individuals are increasingly required to make financial decisions, with the consequence that financial literacy is becoming an important and frequently investigated determinant of human capital formation and development.

A growing body of empirical research from various countries shows that men typically outperform women in financial literacy. The question of why men and women have different levels of financial literacy has attracted growing interest among researchers and policy makers seeking to improve policies and to promote gender equality in economic participation and opportunity. Because women often experience interrupted employment histories, earn less than men during their working lives, and have longer life expectancies and lower confidence in their financial knowledge than men, they are at increased risk of having financial problems and inadequate retirement resources.

The gender gap in financial literacy is likely to develop while individuals are still of school age. Financial literacy can be considered a life skill for students, who need it to make sound financial decisions and address everyday financial matters as well as more complex financial issues as they become independent from their parents.

As boys and girls grow up, they may be exposed to different opportunities to learn and improve their financial competencies, such as different access to labour and financial markets, and therefore, they may develop different levels of financial knowledge and different financial strategies in adulthood over time.

This paper is the first, to the best of our knowledge, that investigates the gender gap in financial literacy among Italian students using data from the 2012 Programme for International Student Assessment (PISA) survey. The interest in this specific topic is motivated by the fact that Italy is the only country (beside the Belgian Flemish community) among the 18 countries that participated in the financial literacy assessment through PISA where, on average, boys scored significantly higher than girls (OECD 2014).

Recent studies on PISA data have found evidence of gender differences in, among others, some factors that seem to play a role as determinants of the student performance in general and of the financial literacy in particular, namely the problem-solving attitudes and the general ability of the students. Usually the former represent a penalizing factor for the girls whereas the latter constitute a weakness for the boys (OECD 2015).

Specifically, the first objective of the paper is to assess the effect of problem-solving attitudes on the score in financial literacy for both female and male students, after controlling for school ability and family background. Such attitudes as perseverance and openness to complex problems are considered to be motivational factors that help students engage in cognitive processes for understanding and solving problem situations (Mayer 1998; Funke 2010). For this reason we believe that they are significant predictors of the performance in financial literacy.

In order to validate our hypothesis, we define a simple Educational Production Function (EPF) that relates the financial literacy score to student and school characteristics. The model is estimated by both a classical OLS regression and an Unconditional Quantile Regression (UQR). The unconditional quantile regression facilitates assessment of whether the significance and magnitude of the effects of the covariates vary across the score

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distribution. Therefore, the UQR allows us to distinguish the effects of these covariates on low-performing students (whose scores are observed in the lower tail of the distribution) from their effects on high-performing students.

A further contribution of this paper to the research on this topic is represented by the decomposition of the gender differential in financial literacy into contributions from measured and unmeasured factors. The decomposition exercise proceeds in two stages. First, a classical Oaxaca-Blinder (OB) decomposition is performed, in which the mean outcome gap is the quantity to be decomposed. Then, an extension of the standard method is implemented through the Recentered Influence Function (RIF) regression technique that uses the UQR estimates to assess the gap at different percentiles of the score distribution.

Within this framework, we formulate the following research questions: if females could fill the gap in terms of perseverance and openness to solving complex problems, would gender difference in financial literacy decrease significantly? And by how much? Conversely, if the boys were to fill the gap with the females in terms of scholastic abilities, would the financial literacy gap increase significantly?

The findings are intended to provide useful insights for policy makers in order to develop specific initiatives and tools for subgroups of students with the aim of improving their financial skills. Indeed, failure to address this issue may exacerbate existing economic gender inequalities, limit the active participation of women in entrepreneurship as well as the labour and financial markets, and hinder them from achieving their greatest possible welfare (Bocchialini and Ronchini 2015).

The remainder of this paper is organized as follows. The next section discusses the literature on gender differences in financial literacy. Section 3 describes the PISA data, particularly the results for Italian students. Section 4 introduces the methodology used. Sections 5 and 6 report the empirical results from the multivariate regression models and decomposition analysis, respectively. Section 7 presents the conclusions.

2 Gender differences in financial literacy

Definitions and measures of financial literacy vary considerably. A complete definition of financial literacy is given by the Organisation for Economic Co-operation and Development (OECD 2012): "Financial literacy is knowledge and understanding of financial concepts and risks, and the skills, motivation and confidence to apply such knowledge and understanding in order to make effective decisions across a range of financial contexts, to improve the financial well-being of individuals and society, and to enable participation in economic life".

According to this definition, financial literacy is a multidimensional measure that is a composite of individual traits such as cognitive ability, personality type, and preferences. This definition encompasses the motivation to seek information and advice in order to engage in financial activities, the confidence to do so, and the ability to manage emotional and psychological factors that can influence financial decision making.

In this framework, the financial literacy is primarily conceived of as *personal financial literacy*, concerning with the way individuals understand, manage and plan their own and their households' financial affairs. This also includes risks that may threaten financial well-being as well as insurance policies and pensions. Financial literacy is thus different from *economic literacy*, which includes broader concepts such as the theories of demand and supply, market structures and so on. In assessing financial literacy, this translates into a

measure of young people's ability to transfer and apply what they have learnt about personal finance into effective decision-making. Research on financial literacy from various countries has devoted increasing attention to gender differences, which are seen as an increasingly important aspect of social inequality in the use of financial competencies.

For both women and men, financial literacy plays a key role for an effective participation in economic activities and for sound financial decisions on such issues as the efficient allocation of financial resources, the choice of a loan, a line of credit or a pension plan (Klapper et al. 2013; Calcagno and Monticone 2015). While the empirical evidence suggests that many people know little about simple financial concepts such as inflation, compound interest and risk diversification, it also suggests that, on average, women perform worse than men on tests of financial knowledge, although they often achieve better average academic performance than men. These gaps are relevant because they are likely to impact strongly on well-being of women.

Personal characteristics and attitudes may affect women's willingness to address financial matters. In this regard, women appear to be less interested than men in financial issues and even less motivated to learn about this topic, which may lead to gender differences in financial achievement (Goldsmith and Goldsmith 1997). Moreover, women act with lower self-confidence than men when handling financial matters (Bucher-Koenen et al. 2012). In line with these arguments, there is evidence that women increase their financial knowledge mostly when it becomes relevant to them, for instance, just before the death of their husbands (Hsu 2011) or when social safety net programmes in their countries do not provide security (Jappelli and Padula 2015).

In recent decades, some studies have measured levels of financial literacy among younger generations, and multiple training initiatives have been launched that are directed at young people (Martin 2007; Lührmann et al. 2015). In particular, several studies have shown that younger generations do not have well-developed knowledge and financial skills (Jones 2005). Lusardi et al. (2010) found that young Americans between 23 and 28 years of age generally show a lack of familiarity with basic financial concepts such as inflation, risk diversification and the compound interest rate. Even students who have received secondary and tertiary education show low average levels of financial literacy. This observation confirms that "*education is not a good proxy for financial literacy*", although there is a relationship between education level and financial literacy (Lusardi and Mitchell 2011). In addition, a broad and growing range of empirical research has shown that the prevalence of financial literacy competencies among young people is associated with some aspects of their family and home background. In particular, parents' financial knowledge and behaviour play a crucial role in the financial literacy of young people (Shim et al. 2010). An important part of this process occurs in the home, where children generally learn about money matters; this suggests that parents who manage their money poorly are likely to influence their children to behave similarly (Lusardi et al. 2010). Agnew and Cameron-Agnew (2015) suggested that this result could be due to 15-year-olds having had less exposure than adults to stereotypical norms within their families, with regards to traditional financial literacy roles and expectations.

With special reference to gender differences among students, several studies have focused on gender as an important determinant of financial literacy. These studies confirm that, on average, boys perform better than girls.

Chen and Volpe (1998) examined the level of financial literacy among 924 U.S. college students from 13 different campuses and explored the reasons why some students are more knowledgeable than others. Their results indicated that male students with a higher class rank and students who majored in business scored better than their counterparts. The

observed gender differences were further explored by the same authors, who found that male students in the United States outperform female students on general knowledge, savings and borrowing, and investment questions (Chen and Volpe 2002).

Danes and Haberman (2007) found that, before receiving financial instruction, male high school students in the U.S. had a greater understanding of credit, auto insurance, and investments than female students. The authors also showed that their financial curriculum reinforced the existing knowledge base of male students, while female students learned a great deal about areas that they were unfamiliar with prior to their instruction. Additionally, they found that male students are more confident in making money-based decisions than female students.

Ford and Kent (2010) focused their study exclusively on the market-based dimension of financial literacy. Their results support assertions that female college students are generally more intimidated by, less interested in, and less aware of financial markets than their male counterparts.

The present study aims to shed further light on gender differences in financial literacy among Italian students. It should be noted that the Italian school curricula do not include the teaching of finance education as intended in PISA. Consequently, the students have to acquire the financial competences outside the school from "external" sources such as the family environment, personal interest and motivation.

However, even in the light of PISA results, there is an increasingly large debate at political level and in the media as to whether financial educational programs have to be implemented in the school curricula at primary and/or secondary level.

A quantitative study that addresses this issue among preadolescents in Italy was conducted by Rinaldi and Todesco (2012). Based on a sample of 12- to 14-year-olds attending lower secondary schools in Northern Italy, they assessed gender differences in three relevant dimensions of money attitudes, i.e., materialism, self-confidence in managing money, and investment attitude.

Further empirical evidence in the Italian context is provided by the experimental financial education programme of the Bank of Italy (Romagnoli and Trifilidis 2013). This study showed that before training and at all school levels, boys had slightly higher levels of financial knowledge than girls. The differences were statistically significant for primary and junior high school. After classroom instruction, however, the gender gap was significant only among junior high school students, and girls actually outperformed boys. This result might be interpreted as greater receptiveness to instruction on the part of preadolescent females. These findings support the importance of starting financial education in primary school because the gender gap is already present in quite young children, and financial education programmes may help to reduce the differences. In addition, Bongini et al. (2015) analyse the financial literacy among freshmen of a large Italian Business School and they conclude that no gender gap arises among individuals who share common interest and motivations in money matters.

3 The performance of Italian students in financial literacy: evidence from PISA

The PISA 2012 financial literacy assessment is the first large-scale international study to evaluate the financial literacy—learned in and outside of school—of 15-year-olds nearing the end of compulsory education. PISA assesses the extent to which approximately 29,000

students in 18 participating countries and economies[2] have the knowledge and skills that are essential to make financial decisions and plan for their futures.

The assessment of financial literacy used a paper-based test composed of 40 items distributed across the dimensions of content, processes and contexts:

1. The content dimension comprises four areas of knowledge and understandings, like money and transactions, planning and managing finances, risk and reward and financial landscape.
2. The processes dimension describes the mental strategies or approaches that are called upon to evaluate financial issues, analyse information in a financial context, apply financial knowledge and understanding, identify financial information.
3. The contexts dimension refers to the situations (both personal and global) in which the domain knowledge, skills and understandings are applied, and it is divided into four groups: education and work, home and family, individual and societal.

Figure 1 shows the mean score in financial literacy[3] for each country. Test scores are scaled to have a mean of 500 and a standard deviation of 100 in the OECD student population. The values range from a high of 603 points for Shanghai-China to a low of 379 points for Colombia.

In Italy, students' performance in financial literacy is low; the average score is 466 points, which is 34 points below the OECD average and is just above Colombia (not an OECD country). More than one in five students in Italy (21.7%, compared with an average of 15.3% in OECD countries and economies) do not reach the baseline level of proficiency in financial literacy. At best, these students can recognize the difference between needs and wants, can make simple decisions on everyday spending, and can recognize the purpose of everyday financial documents, such as an invoice. Only 2.1% of students are top performers (compared with an average of 9.7% in OECD countries and economies). Overall, Italy's performance in financial literacy is lower than might be expected based on students' scores in mathematics and reading (OECD 2014). Thus, although financial literacy skills are positively correlated with mathematics and reading skills, high performance in one of those core subjects does not necessarily signal proficiency in financial literacy. In fact, evidence suggests that the core skills that students acquire in school do not provide them with the skills to perform well in the financial literacy assessment (OECD 2013).

As far as gender differences are concerned, in most OECD countries and economies, there is no significant gender gap in financial literacy scores (Table 1).

In half of the countries (Italy included), boys outperform girls, though the gap to the disadvantage of girls is statistically significant at the 1% level only in Italy (this gap is approximately 8 points on average). Although small in magnitude, this gap points to the need for action in order to provide all students with equal access to opportunities to develop their financial literacy skills. This action is particularly relevant for women, who have fewer opportunities than men in the workplace or the household and less access to financial products.

[2] 13 OECD countries: Australia, the Flemish Community of Belgium, the Czech Republic, Estonia, France, Israel, Italy, New Zealand, Poland, the Slovak Republic, Slovenia, Spain and the United States. 5 partner countries: Colombia, Croatia, Latvia, the Russian Federation and Shanghai-China.

[3] Though the conceptual framework of financial literacy rests on the above mentioned three dimensions, just one score for each student is included in the PISA dataset, calculated across all the dimensions. This prevents from exploring each of the dimensions separately.

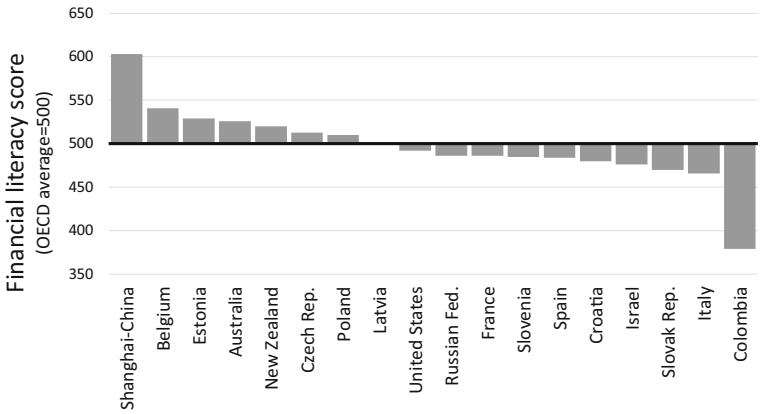

Fig. 1 Performance in financial literacy by country. *Source*: Authors' elaboration of PISA 2012 data

Table 1 Difference in financial literacy performance between females and males by country. *Source*: Authors'elaboration of PISA 2012 data

Country	Female	Male	Difference (standard error in parentheses)
AUSTRALIA	527.68	524.42	3.26 (3.99)
BELGIUM (Flemish community)	535.7	546.76	−11.06* (6.38)
COLOMBIA	378.81	378.52	0.28 (7.65)
CROATIA	477.55	482.94	−5.39 (6.88)
CZECH REPUBLIC	509.88	516.1	−6.21 (6.04)
ESTONIA	530.78	527.48	3.3 (6.16)
FRANCE	489.09	483.41	5.68 (6.2)
ISRAEL	479.72	473.66	6.07 (9.25)
ITALY	462.3	470.21	−7.91*** (3.43)
LATVIA	506.17	495.3	10.87* (6.33)
NEW ZEALAND	518.7	521.26	−2.55 (8.55)
POLAND	508.48	511.84	−3.37 (5.03)
RUSSIAN FED.	485.56	487.02	−1.46 (4.74)
SHANGHAI-CHINA	603.74	603	0.74 (5.52)
SLOVAK REPUBLIC	472.08	468.9	3.18 (6.93)
SLOVENIA	487.97	480.41	7.56 (7.84)
SPAIN	481	487.18	−6.18 (5.8)
UNITED STATES	491.1	492.13	−0.57 (3.63)

* Significant at 10% level; ** significant at 5% level; *** significant at 1% level

Figure 2 shows nonparametric estimates of the density functions of male and female financial literacy scores.

The density curve for males has more mass to the right than the density curve for females, thus confirming a non-negligible gender financial literacy gap.

The differences are more pronounced at the upper end of the distribution, indicating that the gap tends to grow when we consider high-performing students in financial literacy.

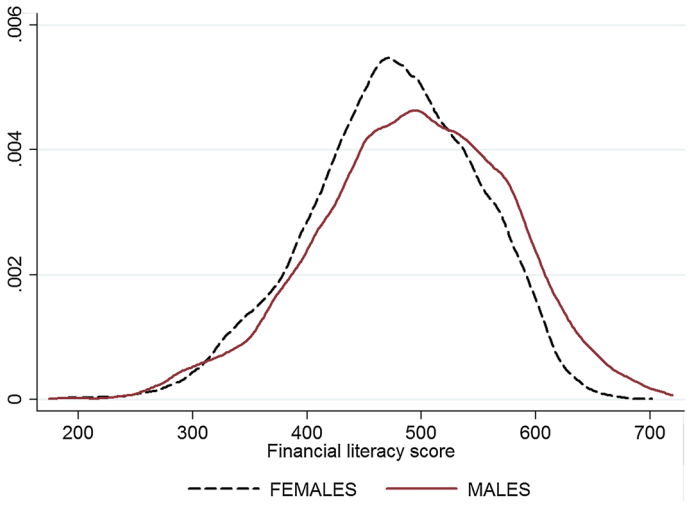

Fig. 2 Kernel density plots for the financial literacy performance of female and male Italian students. *Source*: Authors' elaboration of PISA 2012 data

4 Methods

Using PISA data, we investigate the gender gap in Italy by comparing the financial literacy scores from male and female students.

First, a raw estimate of this differential is obtained by a simple educational production function (EPF):

$$y_i = \beta_0 + \beta_1 F_i + \varepsilon_i \tag{1}$$

where y_i is the financial literacy performance of the i-th student, F_i is a dummy variable for gender (male = 0, female = 1), and ε_i is the error component. The coefficient β_1 from a classical OLS regression provides a first estimate of the size of the gender gap in average score, though it does not allow us to control for other factors that may influence students' performance. For that reason, we adopt a "full" EPF in order to obtain an adjusted estimate of the gender gap, controlling for a set of covariates that include student and school characteristics:

$$y_i = \beta_0 + \beta_1 F_i + \sum_{k=2}^{K} \beta_k x_{ik} + \varepsilon_i \tag{2}$$

The standard errors of the estimated coefficients are computed by accounting for the correlation of factors within schools that affect students' results.

Subsequently, in order to analyse whether and how the determinants of achievement in financial literacy (and therefore the gender gap) vary over the whole distribution of scores, an unconditional quantile regression is employed (Firpo et al. 2009).

This method requires the estimation of a Recentered Influence Function (RIF) for every quantile of interest Q_τ:

$$RIF\left(y;\hat{Q}_\tau\right)=\hat{Q}_\tau+\frac{\tau-I\left(y\le\hat{Q}_\tau\right)}{\hat{f}_y(Q_\tau)} \tag{3}$$

where $\hat{Q}_\tau$ is the sample τ-th quantile, $\hat{f}_y(Q_\tau)$ is a standard nonparametric density estimator (i.e., a kernel), and I is an indicator function.

For every quantile, the estimated RIF is then regressed on the chosen covariates using a standard OLS estimator. The estimated coefficients capture the marginal impact of the covariates on the quantiles of the unconditional distribution of the financial literacy score. In other words, they provide information on the determinants of the financial literacy score among low-performing students (at the lowest quantiles) as well as among high-performing students (at the highest quantiles). In contrast, the classical OLS regression gives only information on the impact of the covariates for an average student. In terms of gender gap estimation, the OLS regression compares the average scores for male and female students who share the same characteristics. By contrast, the UQ regression allows assessment of whether any difference in scores between males and females with the same observed characteristics remains constant across score levels or if it instead shrinks or grows.

We then proceed to disentangle the score gap between females and males using the Oaxaca-Blinder decomposition method.

The classical Oaxaca-Blinder (OB) method of decomposition (Oaxaca 1973; Blinder 1973) is based on the estimation of separate linear regression models (representing the educational production function, EPF) in the two groups, that is:

$$y_{Fi}=\beta_{F0}+\sum_{k=1}^{K}\beta_{Fk}x_{ik}+\varepsilon_{Fi},\ F=0,1 \tag{4}$$

or alternatively:

$$y_{Fi}=\boldsymbol{x'_{Fi}}\boldsymbol{\beta}_F+\varepsilon_{Fi},\ F=0,1 \tag{5}$$

Since the mean of the response variable can be written as:

$$E(y_F)=E(\boldsymbol{x_F})'\boldsymbol{\beta}_F \tag{6}$$

the mean outcome gap, namely:

$$E(y_1)-E(y_0)=E(\boldsymbol{x}_1)'\boldsymbol{\beta}_1-E(\boldsymbol{x}_0)'\boldsymbol{\beta}_0 \tag{7}$$

can be easily decomposed in order to separate the effect due to differences in student characteristics (endowments component) from the effect due to differences in the effects of those endowments on school performance (returns components). To this purpose, a counterfactual distribution must be defined. The counterfactual distribution can be defined by associating the endowments of group 1 with the EPF of group 0. The resulting distribution is the outcome distribution of group 1 individuals if they had the educational responses of group 0 (group 0 is said to be the reference group in this case).

Essentially, the outcome distributions of two actual groups are compared through a third (artificial) group that shares its characteristics with one group and its EPF with the other group. Traditionally, in studies of gender gaps, the reference group is chosen as the male group with the assumption that the EPF for males represents the reference, non-discriminatory model. Female coefficients, as well as coefficients from a pooled regression, could instead be taken as a reference.

With the group 0 coefficients as a reference, the mean (observed) outcome gap of Eq. (7) can be computed as follows:

$$\Delta_O^{\mu} = \bar{y}_1 - \bar{y}_0 = (\bar{x}_1 - \bar{x}_0)'\hat{\beta}_0 + \bar{x}_1'\left(\hat{\beta}_1 - \hat{\beta}_0\right) = \Delta_X^{\mu} + \Delta_S^{\mu} \tag{8}$$

where $\bar{x}_1$ and $\bar{x}_0$ are the vectors of the group means of the endowments, while $\hat{\beta}_0$ and $\hat{\beta}_1$ are the least squares estimates of the coefficients of models (5). The explained effect Δ_X^{μ} accounts for differences in the distribution of X variables between the two groups, while the unexplained effect Δ_S^{μ} accounts for differences in the way the X characteristics influence the students' performance.

The OB method also allows us to obtain a detailed decomposition of the observed gap, in which the contribution of each single explanatory variable x to the main effects is highlighted:

$$\Delta_O^{\mu} = \bar{y}_1 - \bar{y}_0 = \sum_{k=1}^{K}(\bar{x}_{1k} - \bar{x}_{0k})\hat{\beta}_{0k} + \left(\hat{\beta}_{10} - \hat{\beta}_{00}\right) + \sum_{k=1}^{K}\bar{x}_{1k}\left(\hat{\beta}_{1k} - \hat{\beta}_{0k}\right) = \Delta_X^{\mu} + \Delta_S^{\mu} \tag{9}$$

In the above equation, $(\bar{x}_{1k} - \bar{x}_{0k})\bar{\beta}_{0k}$ represents the effect due to the difference between the groups in the endowments of the k-th explanatory variable, whereas $\bar{x}_{1k}\left(\hat{\beta}_{1k} - \hat{\beta}_{0k}\right)$ is the contribution of the difference between the coefficients of the k-th explanatory variable in EPF model. The term $\left(\hat{\beta}_{10} - \hat{\beta}_{00}\right)$ is the difference between the intercepts of the EPF models; it represents the unexplained component for the base group. In the presence of categorical covariates, detailed decomposition of the unexplained effect depends on the choice of the omitted group in the regression model, which gives rise to the "omitted group" problem (Fortin et al. 2011).

The estimation of the mean gap may conceal heterogeneous patterns in the gap across the whole distribution. If the objective is the evaluation of the impact of explanatory variables on not just the mean outcome gap (as is the case for the abovementioned standard OB decomposition) but on the gap in different parts of the unconditional distribution of the outcome (for example, at each percentile), an extension of the standard OB method should be implemented.

In view of several alternative techniques (DiNardo et al. 1996; Machado and Mata 2005), one class of models that is useful for performing aggregate as well as detailed decomposition of the gap across the different quantiles of a distribution is represented by methods based on the Recentered Influence Function (RIF) (Firpo et al. 2009), hereafter referred to as the FFL decomposition.

The properties of the RIF allow us to write the equivalent of the OB decomposition for any $\tau-$th quantile Q_τ of the outcome distribution as follows:

$$\Delta_{\mathrm{O}}^{\tau} = \sum_{k=1}^{K}(\bar{x}_{1k} - \bar{x}_{0k})\hat{\beta}_{0k}^{\tau} + \left(\hat{\beta}_{10}^{\tau} - \hat{\beta}_{00}^{\tau}\right) + \sum_{k=1}^{K}\bar{x}_{1k}\left(\hat{\beta}_{1k}^{\tau} - \hat{\beta}_{0k}^{\tau}\right) = \Delta_X^{\tau} + \Delta_S^{\tau} \tag{10}$$

where $\hat{\beta}_{\mathrm{Fk}}^{\tau}$ (F = 0,1) is the estimated coefficient of the k-th explanatory variable in the unconditional quantile regression for each group.

5 Financial literacy and the gender gap among Italian students

5.1 Descriptive statistics

We use several variables to analyse the gender gap in financial literacy by exploiting the huge amount of PISA data.[4] We refer to the main determinants that the literature has shown to be statistically correlated with the performance level of students (Liang 2010; Thorpe 2006; Alivernini and Manganelli 2015). These covariates may also be of interest for explaining the gender gap.

We identify different typologies of explanatory variables, the first group of variables encompasses the students' attitudes towards problem solving. Previous literature from behavioural psychology has noted a significant impact of personality traits on student performance in general (Alivernini et al. 2016) and on financial literacy in particular (Noon and Fogarty 2007). In particular, PISA results show an association between students' financial literacy and their perseverance (OECD 2014). For this reason, we include a dummy indicating whether the student disagreed with the statement "when confronted with a problem, I give up easily." This dummy (PERSEV) is set to 1 if the student answers "Not much like me" or "Not at all like me" and 0 otherwise.

Likewise, PISA data show an association between students' performance in financial literacy and students' openness to solving complex problems (OECD 2014). In 15 of the 18 countries and economies, students who agree with the statement "I like to solve complex problems" show better performance than those who disagree. For this reason, we include a dummy indicator of openness to problem solving, this variable (PROBL_SOLV) is set to 1 if the student likes to solve complex problems[5] and 0 otherwise.

Finally, an indicator accounting for familiarity with new technologies is included. The rationale is that a greater confidence with Information and Communication Technologies (ICT) can facilitate the access to both extra-curricular information and online payment facilities (encouraging young people to deal with money matters and stimulating interest in these topics). This dummy (FIRST_COMP) takes a value of 1 if the student was 6 years old or younger when she/he first used a computer, and it takes a value of 0 otherwise.

The second group of variables captures the students' general ability. We control for the career regularity of the students as it may be linked to their cognitive development. This aspect is evaluated using a dummy (REPEAT) that indicates whether students repeated a grade (0 = "no", 1 = "yes") during either the compulsory schooling years or in upper secondary school.

Furthermore, Italian schools are divided into types[6] characterized by the self-selection of students. The best and most advantaged students attend schools with academic programmes (*liceo*). For this reason, we define a dummy (LICEO) that takes a value of 1 if a

[4] Due to the absence of financial education in the school curricula in Italy, no specific variables (for example, whether or not the financial education is taught as a separate subject, whether it is taught by school teachers or persons from sector institutions) can be used in order to assess their impact on students' performance. Consequently, no specific policy interventions at the school level can be envisaged in order to improve the achievement in financial literacy.

[5] This category encompasses students who answered "very much like me", "mostly like me" or "somewhat like me".

[6] The Italian upper secondary school system is divided into an academically oriented generalist education provided by high schools (*licei*), a technically oriented education provided by technical schools and a vocational training offered by local schools organized at the regional level.

student attends a school with academic programmes, or 0 if she/he attends a vocational or technical school.

Another set of covariates is related to family background. Indeed, ever since Coleman *et al.* (1966) published their study, educational scientists, sociologists and economists have acknowledged the importance of students' socio-economic status (SES) in determining their educational achievement. In our analysis, instead of using the summary index of economic, social and cultural status (ESCS) calculated for the students[7] , we employ some of the single factors that account for the students background such as the number of books at home, expressed by the dummy BOOKS (it is set to 1 if the books are more than 100 and 0 otherwise), and the occupational status of the father (FATH_FTIME is equal to 1 if the father works full-time and 0 otherwise). Moreover, we focus on the role played by the intergenerational transmission of gender role attitudes from mothers to daughters. In our analysis, the working status of students' mothers is included through the dummy "MOT_WORK" that is set to 1 if the student reports having a mother who is working and 0 otherwise. Finally, to account for both the poor integration of immigrants into Italian society and the likely negative effect this poor integration has on scholastic achievement (Buchmann and Parrado 2006; OECD 2006), we include a dummy variable (IMMIG) that represents the immigration status of students (0 = "native", 1 = "first or second generation immigrant").

Moreover the PRIVATE dummy indicates the type of school attended (0, public; 1, private). Finally, we include macro area fixed effects that reflect the insight that not only family background but also territorial context plays a central role in influencing students' performance (Agasisti and Longobardi 2014; Bratti et al. 2007).

The PISA dataset includes also several variables related to multiple non-cognitive aspects of financial literacy such as the possession of a bank account, the saving behavior or the decisions in hypothetical spending situations. Although these variables may contribute to explain both the financial literacy scores and the gender gap, it was decided not to include them in the analysis because the questions about these topics are addressed to a small subsample of students, consequently, the relevant presence of missing data would have biased the results.

In addition, due to the young age of PISA students, we hypothesize that these variables are to be regarded as proxies of the household's social and economic status rather than indicators of greater predisposition or competence towards the financial issues. Table 2 reports the main characteristics of the Italian PISA sample with respect to the covariates considered in our analysis,[8] focusing on the difference by gender. The subsamples of males and females show significant differences with respect to several factors that are thought to play an important role in determining student performance and in their financial literacy in particular (OECD 2104).

On the one hand, there are statistically significant differences in terms of two behavioural characteristics of the students: perseverance and predisposition towards problem solving. The males are endowed with higher perseverance; over 62% of males but only 50% of females answered negatively to the statement "When confronted with a problem, I give up easily". There is also a similar (and significant) gender difference in openness to problem solving (55.8% of males vs. 44.7% of females like to solve complex problems).

[7] A robustness check was performed by replacing the individual background variables with the OECD composite index (ESCS). The use of ESCS does not alter the results of empirical analysis.

[8] Observations with missing values for any variable of interest have been excluded from the analysis.

Table 2 Descriptive statistics of the explanatory variables for the pooled sample and for male and female students separately. *Source*: Authors'elaboration of PISA 2012 data

Variable	Label	Pooled sample		Females		Males		Difference (F–M)
		Mean	SD	Mean	SD	Mean	SD	
PERSEV	Do not give up easily when addressing a problem	0.560	0.496	0.502	0.500	0.621	0.485	−0.119***
PROBL_SOLV	Like to solve complex problems	0.500	0.500	0.447	0.497	0.558	0.497	−0.111***
FIRST_COMP	First use of computers at 6 years old or before	0.235	0.424	0.183	0.387	0.292	0.455	−0.109***
REPEAT	Grade repetition	0.064	0.246	0.051	0.220	0.079	0.270	−0.028**
LICEO	Academic track (*liceo*)	0.555	0.497	0.657	0.475	0.444	0.497	0.213***
BOOKS	Many books at home (more than 100 books)	0.423	0.494	0.445	0.497	0.400	0.490	0.046*
FATH_FTIME	Father works full time	0.838	0.369	0.817	0.386	0.860	0.347	−0.042**
MOT_WORK	Mother works (either full time or part time)	0.623	0.485	0.626	0.484	0.620	0.485	0.006
IMMIG	Immigrate (either first or second generation)	0.050	0.218	0.042	0.202	0.058	0.233	−0.015
PRIVATE	Private school	0.038	0.190	0.035	0.183	0.041	0.198	−0.006
AREA1	North West	0.243	0.429	0.240	0.427	0.247	0.431	−0.007
AREA2	North East	0.176	0.381	0.179	0.384	0.173	0.378	0.006
AREA3	Centre	0.179	0.383	0.172	0.378	0.186	0.389	−0.014
AREA4	South	0.242	0.428	0.249	0.433	0.233	0.423	0.016
AREA5	Far South and Islands	0.160	0.367	0.159	0.366	0.161	0.368	−0.002

* Significant at 10% level; ** significant at 5% level, *** significant at 1% level

Familiarity with computers also seems to differ between the two subgroups. As highlighted by other studies (Agnetha Broos 2005; Jiang and Luh 2016), this trait is stronger for males. Approximately 29% of boys reported that they had used a computer before they were 6 years old. Girls showed a more delayed approach to ICT; only 18% had used a computer before age 6.

On the other hand, there is evidence of a higher proportion of male students who have repeated a grade (7.9% of males and 5.1% of females) whereas females are overrepresented among students who are enrolled in academic schools (65.7% of girls vs. 44.4% of boys).

In summary, the two subsamples show different features which may contribute to the achievement gap. Some of these differences favour males (especially those related to attitudes and behaviours), while others favour females (e.g., the type of school attended and the frequency of grade repetition). In the next analysis, we aim to explore the main determinants of financial literacy and attempt to shed light on the factors that play major roles in determining the size of the gap between males and females.

5.2 Results from multiple regression models

The first set of results concerns the estimation of EPF models using classical OLS regression for the entire sample of students. The inclusion of a gender dummy allows us to assess the gap in financial literacy between girls and boys while controlling for the effects of other factors.

We analyse the financial literacy determinants in a stepwise fashion. The first model includes the gender dummy alone, thus producing an estimate of the raw average gap. Starting with the second model, we insert the macro area fixed effects. Additionally, we add each group of variables one at a time in order to assess the influence of each group of covariates on both financial literacy scores and the gender gap.

Finally, a full model that includes all the variables is estimated. The dependent variable is student performance in financial literacy expressed by the five PISA plausible values. As for the other PISA domains, the performance in financial literacy tests is reported in PISA dataset through five plausible values per student. Plausible values are multiple random draws from the latent student achievement. The analysis with the plausible values enables to get the average estimator across plausible values and to add the imputation error to the variance estimator.[9] These scores are transformed logarithmically so that the estimated coefficients express the percentage increase or decrease in financial literacy score that would result from a change in the corresponding covariate. In other words, each coefficient expresses the relative difference in score with respect to the reference category for the corresponding dummy covariate, holding all other variables in the model constant.

The results of OLS regression[10] (Table 3) show that the observed average gap in financial literacy score between females (group 1) and males (group 0) is −0.032 (model 1). Therefore, on average, the score achieved by females is 3.2% lower than the score achieved by males.

The estimates obtained using model 2 confirms our hypothesis that perseverance and openness to problem solving play a positive role on financial literacy. After controlling for these attitudes, the gender gap is reduced to approximately half. Indeed the inclusion of these covariates neutralizes the difference in favour of male students, thus leading to a decrease in the gender gap.

In model 3, the variables that capture the general ability are introduced. Consistent with other studies that focused on performance in mathematics and/or reading of Italian students (Bratti et al. 2007), the type of school attended proves to be a very important factor; students from the academic track (who attend *licei*) perform significantly better than students in the reference group (who attend technical and vocational schools). Moreover, students who have repeated at least one grade report on average a significantly lower score than students with a regular school career.

Lastly, we report the results of the full model (mod.4), which includes all covariates.[11] All the covariates, with the exception of immigrant status, are statistically significant

[9] Moreover the Fay's variant of the Balanced Repeated Replication (BRR) method was used, thus accounting for the PISA complex survey design (where schools are the primary sampling units) in the estimation of sampling variances. For methodological details about the plausible values analysis and the use of replicate weights, see OECD (2009).

[10] As a check of robustness, an alternative regression approach was employed using a hierarchical regression model. The main results (available on request) are robust and consistent across the estimation methods.

[11] The full model is also estimated for the subsamples of male and female students separately, the results are reported in the Appendix (Table 7).

Table 3 Results from OLS regression models by macro-category of explanatory variables. *Source*: Authors'elaboration of PISA 2012 data

Variable	mod. 1		mod. 2		mod. 3		mod.4	
	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value
FEMALE	−0.032	0.001	−0.017	0.050	−0.041	0.000	−0.042	0.000
PERSEV			0.050	0.000	0.050	0.000	0.045	0.000
PROBL_SOLV			0.051	0.000	0.042	0.000	0.039	0.000
FIRST_COMP			0.025	0.016	0.021	0.029	0.017	0.071
REPEAT					−0.074	0.000	−0.072	0.000
LICEO					0.095	0.000	0.084	0.000
BOOKS							0.036	0.000
FATH_FTIME							0.025	0.043
MOTH_WORK							0.019	0.034
IMMIG							−0.033	0.145
PRIVATE							−0.075	0.007
REGIONAL FIXED EFFECTS	No		Yes		Yes		Yes	
CONSTANT	6.183	0.000	6.162	0.000	6.133	0.000	6.096	0.000
R-square	0.009		0.162		0.249		0.274	
n	3160		3160		3160		3160	

predictors of financial literacy almost at 10% level. The effects of the students attitude towards problem solving remain significant after controlling for the remaining variables. The highest returns are associated with the general ability of the students and to their enrolment in a public school. Other things being equal, the score in financial literacy is expected to be approximately 8% higher for *liceo* students compared to students at other schools. A similar difference is observed for public school students compared to private school students. Regarding the macro area effects, the results confirm the existence of a large regional divide in achievement in financial literacy. Indeed, the scores of an average student living in the two southern areas (South and Far South plus Islands) are approximately 9 and 12% lower, respectively, than the scores of a student with the same characteristics living in the north-western regions.

In addition to the OLS estimates, we employ an unconditional quantile approach to analyse the determinants of the score in financial literacy at different percentiles of the distribution. Panel A of Fig. 3 shows the raw gender gap, computed as the coefficient of the female dummy from a regression model with no other explanatory variables, and its confidence interval (at the 95% confidence level), plotted against the quantiles of the financial literacy score distributions. The gap is not constant across the percentiles. Indeed, it is statistically null at the bottom of the score distribution, but it significantly favours males from the 30th percentile onwards. It also increases steadily throughout the distribution, and this increase tends to accelerate in the upper percentiles.

Panel B of Fig. 3 shows the conditional gender gap expressed by the coefficient of the female dummy in the full quantile regression model. Once the covariates have been

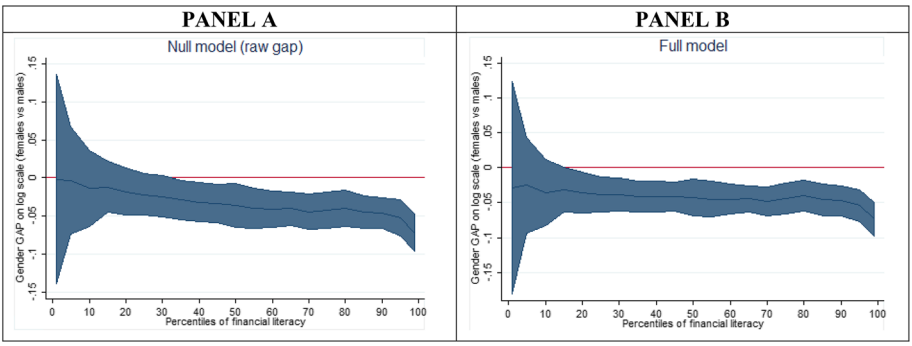

Fig. 3 Analysis of the gender gap in financial literacy (Female vs. Male) using unconditional quantile regression. The *black line* represents the coefficient of the gender dummy from the estimation of unconditional quantile regression models at selected percentiles of the financial literacy score distribution. The *grey area* represents the 95% CI on these estimates. *Source*: Authors' elaboration of PISA 2012 data

accounted for, the performance difference between females and males significantly favours men already at the 15th percentile and then remains almost constant across the distribution.

The difference between the raw and conditional gaps is explained by the differences in the magnitude of the covariates' effects along the financial literacy distribution.

To assess the effect of the covariates at different points along the test score distribution, we report the coefficients of the unconditional quantile regression model for the 10th, 25th, 50th, 75th and 90th percentiles for the pooled sample[12] (Table 4). The results show that the gender gap appears not to be significant at the 10th percentile. From the 25th percentile onwards, it ranges from 3.8 to 4.7%. As expected, at the centre of the distribution the estimated gap is very similar to the mean gap estimated through OLS regression.

Most of the effects are heterogeneous across the different parts of the score distribution.

The impact of attitude towards problem solving is not significant at the 10th percentile, whereas it reaches its highest value at the median of the score distribution. On the one hand, the quantile regression corroborates that perseverance has a positive impact on financial literacy scores, and on the other hand it provides further evidence that its marginal effects are highest at the lowest percentiles. Thus, low-performing students would benefit more than others from any improvement in perseverance.

A similar pattern is observed for enrolment in an academic programme and for being a repeater. As for the former, its impact on the score is significantly positive across the whole distribution. As for the latter, the declining negative effect suggests that low-performing students are much more strongly penalized than high-performing students by having repeated at least one grade.

Among the family background covariates, having many books at home has a positive and significant impact on scores from 25th percentile onwards whereas the working status of either father or mother enhances significantly the score only in the lower middle part of the distribution.

Moreover, attending a private school has a negative impact on the score. This effect is not significant at the lowest percentile, while it is among the largest in magnitude in the upper half of the distribution. Lastly, the effects of macro areas are significant throughout

[12] The results from the full specification of the unconditional quantile regression, separated by gender, are reported in Appendix (Table 8).

Table 4 Results from unconditional quantile regression: full specification. *Source*: Authors 'elaboration of PISA 2012 data

Variable	Percentile									
	p10		p25		p50		p75		p90	
	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value
FEMALE	−0.036	0.138	−0.038	0.003	−0.043	0.002	−0.044	0.000	−0.047	0.000
PERSEV	0.063	0.003	0.064	0.000	0.048	0.000	0.029	0.011	0.025	0.006
PROBL_SOLV	0.020	0.264	0.035	0.010	0.063	0.000	0.054	0.000	0.043	0.000
FIRST_COMP	0.018	0.460	0.016	0.377	0.012	0.420	0.029	0.033	0.021	0.272
REPEAT	−0.118	0.051	−0.095	0.006	−0.083	0.000	−0.059	0.001	−0.045	0.000
LICEO	0.134	0.000	0.122	0.000	0.082	0.000	0.052	0.000	0.035	0.007
BOOKS	0.031	0.161	0.037	0.015	0.036	0.003	0.047	0.000	0.040	0.001
FATH_FTIME	0.014	0.685	0.028	0.217	0.027	0.064	0.013	0.318	0.002	0.914
MOTH_WORK	0.028	0.226	0.038	0.005	0.018	0.117	0.005	0.676	0.003	0.797
IMMIG	−0.110	0.110	−0.053	0.133	−0.014	0.597	−0.007	0.770	−0.021	0.389
PRIVATE	−0.073	0.313	−0.093	0.030	−0.091	0.014	−0.086	0.002	−0.061	0.022
NORTH EAST	0.036	0.145	0.014	0.488	0.013	0.521	0.034	0.125	0.045	0.053
CENTER	−0.013	0.689	−0.043	0.056	−0.061	0.002	−0.040	0.098	−0.009	0.638
SOUTH	−0.106	0.004	−0.115	0.000	−0.115	0.000	−0.076	0.000	−0.032	0.068
FAR SOUTH & ISLANDS	−0.164	0.000	−0.166	0.000	−0.148	0.000	−0.101	0.000	−0.052	0.002
Constant	5.850	0.000	5.973	0.000	6.125	0.000	6.243	0.000	6.327	0.000
R square	0.101		0.193		0.215		0.159		0.094	
n	3160		3160		3160		3160		3160	

the distribution when students living in southern Italy and students living in northern regions are compared. Specifically, the score of a low-achieving student who lives in the far southern regions (including the islands) is approximately 16% lower than the score of a similar student living in the north-western regions, whereas the relative difference shrinks to approximately 5% in the top decile of the score distribution. In summary, among low-performing students, the personal covariates with the largest impacts on financial literacy scores are school career, the type of school attended and perseverance.

In the upper tail of the score distribution, the impact of the above mentioned covariates is still significant though smaller in magnitude. Moreover, the gender gap becomes more pronounced in the upper tail of the score distribution, whereas the attendance of a private school has its largest effect (with a negative sign) on financial literacy scores.

6 Decomposing the gender gap in financial literacy

6.1 OB decomposition

This section shows the results of the Oaxaca-Blinder decomposition applied to the observed average gap in financial literacy score between female and male students. According to the aggregate decomposition, and using the male group as the reference group, the total explained component has a positive sign (+0.012) whereas the total unexplained effect is negative and larger in magnitude (−0.045). Both effects are significant (Table 5). A positive explained effect confirms that females possess those characteristics that are associated with high financial literacy scores to a greater degree than do males. On the other hand, the unexplained component, which is interpreted as an adjusted gap once we control for the set of explanatory variables, is even higher than the raw observed gap. This suggests that, if females had the same score structure as males according to their EPF model, they would actually score higher than the males in financial literacy.[13]

Regarding the detailed decomposition, the findings allow to validate our research questions, with reference to the effects on the average gender gap. Specifically, the explained components show two main forces working in opposite directions, with one tending to narrow the gap and the other tending to widen it. Specifically, if males and females were to have the same degree of perseverance and the same attitude towards solving complex problems, the difference would be narrowed overall by 1.2% points. In contrast, if males were as likely as females to attend academic high school programmes, their scores would be even higher and the gap would further expand by 2.2% points. In fact, enrolment in academic programmes contributes the most to the explained part of the gap. A slight enlargement of the gap (+0.2% points) would be observed if males and females were to share the same percentage of repeaters. The effects of the other single covariates are not significant.[14]

[13] The results are somewhat robust to the choice of the reference group for OB decomposition: the unexplained component is lower, though still significantly negative (−0.038), when the female group is used as the reference group, whereas it amounts to −0.042 when the reference coefficients are derived from the pooled regression model.

[14] The choice of female coefficients as reference coefficients does not alter the results of the detailed decomposition. The signs and the level of significance of all effects are unchanged. However, the explained effect of academic programme decreases in magnitude because the returns associated with academic programmes are lower for females than for males.

Table 5 Oaxaca–Blinder decomposition. *Source*: Authors'elaboration of PISA 2012 data

	OB	
	Coeff.	*p* value
Mean gap	−0.032	0.001
Explained		
PERSEV	−0.008	0.000
PROBL_SOLV	−0.004	0.017
FIRST_COMP	−0.001	0.415
REPEAT	0.002	0.084
LICEO	0.022	0.000
BOOKS	0.001	0.280
FATH_FTIME	−0.001	0.437
MOTH_WORK	0.000	0.800
IMMIG	0.001	0.354
PRIVATE	0.000	0.577
MACRO AREA	0.000	0.958
TOTAL EXPLAINED	0.012	0.049
Unexplained		
PERSEV	−0.021	0.014
PROBL_SOLV	0.006	0.436
FIRST_COMP	0.004	0.241
REPEAT	−0.001	0.395
LICEO	−0.027	0.017
BOOKS	0.016	0.007
FATH_FTIME	0.009	0.629
MOTH_WORK	0.004	0.659
IMMIG	0.000	0.926
PRIVATE	0.001	0.748
MACRO AREA	−0.015	0.311
CONSTANT	−0.020	0.556
TOTAL UNEXPLAINED	−0.045	0.000

As for the unexplained component, the largest unexplained effect is due to the gap in the returns to both academic programme and perseverance in problem solving. Both gaps are in favour of boys. Consequently, if girls and boys were to have the same educational response to enrolment in academic programmes and perseverance, the gap would be narrowed by a significant extent. This result is robust to the choice of the reference category for the corresponding binary covariate. In contrast, the extent of the impact on the gap depends on the arbitrarily chosen omitted group. For this reason, we do not comment upon it. On the other hand, unlike those of boys, girls' scores are positively and significantly affected by having many books at home. Therefore, if boys and girls were to have the same return to this covariate, the gap would expand significantly, and this result occurs regardless of the reference category for the binary covariate. The remaining effects are not significant.

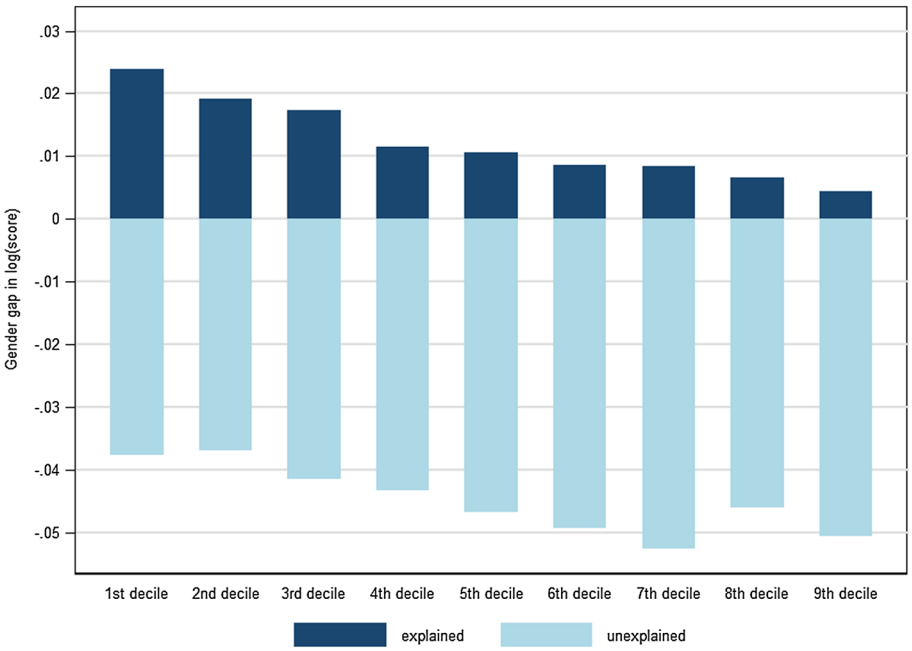

Fig. 4 Aggregate decomposition of gender gap in financial literacy through RIF regression across selected percentiles. *Source*: Authors'elaboration on PISA 2012 data

6.2 FFL decomposition

The results of the FFL decomposition show that the total explained component is significant only in the bottom part of the distribution, whereas it approaches zero at the top of the distribution (Fig. 4). This result suggests that girls are advantaged over boys based on their observable characteristics only among low-scoring students.

The total unexplained effect, which controls for the explanatory variables, is consistently larger than (in terms of its absolute value) the raw gap. Nevertheless, their pattern is very similar, and indeed their 95% CIs overlap across all percentiles (Fig. 5). Ultimately, boys and girls seem to have very different production functions for achievement in financial literacy, which means that they are not equally affected by equal endowment levels.

Through the results of the detailed decomposition (Table 6), we add the evidence that the contribution from some covariates differs significantly among low-performers and among high-performing students. Specifically, the largest reduction in the gender gap in financial literacy (−1.4%) would be observed at the 10th percentile if boys and girls were to have the same degree of perseverance in problem solving. At the highest percentiles, the perseverance factor becomes less important. At the same time, the contribution of attraction to complex problems becomes the largest negative coefficient. On the other side, the effect of enrolment in an academic high school programme on the explained gap is the highest, and in percentage terms its weight grows along the outcome distribution, being more than three times the total explained gap at the 90th percentile. If the percentage of attendees in academic programmes was equal among the boys and girls, the gap would

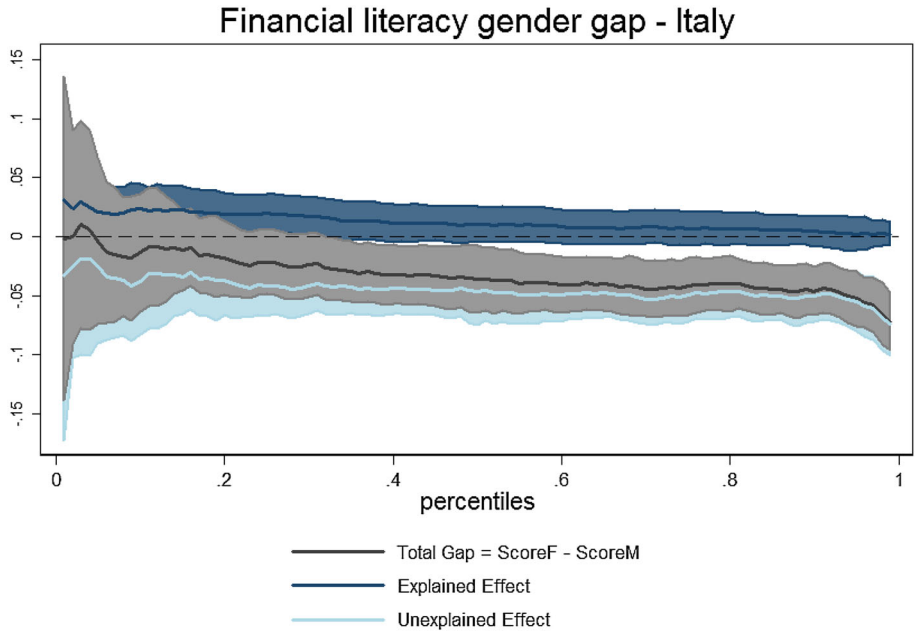

Fig. 5 Aggregate decomposition of gender gap in financial literacy through RIF regression: observed gap, explained and unexplained components and their 95% CIs across all percentiles. The *grey area* represents the 95% CI for the raw gap. The *darkest area* represents the 95% CI for the explained component of the gap. The *lightest area* represents the 95% CI for the unexplained component of the gap. *Source*: Authors'elaboration on PISA 2012 data

increase by a percentage ranging from 1.2 to 3.6 at the 90th and 10th percentiles, respectively. The impact of being a repeater is significant only in the upper half of the distribution, and it has the same sign as enrolment in an academic programme, as explained above.

The decomposition of the unexplained component confirms that gender differences in returns from perseverance in problem solving, the possession of many books and academic programme do matter, though not uniformly across the different quantiles.

7 Discussion and policy implications

According to the OECD, "Financial education should start at school. People should be educated about financial matters as early as possible in their lives" (OECD 2005). Given the worldwide recognised importance of financial education in the earliest stages of life, in the wake of the current debate in the Italian political scene on the implementation of financial educational programs in the school curricula, we have examined gender differences in financial literacy among Italian students, with special reference to the effect of specific students attitudes (perseverance and openness to complex problems).

Table 6 RIF regression results at some selected percentiles. *Source*: Authors'elaboration of PISA 2012 data

	P10		P25		P50		P75		P90	
	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value
Mean gap	−0.014	0.588	−0.022	0.120	−0.036	0.013	−0.042	0.001	−0.046	0.000
Explained										
PERSEV	−0.014	0.002	−0.011	0.000	−0.007	0.001	−0.004	0.087	−0.003	0.057
PROBL_SOLV	0.000	0.955	−0.004	0.120	−0.007	0.002	−0.006	0.003	−0.005	0.021
FIRST_COMP	−0.002	0.581	−0.001	0.724	0.000	0.858	−0.002	0.379	−0.002	0.456
REPEAT	0.002	0.440	0.002	0.248	0.002	0.096	0.002	0.081	0.001	0.065
LICEO	0.036	0.000	0.032	0.000	0.021	0.000	0.015	0.000	0.012	0.004
BOOKS	0.000	0.890	0.001	0.448	0.001	0.409	0.001	0.237	0.001	0.259
FATH_FTIME	0.001	0.756	0.000	0.875	−0.001	0.528	0.000	0.675	0.000	0.757
MOTH_WORK	0.000	0.883	0.000	0.799	0.000	0.817	0.000	0.951	0.000	0.883
IMMIG	0.002	0.365	0.001	0.325	0.000	0.554	0.000	0.991	0.000	0.761
PRIVATE	0.001	0.634	0.001	0.600	0.000	0.618	0.001	0.608	0.000	0.600
MACRO AREA	−0.001	0.897	0.000	0.914	0.000	0.886	0.000	0.997	0.000	0.863
TOTAL EXPLAINED	0.024	0.025	0.020	0.017	0.011	0.176	0.007	0.339	0.004	0.496
Unexplained										
PERSEV	−0.053	0.011	−0.029	0.035	−0.009	0.395	−0.005	0.657	−0.005	0.609
PROBL_SOLV	0.017	0.371	−0.001	0.945	0.000	0.965	−0.001	0.900	−0.001	0.943
FIRST_COMP	0.002	0.777	0.004	0.489	0.007	0.114	0.006	0.202	0.001	0.866
REPEAT	−0.007	0.305	−0.004	0.161	0.000	0.886	0.002	0.309	0.001	0.681
LICEO	−0.044	0.153	−0.040	0.050	−0.023	0.177	−0.026	0.040	−0.025	0.115
BOOKS	0.028	0.140	0.015	0.208	0.018	0.049	0.015	0.117	0.012	0.211
FATH_FTIME	0.044	0.447	0.029	0.332	0.014	0.532	0.004	0.829	−0.007	0.743
MOTH_WORK	0.016	0.651	0.011	0.528	0.005	0.713	0.006	0.565	0.010	0.520
IMMIG	0.000	0.977	0.001	0.819	0.001	0.720	−0.001	0.719	−0.001	0.569

Table 6 continued

	P10		P25		P50		P75		P90	
	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value
PRIVATE	0.002	0.771	0.002	0.659	−0.001	0.703	0.000	0.902	0.001	0.553
MACRO AREA	−0.028	0.530	−0.018	0.535	−0.006	0.813	−0.016	0.445	−0.019	0.436
CONSTANT	−0.016	0.885	−0.012	0.853	−0.052	0.192	−0.034	0.381	−0.018	0.647
TOTAL UNEXPLAINED	−0.038	0.104	−0.042	0.001	−0.047	0.001	−0.049	0.000	−0.051	0.000

The evidence reviewed in this analysis of Italian PISA data highlights a low level of financial competency among Italian students, compared to 15-year-old students in other countries. In addition, the PISA data emphasize that, behind a school desk, Italian girls score significantly worse than boys in financial literacy. There are substantial gender disparities that can affect the way boys and girls acquire financial knowledge and skills, thus leading to gender differences in financial literacy.

In addition to the significant gender gap in financial literacy, our findings show that student performance in financial literacy is most strongly influenced by the school career (whether or not students had repeated a grade) and the type of school attended. However, problem-solving attitudes (perseverance and willingness to get involved in complex problems) also matter significantly, while the direct effect of socio-economic background plays a marginal role.

The large regional divide in performance (especially between students living in the far southern regions, including the islands, and students living in the northwest) points towards a need for effective policies aimed at promoting financial education while reducing regional inequalities.

The unconditional quantile regression estimates emphasize that, for most of the covariates, the effects decline across the score distribution. They are largest in the bottom half of the distribution, that is, among the low-performing students. In contrast, the gender gap among students with the same observed characteristics becomes wider across the distribution, ranging from 3.6% at the 10th percentile to 4.7% at the 75th percentile.

Even though girls score significantly lower than boys, they show more favourable characteristics than the latter for high achievement in financial literacy. More specifically, girls are more likely than boys to be enrolled in an academic programme as well as to have a regular school career with no repetition. However, the returns from both these characteristics are comparatively lower for females than for males.

The decomposition exercise, carried out through the classical OB approach and the more recently developed FFL method, draws attention to a large and significant unexplained component, which confirms that bringing males and females to the same endowment level does not suffice for bridging the gender gap in financial literacy.

With reference to the problem-solving attitude, females are disadvantaged relative to males not only in their endowments but also in the effects of these endowments on financial literacy scores. Indeed, on one side the share of students who do not give up easily when confronted with a problem is smaller for females than for males. On the other side, holding this trait constant, females appear to benefit from it to a lesser extent than males in terms of financial knowledge.

Specifically, our findings suggest that policies intended to bridge the gender gap in financial literacy should ensure that girls improve their approach towards problem solving. This could be achieved, for example, through effective teaching methods and a good school climate in order to foster girls' motivations for them to engage themselves with a greater confidence in understanding and solving specific problem situations. However a better endowment in problem-solving attitudes can not be the final solution for the girls to gain ground over boys. Indeed, our results show that even equal endowment levels between girls and boys do not succeed in closing the gap in financial literacy attainment. What the girls need further is to achieve, with their endowments, the same yields (in terms of scores in financial literacy) as boys.

To this end, we echo the suggestion of Driva *et al.* (2016) who called for financial education programmes that address gender stereotypes directly. The abovementioned authors found an association between the gender gap in financial literacy and gender stereotypes related to financial issues in a sample of German teenagers. We have reason to believe that this prejudice is even more rooted in Italian Society than in Germany—the belief that females are less interested in finances than males, that they are less likely than males to deal with finances both at home and in their job, and that they achieve worse financial results than males. These stereotypes are consolidated by a recent survey on financial investment in Italian households that found that women are mostly excluded from the household financial decisions, since, in three out of four cases, financial decisions are made by men (Consob 2015). These beliefs are likely to influence the approach of girls to financial issues, thus leading them to choose not to acquire financial knowledge, even if they have endowments suitable for achievement in financial literacy.

Appendix

See Tables 7, 8 and 9.

Table 7 Results from full specification of OLS regression model by gender. *Source*: Authors'elaboration of PISA 2012 data

Variable	Male		Female	
	Coeff.	*p* value	Coeff.	*p* value
PERSEV	0.066	0.000	0.025	0.006
PROBL_SOLV	0.032	0.009	0.045	0.000
FIRST_COMP	0.010	0.423	0.030	0.015
REPEAT	−0.060	0.003	−0.088	0.000
LICEO	0.105	0.000	0.063	0.000
BOOKS	0.016	0.160	0.053	0.000
FATH_FTIME	0.018	0.355	0.029	0.044
MOTH_WORK	0.015	0.199	0.022	0.040
IMMIG	−0.038	0.267	−0.034	0.211
PRIVATE	−0.084	0.115	−0.064	0.004
NORTH EAST	0.045	0.027	0.012	0.476
CENTER	−0.033	0.147	−0.033	0.058
SOUTH	−0.067	0.002	−0.098	0.000
FAR SOUTH & ISLANDS	−0.115	0.000	−0.124	0.000
Constant	6.086	0.000	6.066	0.000
R-square	0.275		0.281	
n	1508		1652	

Table 8 Results from unconditional quantile regression: full specification (Males). *Source*: Authors 'elaboration of PISA 2012 data

Variable	Percentile									
	p10		p25		p50		p75		p90	
	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value
PERSEV	0.117	0.001	0.093	0.000	0.057	0.000	0.033	0.067	0.029	0.034
PROBL_SOLV	0.002	0.954	0.037	0.127	0.063	0.000	0.055	0.000	0.043	0.011
FIRST_COMP	0.017	0.581	0.009	0.727	−0.003	0.858	0.017	0.378	0.020	0.453
REPEAT	−0.065	0.409	−0.062	0.192	−0.086	0.004	−0.074	0.001	−0.050	0.000
LICEO	0.168	0.000	0.152	0.000	0.099	0.000	0.071	0.000	0.055	0.002
BOOKS	−0.005	0.888	0.019	0.361	0.015	0.321	0.030	0.085	0.026	0.134
FATH_FTIME	−0.017	0.739	0.006	0.865	0.016	0.463	0.009	0.664	0.006	0.741
MOTH_WORK	0.017	0.678	0.029	0.181	0.013	0.393	−0.002	0.884	−0.007	0.674
IMMIG	−0.117	0.241	−0.064	0.211	−0.024	0.550	0.000	0.992	−0.011	0.744
PRIVATE	−0.091	0.454	−0.123	0.171	−0.076	0.235	−0.090	0.061	−0.077	0.030
NORTH EAST	0.074	0.069	0.041	0.248	0.030	0.308	0.040	0.237	0.063	0.028
CENTER	−0.011	0.840	−0.038	0.323	−0.054	0.092	−0.044	0.147	−0.013	0.627
SOUTH	−0.085	0.142	−0.087	0.027	−0.103	0.000	−0.064	0.054	−0.021	0.372
FAR SOUTH & ISLANDS	−0.140	0.052	−0.158	0.000	−0.144	0.000	−0.103	0.003	−0.048	0.038
Constant	5.840	0.000	5.960	0.000	6.130	0.000	6.248	0.000	6.318	0.000
R square	0.112		0.203		0.209		0.153		0.093	
n	1508		1508		1508		1508		1508	

Table 9 Results from unconditional quantile regression: full specification (Females). *Source*: Authors 'elaboration of PISA 2012 data

Variable	Percentile									
	p10		p25		p50		p75		p90	
	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value
PERSEV	0.012	0.606	0.035	0.025	0.038	0.032	0.023	0.085	0.020	0.125
PROBL_SOLV	0.040	0.104	0.034	0.055	0.062	0.000	0.053	0.000	0.042	0.007
FIRST_COMP	0.029	0.370	0.031	0.132	0.033	0.104	0.047	0.008	0.025	0.299
REPEAT	−0.196	0.041	−0.145	0.001	−0.080	0.009	−0.038	0.150	−0.038	0.085
LICEO	0.101	0.004	0.091	0.000	0.065	0.001	0.032	0.035	0.017	0.356
BOOKS	0.058	0.012	0.052	0.008	0.055	0.000	0.064	0.000	0.053	0.000
FATH_FTIME	0.037	0.446	0.042	0.065	0.033	0.072	0.014	0.384	−0.003	0.889
MOTH_WORK	0.043	0.181	0.047	0.008	0.021	0.224	0.008	0.570	0.009	0.579
IMMIG	−0.121	0.173	−0.049	0.271	−0.005	0.889	−0.018	0.573	−0.035	0.284
PRIVATE	−0.044	0.633	−0.063	0.328	−0.106	0.009	−0.083	0.003	−0.044	0.280
NORTH EAST	0.005	0.895	−0.008	0.719	0.001	0.981	0.033	0.240	0.032	0.309
CENTER	−0.010	0.749	−0.043	0.086	−0.062	0.012	−0.031	0.270	−0.003	0.905
SOUTH	−0.120	0.007	−0.136	0.000	−0.126	0.000	−0.084	0.000	−0.040	0.091
FAR SOUTH & ISLANDS	−0.174	0.000	−0.164	0.000	−0.147	0.000	−0.096	0.000	−0.053	0.022
Constant	5.824	0.000	5.953	0.000	6.085	0.000	6.201	0.000	6.291	0.000
R square	0.113		0.203		0.223		0.160		0.085	
n	1652		1652		1652		1652		1652	

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