

Explaining the Gender Gap in Financial Literacy: The Role of Non-Cognitive Skills

ALFONSO ARELLANO* – NOELIA CÁMARA[†] – DAVID TUESTA[‡]

Economic literature identifies a gender gap in financial literacy. This paper tests to what extent this gender gap is due to a misspecification problem or whether it exists because boys and girls do indeed have differing ways of acquiring financial literacy. Our estimates show that the gender gap decreases by 20 per cent when the model includes the effect of non-cognitive skills, for 15-year-old students in Spain. However, differences between boys and girls in financial literacy remain statistically significant.

(J.E.L.: I00, D83, C81).

1. Introduction

Dramatic transformations in financial markets, with complicated product offerings, together with changes in society, where people live longer and are healthier, increase individual responsibility for financial decisions. In this scenario, the consequences of an aging population cannot reach the optimum if people are unable to translate these benefits into constructing a happier and more prosperous society. Financial literacy plays a key role in helping to manage individual finances efficiently, which can improve the economic behaviour and the quality of people's lives. However, several studies reveal that the current levels of financial literacy around the world are low. In addition, one striking feature of the empirical data on financial literacy is the large and persistent gender differences across surveys and countries (Lusardi *et al.*, 2010; Lusardi and Mitchell, 2008, 2009; Lusardi and Tufano, 2009a, 2009b). Empirical research shows that women consistently emerge as a group with lower financial literacy than men do. Estimates show a decrease in the gender gap between 12 per cent and 50 per cent after controlling for socioeconomic characteristics.¹ However, a remaining

*Complutense University of Madrid and BBVA Research.

[†]BBVA Research, Email: noelia.camara@bbva.com.

[‡]CAF-Bank of Development for Latin America.

difference between men and women persists, which suggests that other factors should be taken into account. It is important for the guidance of economic policy to disentangle the factors behind the gender gap in financial literacy since unequal financial behaviour has consequences for individual welfare.

Some recent papers point to non-cognitive skills, as potential explanations for observed gender differences in financial literacy. However, to the best of our knowledge, only Drive *et al.* (2016) includes a measure of such factors in the models to analyse gender differences. The problem of neglecting non-cognitive factors is two-fold. Firstly, it may lead to an overestimation of the importance of cognitive skills due to a misspecification of the models. If such non-cognitive factors are correlated with gender, it leads to a biased estimate of the gender gap. The higher the correlation between non-cognitive skills and gender, the higher the bias is. In addition, the lack of non-cognitive skills in the model generates an unjustified one-dimensional interpretation of the financial literacy outcomes (Arellano *et al.*, 2014). Taking into account non-cognitive skills may lead to a more accurate estimate of the gender gap, thus improving our understanding of the financial behaviour. Since cognitive and non-cognitive skills are not directly observable, the literature faces an identification problem. Unobservable non-cognitive individual characteristics may account for a part of the cognitive diversity claimed by the gender gap.

In this paper, we explore the gender gap in financial literacy from its origins, paying attention to the potential role of non-cognitive skills (i.e. self-confidence, motivation and perseverance). We rely on the financial literacy tests from the Programme for International Student Assessment (PISA).² The database from PISA includes several questions, which allow us to differentiate between information related to cognitive and non-cognitive skills. We focus on 15-year-old Spanish students who are at the start of the life-cycle in order to avoid, as much as possible, the effect of unobservable factors (i.e. cultural and institutional aspects) and other observable ones, (i.e. work type and marital status) that appear or become stronger as people grow up. Such factors may have a different effect on the performance of boys and girls in financial literacy tests.

¹Bucher-Koenen *et al.* (2011) show that after controlling for marital status, age, education and income, the gender gap decreases considerably; in particular, by 12 per cent in the US, 40 per cent in the Netherlands and 50 per cent in Germany. Fonseca *et al.* (2012) find, for adults in the US, that the gender gap decreases by 25 per cent when including covariates such as marital status, disaggregated in several categories and the length of time that the individual spent in that relationship. These authors find no evidence in favour of labour specialization by gender for financial decision-making, which may be a potential explanation for the gender gap, but financial decision-making is sensitive to the relative education level of spouses.

²Hanushek and Woessmann (2011, 2012) demonstrate that good results in the standardized tests, such as PISA, are positively associated with long-term economic growth.

Our paper contributes to the literature on gender gap in financial literacy. We show that non-cognitive skills (self-confidence, motivation and perseverance) have a role in explaining differences between boys and girls in financial knowledge. Particularly, our findings corroborate the hypothesis that self-confidence, perseverance and motivation explain part of the gender gap. We show that accounting for such non-cognitive skills decreases the differences between boys and girls in financial literacy by 20 per cent.

The rest of the paper is organized as follows. Section 2 discusses a review of the literature. Section 3 presents the data and variable construction. Section 4 explains the econometric strategy. Section 5 shows the empirical results. Finally, section 6 provides concluding remarks.

2. Gender Differences in Financial Literacy

The literature on financial literacy that studies the differences between men and women has amassed compelling evidence indicating that there is a gender gap. Published evidence of a gender gap in financial literacy is documented for a number of countries: the US, the Netherlands, Germany (Bucher-Koenen and Lusardi, 2011), Sweden (Almenberg and S  ve-S  derbergh, 2011), New Zealand (Crossan *et al.*, 2011), Italy (Fornero and Monticone, 2011), Japan (Sekita, 2011), Australia (Agnew *et al.*, 2013), France (Arrondel *et al.*, 2013), Switzerland (Brown and Graf, 2013), India (Filipiak and Walle, 2015), Russia (Klapper and Panos, 2011) and Thailand (Grohmann *et al.*, 2016). For all these countries, except Russia, women have a low level of financial literacy compared to men. Evidence for Russia, East Germany (Bucher-Koenen and Lusardi, 2011) and Thailand reveals that there is no gender gap in these countries.³ However, most of the studies on the origin of the gender gap in financial literacy focus on traditional socioeconomic factors and cultural differences (i.e. the role of financial decision-making at home, the development of financial markets, risk preferences) to explain the differences in financial literacy between men and women. Such factors can only partially explain the gender gap.

Recent works in behavioural literature focus on the importance of personality and non-cognitive skills for financial behaviour. Hadar *et al.* (2011) demonstrates that subjective knowledge has an independent effect on financial decision-making. In a more general vein, Levine (2012) shows that non-cognitive skills have an impact on the personal and professional

³People in East Germany know less about finance than people in the west but there are no differences between men and women. The financial market development may be a cause behind the gender gap. The Thai case reveals that country characteristics on gender equality and financial-related equality can be an explanation for the lack of a gender gap in financial literacy.

future of students.⁴ These studies associate some personality features with better financial and academic outcomes, professional careers and health.⁵ Duckworth *et al.* (2010) give an overview of the psychological literature on the link between personality and IQ. They find that differences between students' motivation to perform well in a test can be expected. A study by Eklof (2007) on test-motivation of Swedish students shows that some students report competitive, comparative or social-responsibility reasons for being highly motivated to perform well on the test, while others are more intrinsically motivated to do so. Borghans and Schils (2012) demonstrate that test scores on achievement tests depend on both cognitive and non-cognitive skills and break the test scores up into two factors. They use the PISA database and claim that the decline in test scores during the test is related to personality traits, mainly to agreeableness, and to motivational attitudes towards learning, and that the motivation effect can explain 19 per cent of the variation in the average test scores between countries.⁶ The authors suggest that both ability and motivation matter for later success.⁷ Almlund *et al.* (2011) point out the importance of personal psychological factors in obtaining good results in matters to do with money as well as academic, work-related and social areas. Other authors (Bénabou and Tirole, 2002) also highlight the role of self-confidence and motivation in the decisions of individuals.

Finally, the literature addresses the question of when the gender gap emerges. Some papers evaluate the effect of the traditional roles of women in society and show that financial literacy is lower among single women who are also in charge of their own finances. This finding goes against the thesis that gender differences are due to the specialization of tasks within the household and that married women only accumulate financial

⁴Recent literature on human capability formation (Cunha and Heckman, 2007, 2008, 2010; Conti *et al.*, 2010, 2011; Heckman *et al.*, 2014), has amassed compelling evidence indicating that health behaviours and outcomes, as well as educational choices, are simultaneously determined from a very early age. The latter being influenced by a complex network of factors that include cognitive skills, non-cognitive or personal traits and initial health endowments. The authors find that individuals with lower non-cognitive skills were most likely to be negatively affected by exposure to mixed-ability schools.

⁵They include the association between skills and earnings (Hanushek *et al.*, 2013; Heckman and Kautz, 2011).

⁶Balart and Cabrales (2015) show that the size of the decline in the test scores is smaller for girls.

⁷While recent research in labour economics document the critical role of skills in predicting key life outcomes, the role of non-cognitive skills and how they affect gender differences related to financial decisions have received limited attention. Only a set of studies on gender wage discrimination examines the contribution of non-cognitive skills. Tognatta *et al.* (2016) suggests that cognitive and non-cognitive skills affect men and women's earnings in different ways. Fortin (2008) finds that differences in non-cognitive traits explain about 8 per cent of the wage gap in the US. For the Netherlands, adding the factor of personality was found to reduce the gender wage gap from 75 per cent to 63 per cent (Nyhus and Pons, 2012); and for Russia, the authors found that the non-cognitive skills used (locus of control and challenge-affiliation) explain about 8 percent of the gender wage gap (Semykina and Linz, 2007).

knowledge late in life, close to widowhood (Hsu, 2011). Looking at young people divided up by groups, (less than 29 years old), there is evidence of a gender gap for people aged between 23 and 28 years old, despite higher education levels and labour force participation of younger women (Lusardi *et al.*, 2011). This is also true among high school pupils (Goldsmith and Goldsmith, 1997; Chen and Volpe, 2002; Mandell, 2008; Ford and Kent, 2010; Luhrmann *et al.* (2015); Driva *et al.*, 2016) and university students (Mandell, 2008). Thus, despite the changes in the roles of women in society in many areas, literature is still documenting a gender gap in financial literacy.⁸ These findings point to the fact that gender differences are present at the start of the life cycle, since the previous works document a gender gap even among young people.

3. Data

The PISA programme conducted in 2012 includes an assessment of competence in financial literacy. Financial PISA begins with the specific purpose of assessing the literacy and financial abilities of 15-year-old students.⁹ The survey intends to measure financial knowledge through the scores in a test on financial topics.

Our study focuses on young people living in Spain. Students in the Financial PISA database are selected using a stratified process. Before randomly choosing students, schools are randomly chosen. Therefore, students belong to a higher level of aggregation: schools. At the first level, students provide personal details of themselves and their family. At the second level, head teachers provide information about the centre. The PISA database also provides comprehensive information on the type of high school in which they study. The database includes 1108 students distributed over 179 high schools.

Regarding students' information, on the one hand, they fill in a questionnaire about their social and family environment, their personal characteristics and their study habits. On the other hand, students answer questions that aim to assess their financial literacy knowledge and their attitudes or non-cognitive skills. Since the whole test has a great deal of questions, OECD (2013) establishes that "covering all variables would definitely go beyond the scope of time and space allocated for questionnaires in PISA. [...] To serve the intended multiple purposes,

⁸There are also studies showing that the framing of questions may be a potential explanation for the gender gap in financial literacy. Van Rooij *et al.* (2011) and Lusardi and Mitchell (2009) sustain that both errors in measurement and framing of questions may differ by gender, and also prove that women are more sensitive to changes in the wording of questions (Lusardi, 2012).

⁹See the technical notes on the PISA Financial Education programme for a more detailed description of the issues relating to the Financial Literacy PISA project.

and to prevent an increase in missing data, PISA introduces a rotation design for the student questionnaire, creating a number of different booklets". Each student is allocated one of the booklets, which includes a set of items that are randomly rotated among schools.

3.1. Financial Literacy Measurement: Dependent Variable

In terms of the measurement of financial literacy, evidence based on both objective and subjective indicators shows that women have less financial knowledge than their male counterparts. Objective indicators that include basic knowledge (Lusardi and Mitchell, 2011a), and more sophisticated questions (Van Rooij *et al.*, 2011; Lusardi and Mitchell, 2009; and Bucher-Koenen and Lusardi, 2011) reveal a gender gap in financial literacy in favour of men. In addition, subjective measures, which focused on self-assessed financial literacy, reflect that the mismatch between actual and self-reported knowledge is different for women and men. Specifically, women assign themselves lower scores than men (Bucher-Koenen and Lamla, 2014).

We rely on an objective measure of financial literacy which is the score obtained by students in the PISA Financial Literacy exam. The OECD divided the student questionnaire of financial literacy in four content areas: money and transactions, planning and managing finances, risk and reward, and financial landscape.¹⁰ For reporting student performance in this exam, the PISA methodology follows imputation methods (plausible values) from the results of the questionnaires. Therefore, the structure of PISA avoids the use of a traditional single value as a reference for the student's results, since a student only replies to a certain number of questions in the entire questionnaire. The replies, together with information on several variables in the questionnaire, yield a distribution of values to create a posteriori value for each individual. In total five values, which are called plausible values, are obtained from this distribution for each student. Plausible values are random draws from the marginal posterior of the latent distribution for each student.

The plausible value is a representation of the range of abilities that a student might reasonably have (Wu and Adams, 2002). PISA allocates the five plausible values to each student on each performance scale. Statistical analyses should be carried out independently for each of these five plausible values and results should be aggregated to obtain the final estimates of the scores and their respective standard errors.

Table 1 provides a detailed description of the PISA financial literacy scores. For Spain, gender differences in the results of the financial literacy exam are on average: 487.18 for boys and 481 for girls.¹¹

¹⁰The precise questions are not released by the OECD.

¹¹The averages for all the participant countries are 500 and 484.25 for boys and girls respectively.

Table 1: Descriptive Statistics of the Variables

Variable	Girls		Boys	
	Average	Standard Dev.	Average	Standard Dev.
Test score	481.004	4.276	487.18	4.296
Student characteristics				
Birth in the 1st. Semester	0.499	0.500	0.472	0.500
Birth in the 2nd. Semester	0.501	0.500	0.528	0.500
Repeated a year	0.174	0.379	0.284	0.451
Numeracy	0.358	0.480	0.368	0.483
Self-confidence	1.650	1.760	1.817	1.941
Positive perseverance	0.994	1.159	0.990	1.192
Negative perseverance	0.346	0.644	0.287	0.594
Motivation	0.633	0.482	0.595	0.491
Family characteristics				
Highly educated mother	0.289	0.454	0.28	0.45
Highly educated father	0.268	0.443	0.258	0.438
Lowly educated mother	0.352	0.478	0.342	0.475
Lowly educated father	0.405	0.491	0.350	0.478
Working mother	0.633	0.482	0.672	0.470
Working father	0.771	0.421	0.834	0.372
Above 25 books at home	0.782	0.413	0.747	0.435
E-book at home	0.143	0.351	0.152	0.359
High School characteristics				
Financial education available	0.157	0.364	0.142	0.349
Academic admission policy	0.071	0.257	0.080	0.272
Computers with Internet per child	0.577	0.374	0.596	0.370
State-sector school	0.639	0.481	0.638	0.481

Source: PISA database (2012).

Notes: Table 1 reports summary statistics for explanatory variables separately for women and men. Our empirical analyses are based on 523 observations for women and 585 for men. The values for self-confidence belong to the range between 0 and 5, for positive and negative perseverance the range is between 0 and 3, and between 0 and 2, respectively. Except for the computers with Internet per child, the rest of variables are binary variables.

3.2. Non-Cognitive Skills Measurement: Explanatory Variables

Individual characteristics focus not only on the conventional questions about the student, such as gender and birth date, but also on factors associated with the individual's personality or psychology, such as self-confidence, perseverance and motivation.

These non-cognitive skills reflect the emotional characteristics of the individual, which are determined by their own perception of themselves. We construct indices to measure non-cognitive skills by aggregating reported responses to various items that ask for personality traits and behaviours in the PISA financial literacy surveys.¹² Items measuring these

¹²See Appendix B for an explanation of the items used to build the non-cognitive variables and their location in the questionnaire.

traits and behaviours are rated on a four-point scale from “strongly disagree/not at all like me” to “strongly agree/very much like me.”

We construct categorical and dummy variables in order to measure three kinds of non-cognitive skills:

- a. Self-confidence: this variable is constructed by using information about solving problems. Students have to pick only one of the following choices: very much like me, mostly like me, somewhat like me, not much like me, not at all like me according to their identification with the following questions. Thus, we aggregate the answers to five statements into a categorical variable (1–5). The five statements under consideration, which define self-confidence, are “I can handle a lot of information”, “I am quick to understand things”, “I seek explanations for things”, “I can easily link facts together” and “I like to solve complex problems”. Given that the students trend to avoid answering questions about themselves with a negative connotation, we summarize each item’s information in the following way. The variable is categorical and increased by one; if the individual feels that, he or she has a high level of self-confidence (very much like me, mostly like me) and zero otherwise. Only students who clearly identify with the item positively are considered as self-confident people.
- b. Perseverance is also determined based on the information about solving problems. In particular, we construct two proxies, one positive and one negative according to the student’s identification with the following statements. For the negative proxy, the statements contain a negative connotation (i.e. “when confronted with a problem, I give up easily” and “I put off difficult problems”). For the positive proxy, the statements contain a positive connotation (i.e. “I remain interested in the tasks that I start”, “I continue working on tasks until everything is perfect”, and “when confronted with a problem I do more than what is expected of me”). For instance, the student who largely identifies with any of the concepts in the positive version is a student with a high degree of perseverance. By contrast, the student who largely identifies with the concepts in the negative version is associated with a low perseverance type. This variable takes the value 1 for each statement if the student highly identifies him/herself with the statement (very much like me, mostly like me) and 0 otherwise. The range of this positive proxy is between 0 and 3, while the range for the negative proxy is between 0 and 2.
- c. Motivation is determined based on the information contained in the classroom and school climate module. Students have to pick only one of the following choices according to their feelings: strongly agree, agree, disagree and strongly disagree. The statement to proxy motivation is

“trying hard at school is important”. This variable takes the value 1, if the student is highly motivated (strongly agree, agree) and zero otherwise.

All these variables are constructed taking into account that students are not prone to declaring the truth when a given statement has a negative connotation about their personal abilities. Thus, in order to minimize measurement errors, we only take into consideration the answers that more clearly identify the student (i.e. strongly agree and agree). Regarding the missing values derived from the choices “I don’t know” (DK) or “I don’t want to answer” (DA), they are treated as lacking the quality under consideration when creating the explanatory variables for non-cognitive skills. This is a valid approach when answers to the questions represent the person’s view, so there is no one correct or expected answer. In this case, the DK/DA responses contain relevant information for our set of variables of interest, the non-cognitive skills. In particular, they can be considered as a sign of weak self-confidence, persistence and motivation. Bucher-Koenen *et al.* (2011) argue that “do not know” responses reflect not simply lack of knowledge but lack of confidence. In the sample, the DK/DA cases in the non-cognitive skill variables are relatively small. This procedure also helps to identify more clearly the feature behind the three non-cognitive skills, taking the respondents who identify with this concept, without hesitation, and clearly dividing this group off from the rest.

Constructing the variables in this way also avoids skewing the influence of the weightings in the estimates. Deriving from the two-stage sampling, weights are associated with each student and each school because students and schools in a particular country do not necessarily have the same probability of selection. Differential participation rates, according to certain types of school or student characteristics, required various non-response adjustments; and some explicit strata were over-sampled for national reporting purposes (OECD, 2009, 2012). Interpreting the variables where the information on the individuals is not complete is different from the conventional interpretation.

Table 1 shows that the levels of perseverance are relatively low in general. In its positive format, it is close to a third of its maximum value (0.994 for girls and 0.990 for boys out of 3); and above 15 per cent in its negative version (0.346 for girls and 0.287 for boys out of 2). The level of self-confidence is lower (1.650 for girls and 1.817 for boys out of 5) and the variable for motivation is near 60 per cent of its corresponding maximum (0.633 for girls and 0.595 for boys out of 1).

3.3. Cognitive Skills, Socioeconomic and School Characteristics: Other Explanatory Variables

To identify cognitive skills, we incorporate variables based on academic performance in the past and numeracy skills (Christelis *et al.*,

2010). The use of lagged variables to control cognitive skills avoids reverse causality problems due to the relationship between this variable and our dependent variable. Only 20 per cent of students claim to have repeated a year in the middle years of primary school, and 36 per cent of the respondents indicate good grades in mathematics.

Table 1 shows that the number of boys and girls is similar, (around 53 per cent of individuals are boys and 47 per cent are girls). Dates of birth are evenly distributed across the year. Family characteristics reveal that around 27 per cent of parents have university-level education, while around 36 per cent left high school at 15 or 16. Nearly 7 out of 10 students have a mother working outside the home, and the figure rises to eight in the case of the father. The variable for the number of books in the household tries to measure the taste for reading in the household. Only 36 per cent of students claim to have more than 25 books at home.¹³ E-books also represent the taste for reading and the household's socio-economic status.

Regarding high schools, 64 per cent of the students in the database go to state schools. Only a very small proportion of students are at a high school where access is based on academic merit (below 8 per cent). The ratio of computers with internet access per student is around 0.6. Finally, it is interesting to note that only 15 per cent of schools provide some kind of specific financial education programme.

4. Econometric Strategy

Our estimation process aims to control for the two levels of information mentioned above, students and schools, by including the weights associated with each level. PISA applies a two-stage sampling instead of a simple random sampling, because selected students within a school usually have more common characteristics than students from different schools, so they cannot be considered as independent observations.

This nested system in PISA does not allow the application of conventional linear regression analysis, since students at the same high school share characteristics with their peers. In this context, the classic assumption in regression models—independence of observations—disappears. We carry out estimations based on a multilevel analysis, in which a hierarchy structure is considered. We distinguish between two levels of information. The first level accounts for students and the second level for schools.

¹³This variable aims to pin down structural sociocultural variations rather than trends. For this reason, this variable is included in our regressions as well as the availability and use of electronic books (e-books) at home.

Following the methodology explained in OECD (2009, 2012), the student questionnaire on financial literacy is divided into four content areas: money and transactions, planning and managing finances, risk and reward, and financial landscape. Our dependent variable is defined by the results obtained by the student in financial competence tests, as explained in the previous section.

The five plausible values associated with the test score must be used in the estimation process in order to avoid problems associated with biases and inefficiency (OECD, 2009, 2012). To control for these properties, PISA's database provides eighty replicates of individual weightings, which allow efficient estimators. The use of replicates is necessary in order to take into account the way students are selected in the PISA sample.

In our multilevel analysis, students' results depend on their personal and family characteristics, as well as on the characteristics of the high school. We estimate the following multilevel mixed-effects linear regression model by maximum likelihood, using robust variance-covariance estimates. Bearing in mind that the observations are nested, this type of model allows the inclusion of fixed effects and random effects.

The overall model is expressed as follows (Laird and Ware, 1982):

$$Y_j = X_{1j}\beta_1 + X_{2j}\beta_2 + Z_j\gamma_j + \varepsilon_j$$

$$\varepsilon = [\varepsilon_j]_{j=1, \dots, 179}, \quad \varepsilon \sim N(0, \sigma_\varepsilon^2 \Sigma_\varepsilon)$$

where $\gamma = [\gamma_j]_{j=1, \dots, 179}$ has a matrix of variances and covariances Σ_γ and this vector is orthogonal to ε .

Let the dependent variable Y_{ij} be the (expected) educational result of the student i at the high school j ($j = 1, \dots, 179$, where each school includes n_j students in the sample). These results are aggregated in a column vector, Y_j , which includes all the results of the exam ($Y_j = [Y_{ij}]_{i=1, \dots, n_j, j=1, \dots, 179}$).

Vector X represents the characteristics associated with the student, and is divided into two subgroups (X_1, X_2). X_1 represents the non-cognitive skills and contains the following variables: self-confidence, positive perseverance, negative perseverance and motivation. The remaining characteristics of the student are included in the vector X_2 . It includes personal characteristics, such as gender, birth date (divided into two options: birth in the first semester of the year or in the second semester of the year) and cognitive skills (information contained in the variable of having repeated a course in previous years and the variable that measures numeracy). Family characteristics include the educational level of the parents, and whether or not they work outside the home. Finally, we control for the number of books and e-books within the household. The inclusion of

family variables is justified in the results shown by Villar (2013) and García-Montalvo (2013). According to these authors, the distribution of students with poorer results is uneven between social groups and they experience significant difficulties in social progress. Moreover, the family environment is confirmed as a factor that needs to be taken into account in the estimation process (Lusardi *et al.*, 2010; Lusardi and Mitchell, 2013).

Vector Z contains characteristics relating to high schools (identical for all the students in each high school), in order to control for the composition effects or group effects stemming from the high school itself. The effects of these variables are estimated with random effects.

The parameter vectors β_1 , β_2 and γ contain the coefficients associated with the independent variables. The fixed effects are represented by β_1 and β_2 , and the random effects, at high school level, are represented by γ .¹⁴

5. Empirical Results

Table 2 shows the results of the estimates. We have four different models whose endogenous variable represents the scores in the financial literacy test. We use this variable to represent the degree of financial literacy of students. Statistics of individual significance are in brackets and the asterisks denote conventional levels of significance.

Models 1 to 3 are estimated with fixed effects and include individual and family characteristics. Model 4, which controls for the high school characteristics, is estimated with random effects.

We start from a base model, Model 1, in which we control for individual characteristics, such as gender and semester of birth, and for cognitive skills that may influence financial literacy. Cognitive aspects include information about whether the student has repeated a year or not, and information as to whether the student has good numeracy skills (having good grades in mathematics). This controls for the potential synergies between numeracy abilities and financial literacy.¹⁵

In line with the literature, we find a gender gap in favour of boys. Thus, girls with similar characteristics to boys score 12.8 points less on average in the financial literacy exam. Variables to proxy cognitive skills are both significant and have the expected sign. We also find a sizeable and positive maturity effect, comparing students who were born in the first and second semester of the year. The latter group of students achieves nearly eight

¹⁴Given the specific conditions of the sample, we carry out the estimates following the indications of the OECD (2009) to obtain accurate estimates and standard deviations.

¹⁵In order to prevent endogeneity in our model, we do not use the scores in reading and maths exams since the direction of causality of these variables is not clear.

Table 2: Financial Education Among the Young: The Case of Spain

Variables	Model 1	Model 2	Model 3	Model 4
Self-confidence			11.10*** (6.71)	11.30*** (6.78)
Positive perseverance			−5.06** (−2.22)	−5.51** (−2.35)
Negative perseverance			−14.18*** (−3.65)	−14.10*** (−3.67)
Motivation			5.98 (0.94)	6.42 (1.03)
Girl	−12.81** (−2.33)	−13.79** (−2.52)	−10.67* (−2.01)	−10.56* (−1.98)
2nd. Semester	−7.54** (−1.55)	−8.93** (−1.97)	−7.75* (−1.71)	−7.81* (−1.71)
Repeated a year	−71.64*** (−11.57)	−58.77*** (−9.39)	−57.03*** (−9.14)	−56.71*** (−9.19)
Numeracy	12.29** (2.46)	11.42** (2.32)	9.96* (1.76)	9.46* (1.68)
Highly educated mother		10.04 (1.10)	7.93 (0.86)	7.53 (0.81)
Lowly educated mother		5.50 (0.75)	8.42 (1.10)	8.61 (1.13)
Highly educated father		16.94* (1.85)	20.18** (2.30)	19.76** (2.27)
Lowly educated father		−3.74 (−0.47)	−1.60 (−0.21)	−1.50 (−0.19)
Highly educated parents		−16.17 (−1.12)	−18.43 (−1.31)	−18.14 (−1.31)
Lowly educated parents		−7.77 (−0.71)	−9.49 (−0.85)	−9.90 (−0.89)
Working mother		9.72 (1.65)	6.57 (1.15)	6.31 (1.11)
Working father		1.90 (0.26)	4.05 (0.58)	4.16 (0.60)
Above 25 books at home		49.02*** (6.84)	40.85*** (5.58)	40.44*** (5.50)
E-book at home		−1.49 (−0.20)	−2.11 (−0.32)	−1.22 (−0.18)
Constant	509.50*** (82.10)	460.35*** (37.54)	450.65*** (34.72)	453.11** (35.12)
Random effects	No	No	No	Yes
Students	1108	1108	1108	1108
Schools	179	179	179	179

Source: PISA (2012) database.

Notes: Table 2 reports the estimated effect of the explanatory variables on the test score in PISA Financial Literacy. Model 1 includes individual characteristics; Model 2 incorporates individual and family characteristics; Model 3 takes into account all student characteristics (individual, family and non-cognitive characteristics); and Model 4 includes student characteristics and random effects from school characteristics. Robust standard errors are given in parentheses. ***, **, * denote significance at the 1, 5, and 10 per cent level, respectively

points less than the students in the reference group (who are students born in the first semester).

In Model 2, we also control for the family context by including information about parents' educational level, parents working outside the home, the tastes in reading in the family environment, (which is approximated taking into account the number of books at home), and the existence and use of e-books. All the variables have the expected sign, although not all are statistically significant. It is interesting to note that having more than 25 books in the household is significant and it is of greater importance compared to the rest of the variables. Those students claiming to have more than 25 books at home score nearly 50 points more than the rest in the exam. Having a large number of books at home reflects a taste for reading that might be because of parental interest in their children's education and other aspects related to social status. However, having an e-book is a non-significant variable. Regarding the variables related to the family's educational level, only the father's education (when it is high) has a significant effect.

In Model 3, we introduce the variables of interest, related to non-cognitive skills (i.e. personal psychology and emotions). As we observe, perseverance and self-confidence are significant at conventional levels but this is not true for motivation. The gender gap decreases once controlled for the non-cognitive skills. Particularly, the estimate for the effect of gender is 22 per cent lower than those obtained in the previous specifications. The significance level of this binary variable also is lower. This evidence points to the hypothesis that non-cognitive skills also affect performance in the financial literacy test, and helps to explain part of the gender gap in financial literacy.

Self-confidence is significant and has a sizeable effect on the test's results. Those students who have a high degree of self-confidence score more than 55 points ($11.10 \times 5 = 55.5$), on average, than identical schoolmates. Only the magnitude associated with the effect of having repeated a year in the first phase of secondary education is higher (-57.0). This information discriminates among students who may have poor cognitive skills or other significant problems. Our results are in line with Bucher-Koenen *et al.* (2012), who attribute gender differences to a problem of self-confidence in financial issues, which also differs by gender.

The variable, which measures perseverance in a negative sense, has the expected sign and its effect on the test grade is important (over 28 points, $2 \times 14.18 = 28.36$). However, perseverance in its positive form results in a direction, which in principle appears unexpected, but can be justified by the psychology theory. This variable (positive perseverance) may be reflecting issues such as the perverse effects of perfectionism, which could lead to irrational behavioural patterns (Bénabou and Tirole, 2002, 2003).¹⁶ Another possible explanation may be the fact that the percentage of individuals who claim to largely identify with statements denoting this quality is comparatively higher than for the negative

perseverance variable. They represent between 25 per cent and 35 per cent of the total sample for positive perseverance, compared to 11 per cent for negative perseverance. An alternative explanation is given by the overestimation of an individual's own abilities (Akerlof and Dickens, 1982; Bénabou and Tirole, 2002).

Finally, the lack of significance of motivation may be due to a weak definition of this variable since a single item defines motivation and there may be difficulties in capturing this feature.

To reinforce the robustness of our results, we include random effects associated with the characteristics of the high school. Model 4 illustrates the specification in Model 3, together with the variables referring to the high school, which enter the model via random effects. Neither the magnitude of the fixed effects coefficients nor their significance show major changes from the results in Model 3.

6. Conclusions and Policy Implications

The empirical literature documents that gender differences in financial literacy are persistent and widespread. Observed gender differences in financial literacy are present not only among adults but also among young people. Traditional explanations, based on socioeconomic characteristics and cognitive skills cannot fully account for the observed male/female knowledge gap. We focus on young people to study factors behind the gender gap in financial literacy at early stages of life. This paper tries to shed some light on the causes of the gender gap in financial literacy by focusing on the differences between 15-year old boys and girls in their non-cognitive skills. We test whether such skills have a different impact on the financial literacy results from the start of the life cycle.

We find that self-confidence is significant and has a sizeable effect on the test's results. Those students who have a high level of self-confidence score considerably above identical schoolmates. In addition, perseverance taken to extremes can generate irrational behaviour, giving rise to poorer results. In addition, non-cognitive skills in the specification of our models reduces the gender gap in financial literacy by more than 20 per cent.

¹⁶Also, the positive self-qualification of individual work capacity and perfection may hide the intention of giving positive messages off about him/herself (despite the anonymity of the test) or the person's own overestimation of their successful experiences as against the negative ones (cognitive dissonance). Our hypothesis is that there may be some kind of decreasing return to scale in this variable, which means that high levels of persistence lead to worse results. Persistence taken to extremes can generate irrational behaviour, giving rise to poorer results. To control for this hypothesis, we include non-linear specifications in our models. However, we are not able to capture this feature. Results are available upon request.

A part of the documented gender gap remains unexplained. This is particularly worrisome because women need to deal with specially challenging circumstances. Women have different savings needs because they tend to live longer than men, have shorter working lives (i.e. women have less of an attachment to the labour market, with interrupted careers because of maternity), have lower wages than men and are likely to spend part of their retirement as widows. Thus, women are at risk of having inadequate retirement resources and of living their final years in poverty. Women are more likely to make important and daily decisions about the allocation of household resources. In addition, they are likely to take primary responsibility for childrearing and to have a major role in the transmission of financial habits and skills to their children. In this context, increasing financial education is needed not only to improve women's management of their personal and household finances, but also to empower them to choose and access appropriate financial services and products, as well as to develop and manage entrepreneurial activities.

Evidence on the role of non-cognitive skills should be taken into account for policymakers to both increase financial literacy and reduce the gender gap. Policies should be designed bearing in mind that cognitive skills alone do not explain an individual's financial decision-making, but are only part of the story.

REFERENCES

- J. R. AGNEW – H. BATEMAN – S. THARP (2013), “Financial Literacy and Retirement Planning in Australia”, *Numeracy*, 6 (2).
- G. AKERLOF – W. DICKENS (1982), “The Economic Consequences of Cognitive Dissonance”, *American Economic Review*, 72, pp. 307–319.
- J. ALMENBERG – J. SÄVE-SÖDERBERGH (2011), “Financial Literacy and Retirement Planning in Sweden”, Netspar Discussion Paper No 01/2011-018.
- M. ALMLUND – A. L. DUCKWORTH – J. J. HECKMAN – T. D. KAUTZ (2011), *Personality Psychology and Economics*, NBER Working Paper, No. 16822. Cambridge, MA: National Bureau of Economic Research.
- A. ARELLANO – N. CÁMARA – D. TUESTA (2014), “The Effect of Self-Confidence on Financial Literacy”. BBVA Research Working Paper, N° 14/28, October 2014, Madrid.
- L. ARRONDEL – M. DEBBICH – F. SAVIGNAC (2013), “Financial Literacy and Financial Planning in France”, *Numeracy*, 6 (2).
- R. BÉNABOU – J. TIROLE (2002), “Self-Confidence and Personal Motivation”, *The Quarterly Journal of Economics*, 117 (3), pp. 871–915.
- R. BÉNABOU – J. TIROLE (2003), “Intrinsic and Extrinsic Motivation”, *The Review of Economics Studies*, 70 (3), pp. 489–520.
- T. BUCHER-KOENEN – A. LUSARDI – R. ALESSIE – M. VAN ROOIJ (2012), How Financially Literate are Women? Some New Perspectives on the Gender Gap”, Netspar Panel Paper, No. 31.
- T. BUCHER-KOENEN – A. LUSARDI (2011), “Financial Literacy and Retirement Planning in Germany”, *Journal of Pension Economics & Finance*, 10 (4), pp. 565–584.
- T. BUCHER-KOENEN – B. LAMLA (2014), The Long Shadow of Socialism: On East-West German Differences in Financial Literacy. Max Planck Institute for Social Law and Social Policy Discussion Paper No. 282-14
- D. CHRISTELIS – T. JAPPELLI – M. PADULA (2010), “Cognitive Abilities and Portfolio Choice”, *European Economic Review*, 54 (1), pp. 18–38.
- G. CONTI – J. HECKMAN – S. URZÚA (2010), “The Education-Health Gradient” *American Economic Review*, 100 (2), pp. 234–238.
- G. CONTI – J. HECKMAN – S. URZÚA (2011), Early Endowments, Education and Health”. Human Capital and Economic Opportunity Working Group Working Paper 2011 011–University of Chicago.
- D. CROSSAN – D. FESLIER – R. HURNARD (2011), “Financial literacy and retirement planning in New Zealand”, *Journal of Pension Economics and Finance*, 10 (4), pp. 619–635.
- F. CUNHA – J. HECKMAN (2007), “The Technology of Skill Formation”, *American Economic Review*, 97 (2), pp. 31–47.
- F. CUNHA – J. HECKMAN (2008), “Formulating, Identifying and Estimating the Technology of Cognitive and Noncognitive Skill Formation”, *Journal of Human Resources*.
- F. CUNHA – J. HECKMAN – S. SCHENNACH (2010), “Estimating the Technology of Cognitive and Noncognitive Skill Formation”, *Econometrica*, 78 (3), pp. 883–931.

- A. DRIVA – M. LUHRMANN – J. WINTER (2016), “Gender Differences and Stereotypes in Financial Literacy: Off to an Early Start?”, *Economics Letters*, 146, pp. 143–146.
- A. L. DUCKWORTH – P. D. QUINN – D. LYNAM – R. LOEBER – T. MOFFIT – A. CASPI (2010), What Intelligence Tests Test: Individual Differences in Test Motivation and IQ.” Unpublished Manuscript, University of Pennsylvania.
- H. EKLOF (2007), “Test-taking Motivation and Mathematics Performance in TIMSS 2003”, *International Journal of Testing*, 7 (3), pp. 311–327.
- U. FILIPIAK – Y. M. WALLE (2015), The Financial Literacy Gender Gap: A Question of Nature or Nurture? (No. 176). Courant Research Centre: Poverty, Equity and Growth-Discussion Papers.
- R. FONSECA – K. J. MULLEN – G. ZAMARRO – J. ZISSIMOPOULOS (2012), “What Explains the Gender Gap in Financial Literacy? The Role of Household Decision Making”, *Journal of Consumer Affairs*, 46 (1), pp. 90–106.
- M. W. FORD – D. W. KENT (2010), “Gender Differences in Student Financial Market Attitudes and Awareness: An Exploratory Study”, *Journal of Education for Business*, 85 (1), pp. 7–12.
- N. M. FORTIN (2008), “The Gender Wage Gap Among Young Adults in the United States: The Importance of Money Versus People”, *Journal of Human Resources*, 43 (4), pp. 884–918.
- J. GARCÍA MONTALVO (2013), “Crisis, igualdad de oportunidades y resultados educativos: una comparación temporal de pisa con los resultados de 2012 en España”, in INEE (Ed.), PISA 2012: Programa para la evaluación internacional de los alumnos. Informe español. Volumen II: Análisis secundario. Madrid, 2013.
- E. GOLDSMITH – R. E. GOLDSMITH (1997), “Gender Differences in Perceived and Real Knowledge of Financial Investments”, *Psychological Reports*, 80 (1), pp. 236–238.
- A. GROHMANN – O. HÜBLER – R. KOUWENBERG – L. MENKHOFF (2016), Financial Literacy: Thai Middle Class Women Do Not Lag Behind”. DIW Discussion Paper 1615.
- L. HADAR – S. SOOD – C. R. FOX (2011), It’s Not Only What You Know But Also How Knowledgeable You Feel: Subjective Knowledge in Consumer Financial Decisions. AP-Asia-Pacific Advances in Consumer Research Volume 9.
- E. A. HANUSHEK – G. SCHWERDT – S. WIEDERHOLD – L. WOESSMANN. (2013), Returns to Skills Around the World—Evidence From PIAAC. Working Paper 19762. Cambridge, Mass.: National Bureau of Economic Research.
- J. J. HECKMAN – T. KAUTZ. (2011), Fostering and Measuring Skills—Interventions That Improve Character and Cognition. Working Paper 19656. Cambridge, Mass.: National Bureau of Economic Research.
- J. J. HECKMAN – J. E. HUMPHRIES – G. VERAMENDI – S. URZÚA (2014), “Education, health and wages”. NBER working paper 19971.
- H. C. HSU (2011), “Gender Disparity of Successful Aging in Taiwan”, *Women & Health*, 42 (1), pp. 1–21.
- L. KLAPPER – G. A. PANOS (2011), “Financial Literacy and Retirement Planning: the Russian Case”, *Journal of Pension Economics and Finance*, Cambridge University Press, 10 (04), pp. 599–618.
- R. LEVINE (2012), “The Governance of Financial Regulation: Reform Lessons from the Recent Crisis”, *International Review of Finance*, 12 (1), pp. 39–56.

- N. M. LAIRD – J. H. WARE (1982), “Random-Effects Models for Longitudinal Data”, *Biometrics*, 38, pp. 963–974.
- M. LUHRMANN – M. SERRA-GARCIA – J. WINTER (2015), “Teaching Teenagers in Finance: Does It Work?”, *Journal of Banking and Finance*, 54, pp. 160–174.
- A. LUSARDI – O. S. MITCHELL (2008), “Planning and Financial Literacy: How Do Women Fare?”, *American Economic Review Pap Proc*, 98 (2), pp. 413–417.
- A. LUSARDI – O. MITCHELL (2009), “How Ordinary Consumers Make Complex Economic Decisions: Financial Literacy and Retirement Readiness”, NBER Working Paper, No. 15350. Cambridge, MA: National Bureau of Economic Research.
- A. LUSARDI – O. S. MITCHELL – V. CURTO (2010), Financial Literacy Among the Young: Evidence and Implications for Consumer Policy”, CFS Working Paper, No. 2010/09, Center for Financial Studies, Goethe-Universität Frankfurt.
- A. LUSARDI – O. S. MITCHELL (2011), “Financial Literacy and Retirement Planning in the United States”, *Journal of Pension Economics and Finance*, 10 (4), pp. 509–525.
- A. LUSARDI (2012), Numeracy, financial literacy, and financial decision-making (No. w17821). National Bureau of Economic Research.
- L. MANDELL (2008), *Financial Education in High School. Overcoming the Saving Slump: How to Increase the Effectiveness of Financial Education and Saving Programs*. Chicago, IL: University of Chicago Press, pp. 257–279.
- E. K. NYHUS – E. PONS (2012), “Personality and the Gender Wage Gap”, *Applied Economics*, 44 (1), pp. 105–118.
- OECD (2009). “PISA Data Analysis Manual: SPSS Second Edition”. OECD. Paris. ISBN: 978-92-64-05626-8.
- OECD (2012). “PISA 2009 Technical Report”. PISA. OECD Publishing. Paris. <https://doi.org/10.1787/9789264167872-en>.
- OECD (2013). “PISA 2012 Assessment and Analytical Framework: Mathematics, Reading, Science, Problem Solving and Financial Literacy”. OECD Publishing. <https://doi.org/10.1787/9789264190511-en>.
- S. SEKITA (2011), “Financial Literacy and Retirement Planning in Japan”, *Journal of Pension Economics & Finance*, 10 (4), pp. 637–656.
- A. SEMYKINA – S. J. LINZ (2007), “Gender Differences in Personality and Earnings: Evidence from Russia”, *Journal of Economic Psychology*, 28, pp. 387–410.
- N. TOGNATTA – A. VALERIO – M. L. SANCHEZ PUERTA (2016), “Do Cognitive and Noncognitive Skills Explain the Gender Wage Gap in Middle-Income Countries? An Analysis Using STEP data.” Policy Research Working Paper 7878. World Bank.
- M. VAN ROOIJ – A. LUSARDI – R. ALESSIE (2011), “Financial Literacy and Stock Market Participation”, *Journal of Financial Economics*, 101 (2), pp. 449–472.
- A. VILLAR (2013), “Rendimiento, esfuerzo y productividad: Análisis de los resultados en matemáticas de los estudiantes españoles según PISA (2012)”, in INEE (Ed.), *PISA 2012: Programa para la evaluación internacional de los alumnos. Informe español. Volumen II: Análisis secundario*. Madrid, 2013.
- M. L. WU – R. J. ADAMS (2002), “Plausible Values: Why They are Important”. Paper Presented at the International Objective Measurement Workshop, New Orleans, LA.

Non-technical Summary

Economic literature points out that there is a gender gap in financial literacy and claims that boys and girls have differing ways of acquiring financial literacy. This paper tests to what extent this gender gap is due to real differences or it is a misspecification problem of econometric models. Our estimates show that part of the gender gap (20 per cent) disappears when the model includes the effect of non-cognitive skills (i.e. motivation, self-confidence and perseverance). However, there is still a part of differences between boys and girls in financial literacy that remains unexplained. The data covers 15-year-old students in Spain and come from PISA Financial Literacy tests (OECD).

A. Appendix: Variable definitions

Table A.1: Description of the Variables

Student: St Questionnaire PISA 2012

Test score	PV1FLIT- PV5FLIT		Combination of plausible values in Financial Literacy
Girl	ST04	Q4-Form A,B y C	Dummy: 1 if the student is a girl and 0 otherwise
Birth in the 1st. Semester	ST03Q01	Q3-Form A, B, C	Dummy: 1 if the student was born between January and June and 0 otherwise
Birth in the 2nd. Semester	ST03Q01	Q3-Form A, B, C	Dummy: 1 if the student was born between July and December and 0 otherwise
Repeated a year	ST07Q02	Q7-Form A, B, C	Dummy: 1 if the student repeated a year in the first phase of secondary education and 0 otherwise
Numeracy	ST42Q04	Q44-Form B	Dummy: 1 if the student claims to have good grades in mathematics and 0 otherwise
Self-confidence	ST94Q05, Q06, Q09, Q10, Q14	Q51-Form B	Discrete quantitative variable – Self- confidence
Positive Perseverance	S93Q04, 06, 07	Q28-Form A	Discrete quantitative variable – Positive Perseverance
Negative Perseverance	S93Q01, 03	Q28-Form A	Discrete quantitative variable – Negative Perseverance

continued

Table A.1: Continued

Motivation	S89Q04	Q39-Form B	Dummy (1/0) Motivation
Family: St Questionnaire PISA 2012			
Highly educated mother	ST14Q01, Q02, Q03	Q15-Form A, B, C	Dummy: 1 if the mother has tertiary education and 0 otherwise
Highly educated father	ST18Q01, Q02, Q03	Q20-Form A, B, C	Dummy: 1 if the father has tertiary education and 0 otherwise
Lowly educated mother	ST13Q01	Q15-Form A, B, C	Dummy: 1 if the mother completed first phase of secondary education or less and 0 otherwise
Lowly educated father	ST19Q01	Q20-Form A, B, C	Dummy: 1 if the father completed first phase of secondary education or less and 0 otherwise
Working mother	ST15	Q16-Form A, B, C	Dummy: 1 if the mother works outside the home and 0 otherwise
Working father	ST19	Q21-Form A, B, C	Dummy: 1 if the father works outside the home and 0 otherwise
Above 25 books at home	ST28Q01	Q27-Form A, B, C	Dummy: 1 if there are more than 25 books in the student's home and 0 otherwise
E-book at home	IC01Q11		Dummy: 1 if there is an ebook reader in the student's home and it is used by the student and 0 otherwise
High School: Sc Questionnaire PISA 2012			
Financial education available	SC47		Dummy: 1 if the high school offers financial education courses and 0 otherwise
Academic admission policy	SC32Q01		Dummy: 1 if the high school has an academic admission policy and 0 otherwise
Computers with Internet per child	SC11Q03/ SC11Q01		Ratio of computers with internet access per child
State-sector school	SC01		Dummy: 1 if the high school is state-sector and 0 otherwise
Source: PISA database (2012)			

B. Appendix: Explanatory non-cognitive variables

Non-cognitive variables are included in following blocks:

Self-confidence

PROBLEM SOLVING EXPERIENCES:

Please tick only one box in each row: Very much like me, mostly like me, somewhat like me, not much like me, not at all like me.

Q62 (ST94). How well does each of the following statements below describe you?

Options	Sense of the option
a) I can handle a lot of information.	Positive
b) I am quick to understand things.	Positive
c) I seek explanations for things.	Positive
d) I can easily link facts together.	Positive
e) I like to solve complex problems.	Positive

Perseverance

PROBLEM SOLVING EXPERIENCES:

Please tick only one box in each row: Very much like me, mostly like me, somewhat like me, not much like me and not at all like me.

Q61 (ST93). How well does each of the following statements below describe you?

Options	Sense of the option	Variable
a) When confronted with a problem, I give up easily.	Negative	Negative
b) I put off difficult problems.	Negative	Perseverance
c) I remain interested in the tasks that I start.	Positive	Positive
d) I continue working on tasks until everything is perfect.	Positive	Perseverance
e) When confronted with a problem, I do more than what is expected of me.	Positive	

Motivation

CLASSROOM AND SCHOOL CLIMATE:

Please tick only one box in each row: strongly agree, agree, disagree and strongly disagree.

Q59 (ST89). Thinking about your school: to what extent do you agree with the following statements?

Options	Sense of the option
d) Trying hard at school is important.	Positive