THE MULTIDIMENSIONAL DRIVERS OF FINANCIAL LITERACY OF ITALIAN STUDENTS

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Abstract
The globally integrated nature of modern economies has increased the complexity of the socio-economic context, particularly with reference to economic and financial issues. Individuals are increasingly required to make financial decisions, such as saving for retirement, expenditure on education and health, or buying a home, with the consequence that financial literacy is becoming an increasingly important and frequently investigated determinant of human capital formation and development. Given the importance of financial knowledge in modern society, the aim of this paper is to assess the determinants of financial literacy among Italian students using data from the 2012 Programme for International Student Assessment (PISA) survey. A structural equation approach is adopted in order to explore not only the direct effect of family socio-economic background on the students’ financial competences, but also its indirect effect, when student’s motivations and attitudes are considered as mediator factors. The findings are intended to provide useful insights for policy makers in order to develop specific initiatives to improve the level of financial knowledge among the young people.

Keywords: financial literacy, structural equation model, openness to problem solving, math self-efficacy.

1 INTRODUCTION
Individuals are increasingly required to make financial decisions, such as saving for retirement, expenditure on education and health, or buying a home, with the consequence that financial literacy is becoming an increasingly important and frequently investigated determinant of human capital formation and development. A widespread literature has highlighted the relationship between financial literacy and household’s economic and financial wellbeing. Indeed, individuals with high level of financial skills are able to make better decision regarding to savings and retirement planning ([1], [2]), wealth accumulation ([3]), mortgages ([4]) and stock market participation ([5]). This issue can also be inserted within a broader debate on economic growth. Indeed, the improvement of students’ financial knowledge is essential for a better participation in modern society ([6]) that can generate positive beneficial for the economy and society as a whole ([7]). Even though most financial decisions are made by adults, "people should be educated about financial matters as early as possible in their lives" ([8]). Financial education should begin in the earliest stages of life, in order to provide students with the skills needed to make conscious financial choices in adulthood when they will deal with increasingly complex financial products and services. In this light, we aim to disentangling the process of financial skills development focusing on the financial knowledges of Italian 15 years old students by exploiting the huge amount of OECD (Organisation for Economic Co-operation and Development) PISA (Program for International Students assessment) data. Our analysis is closely connected with research into the determinants of educational production. In this framework, financial skills are described as output of an education production process in which the effects of several factors at individual, familiar and scholastic level interact with each other. The starting point of our research is the multidimensional concept of financial literacy which encompasses, as defined by OECD, 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 view, we try to evaluate the complex pattern of relationships between financial literacy and the combination of students’ socio-economic status with motivational and attitudinal factors, specifically, openness to problem solving and students’ attitudes towards mathematics. Particularly, we want to explore not only the direct, and well-noted, effect of family socio-economic background on the financial score, but also its indirect effect (mediation) on financial score.
From a theoretical point of view, some reasons have led to choose openness to problem solving and students’ attitudes towards mathematics as the main drivers of the process of financial skills development. First, it should be noted that the Italian educational system do not provide financial education in any institutional curriculum, consequently, the students have to acquire the financial competences outside the school from “external” sources such as the family environment, the personal interest and motivation. Second, previous literature from behavioural psychology has noted a significant link between personality traits and financial literacy ([9]). In particular, PISA results show an association between students’ financial literacy and their openness towards problem solving ([10]). Last, several studies shows the importance of mathematical skills and confidence ([6], [11]) as strong predictors of financial competences. This finding is supported by PISA data which shows high correlation level between math and financial scores obtained by Italian students (0.73). In addition, as highlighted by OECD ([10]), the resolution of many PISA financial questions requires the use of mathematical-like instruments. On the basis of this conceptual framework, the analysis aims to assess how students’ individual traits influence the level of financial skills interacting with each other and at the same time, mediating the effect of students’ socio economic background.

A structural equation modeling approach (SEM), also known as latent variable modelling, was used to model latent variables, such variables can be only measured indirectly by a set of observed indicators. The analysis of these relationships can 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. The remainder of this paper is organized as follows. The next section discusses the PISA data, particularly the results for Italian students, and the variables used in the analysis. The methodology is described in Section 3. Sections 4 reports the empirical results from the structural equation model. Section 5 presents the conclusions.

2 DATA AND VARIABLES

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 countries have the knowledge and skills that are essential to make financial decisions and plan for their futures. The PISA results provides an overall picture of students’ ability to apply their accumulated knowledge and skills to real-life situations involving financial issues and decisions. A complete definition of financial literacy is given by the 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”.

Like other PISA domains, financial literacy assessment is designed to provide a rich set of comparative data that policy makers and other stakeholders can use to make evidence-based decisions. 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).

Overall, Italy’s performance in financial literacy is lower than might be expected based on students’ scores in mathematics and reading ([10]). 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 ([10]).

1 On average across the 13 OECD countries participating to PISA financial assessment, the correlation between financial literacy and mathematics is 0.83.
In the light of these considerations, our analysis focused on assessing the determinants of financial literacy among Italian students. Particularly we aim to evaluate if the influence of students’ socio-economic status (SES) always remains significant when we consider the impact of motivational and attitudinal variables, specifically, openness to problem solving and students’ attitudes towards mathematics.

Starting from the seminal work of Coleman et al. ([12]), there is a widespread consensus on the role of SES in determining educational achievement. In our analysis, we use the ESCS (economic, social and cultural status) summary indicator provided by the OECD to account for the effects of socioeconomic background. By construction, this indicator has an OECD mean of zero and a standard deviation of one, and it captures students’ family and home characteristics (i.e., possession of goods, parents education and occupation) that describe their socio-economic background.

Focusing on motivational and attitudinal factors, there is no well recognized measure of these variables, because they are abstract construct that cannot be directly measured. For this reason we use a set of observed indicators that capture different aspects of the openness to problem solving and mathematics attitudes. So, the openness to problem solving and math self-efficacy are treated as a latent variables, whose values are not observable.

In PISA the term “Mathematics Self-Efficacy” (M_ATT) is the extent to which students believe in their own ability to handle mathematical tasks effectively and overcome difficulties. According to Bandura’s ([13]) social cognitive theory, it is defined as an individual’s beliefs or perceptions with respect to his or her abilities in mathematics. In other words, an individual’s mathematics self-efficacy is his or her confidence about completing a variety of tasks, from understanding concepts to solving problems, in mathematics. Mathematic Self-efficacy, in general, has been linked with motivation. It has been well established that students with higher levels of self-efficacy tend to be more motivated to learn than their peers and are more likely to persist when presented with challenges ([14], [15], [16]). Mathematics Self-efficacy has eight indicators (ST37) measured with a four-point scale, where 1 = very confident and 4 = not at all confident. In the present analysis the scores have been reversed in order to associate higher values to more confident feelings. The eight variables have been considered as different manifest indicators of a latent, unobserved factor (M_ATT) accounting for the attitudes of the students towards mathematics.

In PISA, “Openness to Problem solving” (OPENN) has been defined as: “an individual’s capacity to engage in cognitive processing to understand and resolve problem situations where a method of solution is not immediately obvious. It includes the willingness to engage with such situations in order to achieve one’s potential as a constructive and reflective citizen” ([10]). It was assessed using student responses (ST94) to five questions about how well some statements describe them. For these questions too the order of the responses and their corresponding scores (from 1 to 5) have been reversed with the aim of attaching higher scores to more positive attitudes towards problem solving. The five variables enter in the analysis as indicators of the same latent construct representing the attitudes of the students towards problem solving.

The dependent variable is the score in Financial Literacy (fl_mean), computed as the mean of the five plausible values that the PISA dataset includes for assessing the students’ performance in financial literacy. In table 1, the main descriptive statistics of the manifest variables are displayed.

Approximately 65% of the students in the original sample provided valid responses (i.e. responses net of missing values) to the questions about math self-efficacy and openness problem solving. Therefore, our analysis is restricted to a sample size of 4,492 students. Among the indicators of math self-efficacy, the highest mean score is associated with the confidence in solving equations (st37q05 and st37q07 items). With reference to the problem solving experience, the attraction to complex problems (st94q14 item) shows the lowest mean score together with the largest variability.
3 METHODOLOGY

A structural equation modeling approach (SEM), also known as latent variable modelling, was used to model latent variables, such variables can be only measured indirectly by a set of observed indicators. SEM is popular because they enable to test a wide range of hypotheses and to assess the cause-effect relationships simultaneously between a set of latent (unobserved) constructs, each measured by one or more manifest (observed) variables ([17], [18]). The latent variables are not directly observed. They are typically theoretical constructs which can only be determined as a combination of other measurable variables. Structural equation modeling is a class of statistical multivariate techniques that encompasses a broad array of models from linear regression to measurement models to simultaneous equations. In the primary form of analysis, SEM is similar to combining multiple regression and factor analysis.

Few relevant reasons supported such a methodological decision. First, the greater part of the empirical research to test the influence of certain independent variables on some of the components of the model is based on regression or correlation analyses. Although useful for theory testing, these techniques appear to be incomplete because they do not provide a simultaneous assessment of the different paths (they test only one layer of linkages between independent and dependent variables at the same time) and they test relationships among manifests rather than latent variables ([19]). Structural modeling, instead, appears to be more appropriate to test a mediational model. This allows to model the same variable as dependent variable in an equation and as independent variable in another equation and to decompose the effects of a variable on other variables in direct and indirect effects.

In a common two-step approach of SEM, two models are usually specified and estimated. In the first step, a measurement model is performed to deal with "the extent to which the observed variables are assessing the latent variables in terms of reliability and validity." ([20]). In the second step, a structural model determines causal relations between latent variables.

The items, the applied constructs, and the values of the Cronbach’s alpha as reliability index ([21], [22]) are all displayed in Table 2. A high level of each construct’s internal consistency was found since both alpha coefficients exceeded the 0.70 cut-off recommended by Nunnally and Bernstein ([23]).
Table 2. Items and construct reliability analysis.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Item</th>
<th>Construct</th>
<th>Cronbach's Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>st37q01</td>
<td>Using a train timetable to work out how long it would take to get</td>
<td>Math Self-Efficacy (M_ATT)</td>
<td>0.8026</td>
</tr>
<tr>
<td></td>
<td>from one place to another</td>
<td></td>
<td></td>
</tr>
<tr>
<td>st37q02</td>
<td>Calculating how much cheaper a TV would be after a 30% discount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>st37q03</td>
<td>Calculating how many square meters of tiles would be needed to</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>cover a floor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>st37q04</td>
<td>Calculating the petrol-consumption rate of a car; understanding</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>graphs presented in newspapers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>st37q05</td>
<td>Solving an equation like 3x+5=17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>st37q06</td>
<td>Finding the actual distance between two places on a map with a</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1:10 000 scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>st37q07</td>
<td>Solving equations like 3x+5=17 and 2(x+3)=(x+3)(x-3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>st37q08</td>
<td>Calculating the petrol-consumption rate of a car</td>
<td></td>
<td></td>
</tr>
<tr>
<td>st94q05</td>
<td>I can handle a lot of information</td>
<td>Openness to Problem Solving</td>
<td>0.7828</td>
</tr>
<tr>
<td>st94q06</td>
<td>I am quick to understand things</td>
<td>(OPEN)</td>
<td></td>
</tr>
<tr>
<td>st94q09</td>
<td>I seek explanations for things</td>
<td></td>
<td></td>
</tr>
<tr>
<td>st94q10</td>
<td>I can easily link facts together</td>
<td></td>
<td></td>
</tr>
<tr>
<td>st94q14</td>
<td>I like to solve complex problems</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors’ elaboration from PISA dataset

In details, we model the cognitive process of the acquisition of financial literacy skills through the following hypotheses that lead to the specification of the theoretical model reported in Figure 1:

- H1: The performance in financial literacy (FL) is affected by the family socio-economic status (SES) of the students
- H2: Both students’ openness to problem solving and students’ attitudes towards mathematics are latent factors that impact on the FL score
- H3: Openness to problem solving influences the attitudes towards mathematics
- H4: SES affects both attitudes towards problem solving and attitudes towards mathematics

In Figure 1, the manifest variables appear enclosed by rectangles whereas the latent factors are enclosed by ovals.
4 MAIN RESULTS

SEM was applied to estimate the conceptual model. The loss in precision of the estimates due to interdependencies of first-level observations (the students) within clusters (the schools) was addressed through the calculation of cluster-robust standard errors ([24]).

The fit between the structural model and data was evaluated by means of the standardized root mean squared residual (SRMR) index. The SRMR is a measure of the average difference between the observed and model implied correlations. Values for SRMR index range from 0 to 1; values lower than 0.08 reveal a good fit ([25], [26]). The estimated model has a SRMR equal to 0.038, thus, the findings indicate that the research model fits the data fairly well. The fit of the model benefited notably from the estimation of some covariances between the errors of different manifest variables that measure the same construct (namely st94q05 and st94q06; st94q09 and st94q10; st37q05 and st37q07), as can be seen in Figures 1 and 2. Figure 2 provides the estimates of the hypothesized main effects of the conceptual model.

At the measurement level of SEM, the factor loadings in their standardized version can be interpreted as correlation coefficients between the observed variable and the corresponding latent variable. On the one hand, amongst the indicators for the latent factor OPEN, quickness in understanding things (st94q06) and aptitude for linking facts together (st94q09) show the highest loadings, approximately equal to 0.70. On the other hand, regarding the measurement of the latent factor MAT_ATT, the indicators with the highest standardized coefficients are the self-confidence in solving calculations for a discounted price (st37q02) and for the square meters of tiles needed to cover a floor (st37q03).

At the structural level of SEM, all the estimated direct effects are positive and statistically significant with the exception of the path from the latent factor OPEN to the score in financial literacy, which has a negative sign though it is not significant (p-value=0.335). This result suggests that the openness to problem solving impacts on the achievement in financial literacy only indirectly via the math self-efficacy. The latent construct MAT_ATT has the strongest direct effect on financial literacy: indeed, a 1 standard deviation change in MAT_ATT translates to a 0.48 standard deviation change in the score. Moreover, the socio-economic context has a positive influence on both latent factors OPEN and MAT_ATT. This suggests that students with a strong family background score higher in financial literacy than their peers from a poor family context. The mediation test for the effect of ESCS on the score in financial literacy reveals that the direct path remains significant when the relationship is mediated by motivational and attitudinal constructs, though it is reduced in absolute size with respect to the total effect. This result indicates a partial mediation. Specifically the proportion of total effect mediated (that is the ratio of the indirect effect to the total effect) is equal to 39.5.
5 CONCLUSIONS

In exploring the mechanisms through which the socio-economic condition of Italian 15-year-old students influences their achievement in financial literacy, this paper focuses on the mediating role of two constructs that account for the attitudes towards problem solving and the self-confidence in math ability. Indeed, we could expect that the absence of financial education (at least as it is defined in PISA) in the curricula of Italian schools delivers importance to the role of parental education and occupation in influencing the behaviours of children in relation to money matters, which could in turn impact on their knowledge and skills in financial literacy. The results from the estimation of a structural equation model indicate that the effect of the family background on the score in financial literacy is just partially mediated. The direct impact of family context on financial literacy attainment still holds above and behind the mediating effect of students attitudes and motivations. This finding brings the educational equity issue into play. If one of the aims of an educational system is to reduce the impact of students’ background on their achievements in order to assure equitable learning opportunities to every student regardless of their socio-economic condition, these results suggest that encouraging the students’ attitudes of problem solving and math self-efficacy yields just a partial effect, with reference to the achievement in financial education. The family background still have a significant direct influence on the financial literacy score.

REFERENCES


