

FINANCIAL KNOWLEDGE OF PRE-UNIVERSITY STUDENTS: AGE AND GENDER

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RESUMEN

La educación financiera es esencial para mejorar el bienestar de la sociedad en general evitando, en gran medida, decisiones financieras erróneas. Es, por ello, necesario inculcar una adecuada formación financiera desde una edad temprana. El objetivo de este trabajo es identificar los posibles efectos la edad y el género sobre la adquisición de conocimientos financieros, profundizando en las posibles interrelaciones entre ellas. Aplicando un conjunto de modelos de regresión multinivel (efectos mixtos) a una muestra de 9.917 estudiantes preuniversitarios de 175 centros de formación de Andalucía, nuestros resultados muestran que la edad y el género están significativamente relacionados con la adquisición de conocimientos financieros de los estudiantes preuniversitarios. Además, el género juega un papel moderador en la relación entre la edad y la adquisición de conocimientos financieros. Los resultados de este estudio tiene valiosas implicaciones para profesores, alumnos, directores de centros y planificadores educativos, porque ayudan a comprender mejor los factores clave en la educación financiera a nivel preuniversitario.

Palabras clave:

Educación financiera, conocimiento financiero, edad, género, estudiantes preuniversitarios.

ABSTRACT

Financial education is essential to improve the well-being of society at large by avoiding, to a large extent, erroneous financial decisions. It is, therefore, necessary to inculcate adequate financial literacy from an early age. The aim of this paper is to identify the possible effects of age and gender on the acquisition of financial literacy, exploring the potential interrelationships between them. Applying a set of multilevel (mixed effects) regression models to a sample of 9,917 pre-university students from 175 training centres in Andalusia, our results show that age and gender are significantly related to the pre-university student's financial literacy. Moreover, gender plays a moderating role in the relationship between age and financial literacy acquisition. The results of this study have practical implications for teachers,

students, school principals and educational planners because they help to understand better the critical factors in financial literacy at the pre-university level.

Keywords:

Financial literacy, financial knowledge, age, gender, pre-university students.

1. Introducción

Financial education is a constant social concern since it is essential to improve the standard of living of individuals and society (Garman et al., 1999). Poor financial education can bring serious consequences, such as over-indebtedness, lack of savings or inefficiency in managing personal finances that can lead to serious economic and even social problems.

Things like doing simple price calculations when shopping, making transfers, using ATMs¹, checking exchange rates, keeping track of interest rates, tracking income and expenses, managing bank accounts, prioritizing expenses, saving for hard times, using credit cards responsibly, managing a monthly budget, being aware of different alternatives when using money, are basic needs for everyone. Therefore, an adequate financial base is necessary and instilled from an early age.

In this sense, it should be noted that various studies show that age is a variable significantly related to financial knowledge in the general population, with the young segment, together with the elderly, suffering from the worst levels of financial education (Kokkizil et al., 2017; Lusardi & Mitchell, 2011). In addition, according to some studies, it is observed that the foundations of financial knowledge are really built during childhood (Otto et al., 2006; Boshara & Emmons, 2015; Drever et al., 2015), so it seems interesting that young people receive financial education from an early age (Migheli & Coda Moscarola, 2017), in this way they will be able to improve their financial skills in the future (Mandell & Klein, 2009).

However, each stage of child/adolescent development requires instruction in a certain area of financial education. Thus, for primary school students, financial socialization is essential. By such it is meant the acquisition and development of values, attitudes, standards, norms and behaviours that provide contexts for one's own financial practices (Drever et al., 2015). On the other hand, the objective to achieve in the case of adolescents and young adults would be the development of both financial skills and habits. In short, financial education taught from an early age will support learning for later levels of training (Sosin et al., 1997).

Likewise, the study of gender differences is a constant in the educational and social spheres. In the field of financial education, a certain number of international investigations find a notable gender gap in financial knowledge: women have lower levels of financial knowledge compared to men (Robson & Peetz, 2020), but the explanations of this gap remain a subject of active debate. Regarding high school students, a study carried out with data from 18 countries shows that there is a gender gap in financial knowledge that favors male students, so it seems plausible that parents can influence said knowledge (Chambers et al., 2019). But even this gap reaches university students (Lee & Hanna, 2014).

Following this line of argument, we consider the possibility that gender may play a moderating role in the relationship between age and the acquisition of financial knowledge. To the best of our information, these extremes have not been investigated to date.

Consequently, and considering that a greater number of studies are necessary to relate the probability of success of training actions in financial matters with the demographic characteristics of the students, especially gender and age, the objective of this work is to identify the potential effects of these demographic variables on their acquisition of financial knowledge, delving into the potential interrelationships between the two.

2. DATA AND METHODOLOGY

2.1. *Sample characteristics and variable selection*

Data collection was conducted in October and November 2019 through the Edufinet project, a training action for young people led by Unicaja Bank, one of the most important financial institutions in Andalusia, that aims to bring the financial culture closer to citizens by acquiring

¹ Automated Teller Machines.

the knowledge required to make their fundamental financial decisions with objective criteria in a conscious and informed manner (Edufinet, 2018).

All procedures performed in this study were in accordance with the Committee of Publication Ethics (COPE) guidelines and the standards of the institutional ethical committee. Regarding data collection, informed consents were obtained from all the volunteer participants and their legal guardians when they are minors, no personal data were recorded, so the anonymity of the participants was ensured. Due to the nature of the activity, the absence of any physical or psychological damage is guaranteed.

Our sample of 9,917 pre-university students from 175 training centers in Andalusia was obtained based on a designed questionnaire that participants had the option to complete after some financial sessions². The questionnaire included four questions related to basic financial concepts such as inflation, simple and compound interest rate and risk diversification, in line with the questions included in the Survey of Financial Competences prepared by the National Securities Market Commission and the Bank of Spain (Bover et al., 2016). The survey also included questions on the respondent's socio-demographic characteristics and on the evaluation of the session, which must be completed after the session.

A summary of the sample characteristics regarding the educational center can be seen in table 1, as well as the province, gender and age range in table 2. Table 3 shows the definition of the variables.

TABLE 1
Multi-group characteristics of the sample

Number of centres	Number of observations per training centre			
	Minimum	Average	Maximum	Number of observations
175	7	55,5	218	9917

Source: own elaboration.

TABLE 2
Demographic characteristics of the sample

	Gender			Age				Total
	Male	Female	DK/DA	Up to 15	16 or 17	18 or 19	20 or more	
Almería	367	461	7	149	569	62	55	835
Cádiz	467	532	18	173	571	146	127	1.017
Córdoba	363	427	16	142	546	53	65	806
Granada	791	877	44	336	1.094	173	109	1.712
Huelva	98	108	4	62	124	23	1	210
Jaén	411	509	12	140	530	117	145	932
Málaga	1.216	1.373	81	648	1.476	293	253	2.670
Sevilla	780	932	23	425	1.034	166	110	1.735
Total	4.493	5.219	205	2.075	5.944	1.033	865	9.917

Source: own elaboration.

² The EDUFINET project certifies that the data obtained in the framework of its *XI Jornadas de Educación Financiera* have been subject to internal control in terms of the methodology used, data collection and analysis, in the bodies of the aforementioned project.

TABLE 3
Questionnaire and variables definition

Variable	Questionnaire verbatim	Values
<i>Financial knowledge (Bover et al., 2016)</i>		
Inflation	Five siblings receive a gift of €1,000, which they share equally. If they must wait a year to get their share of the €1,000 and that year's inflation is expected to be 1%, when they receive the money they will be able to buy: a) More than they could buy today b) The same c) Less	1: correct 0: incorrect or not answered
Simple Interest	You deposit 100 euros in a savings account with a fixed interest rate of 2% per year. This account does not generate any fees or taxes. If you do not make any other deposits into this account and do not withdraw any money, how much money will be in the account at the end of the first year once the interest is paid to you?	1: correct 0: incorrect or not answered
Compound Interest	Based on the assumption in the previous question, if you do not make any deposits or withdraw any money, how much money will be in the account after five years? - More than 110 euros - Exactly 110 euros - Less than 110 euros	1: correct 0: incorrect or not answered
Investment Risk	It is generally possible to reduce the risk of investing in the stock market by buying a wide variety of shares.	1: correct 0: incorrect or not answered
Number of right answers	Aggregation of previous answers. Number of correct answers	0 to 4
<i>Socio-demographic variables</i>		
Gender	Gender of the individual	1: female 0: male
Age	Age of the individual, in number of years	11 to 50
Previous studies	Do you study or have you studied economics?	1: yes 0: no
Self-perceived previous knowledge	What level of knowledge do you consider you have?	1: low 2: medium 3: high
Rating	How would you rate the training session? Students evaluate the course from 0 to 10. The evaluation is then re-graded.	0: D failed 1: C passed 2: B notable 3: A outstanding
Amusing presentation	Did you enjoy the presentation?	1: yes 0: no

Source: own elaboration.

2.2. Methodology

We performed a preliminary analysis regarding descriptive statistics (table 4) and correlations (table 5), the acquisition of financial literacy was assessed through the aggregation of four questions related to four basic financial concepts: inflation, simple interest, compound interest and investment risk.

TABLE 4
Descriptive statistics

		Mean	Stand. Dev.	Min	Máx.
I	Total correct answers	2.09	1.00	0	4
II	Inflation	0.62	0.49	0	1
III	Simple interest	0.58	0.49	0	1
IV	Compound interest	0.29	0.46	0	1
V	Risk	0.59	0.49	0	1
VI	Age	16.92	3.29	11	51
VII	Sex	0.54	0.50	0	1
VIII	Amusing presentation	0.87	0.33	0	1
IX	Self-perceived prior level	1.54	0.56	1	3
X	Previous studies in economics	0.78	0.41	0	1
XI	Course evaluation	2.38	0.69	0	3

Source: own elaboration.

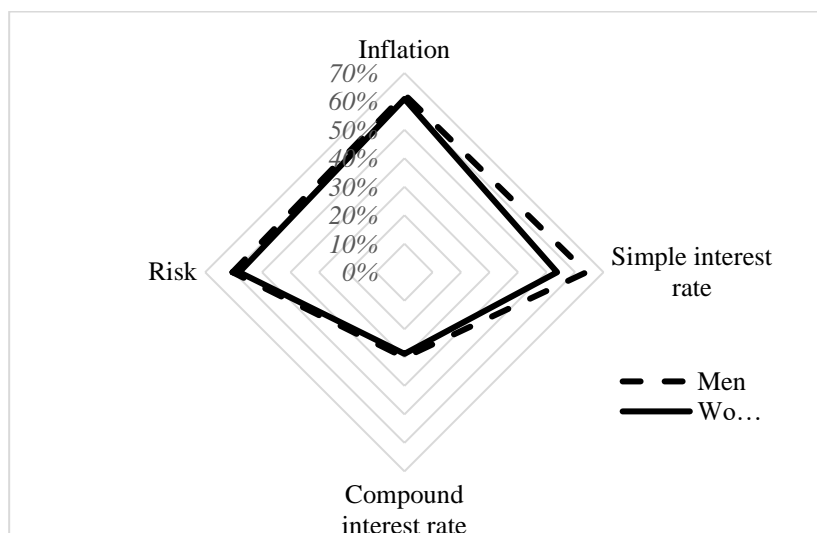
TABLE 5
Correlations

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
I Total correct answers	1										
II Inflation	0.58	1									
III Simple interest	0.56	0.16	1								
IV Compound interest	0.45	0.04	-0.04	1							
V Risk	0.49	0.01	0.01	-0.01	1						
VI Age	0.06	0.04	0.09	0.02	-0.03	1					
VII Gender	-0.08	-0.02	-0.10	-0.01	-0.02	0.01	1				
VIII Amusing presentation	0.07	0.06	0.06	0.01	0.01	0.02	0.04	1			
IX Self-perceived prior level	0.09	0.08	0.08	0.01	0.03	0.06	-0.11	0.04	1		
X Previous studies in economics	0.08	0.10	0.05	-0.01	0.02	-0.16	0.07	0.44	0.16	1	
XI Course evaluation	0.06	0.04	0.06	0.00	0.02	0.00	0.02	0.06	0.03	0.04	1

Source: own elaboration.

Figure 1 analyses the percentage of correct answers to knowledge questions disaggregated by gender. It shows that the question on compound interest was much more difficult for both groups and that gender differences are more pronounced on the simple interest rate question. The evaluation of the validity of the test questions according to the two dominant theories of the tests, the classical and the item response theories, has been explained in Appendix A.

FIGURE 1
Correct answer rates



Source: own elaboration.

We then adopted a multi-level regression approach, called mixed-effects or hierarchical (Gelman and Hill, 2006; Goldstein, 1995), to avoid potential problems of estimation bias derived from classical methods, because the values of the school variables of students from the same school are correlated (Hox et al., 2010). Mixed effects models are characterized by containing both fixed effects and random effects. Fixed effects are analogous to standard regression coefficients and are estimated directly. Random effects are not estimated but rather summarized according to their estimated variances and covariances. Random effects can take the form of random intercepts or random coefficients.

In this way, to identify which variables influence the success of each of the questions, different binary logistic regression models with mixed effects (melogit) were tested, the results of which can be consulted in the appendix A. Melogit models fit mixed effects models for binary and binomial responses that assume that the random effects of the responses follow a Bernoulli conditional distribution, whose probability of success is determined by the cumulative logistic distribution function. To do this, melogit performs optimization using the original variance component metric.

The procedure was as follows: we coded the students' correct answers as 1, 0 otherwise. Next, the probability of success was regressed with the explanatory variables age and gender, in addition to the control variables described above. For each of the responses, we conducted a model in which the intercept and the age effect was distinguished by gender, in order to identify the potential moderating effect of the latter on the relationship between the correctness of the test and the age of the respondent. In addition, we checked the significance of the gender differences regarding intercepts and age slopes through the Wald Chi2 test. Furthermore, a variable was created that encodes the number of correct answers in the exam, taking integer values from 0 to 4, and it was standardized. Next, the previous process was repeated to identify which variables affect the number of correct answers in the exam, taking a multi-level linear regression model of mixed-effects (mixed).

The program used for all analyses was Stata 14.

3. RESULTS

Table 6 summarizes the results as described in section 2.2. (appendix A provides further detail).

First, the intercept for men is significantly higher than for women except for the compound interest, suggesting that men are more likely to be correct than women regarding inflation, simple

interest and investment risk questions; similarly, they will obtain a higher number of correct answers in the test.

TABLE 6
Results

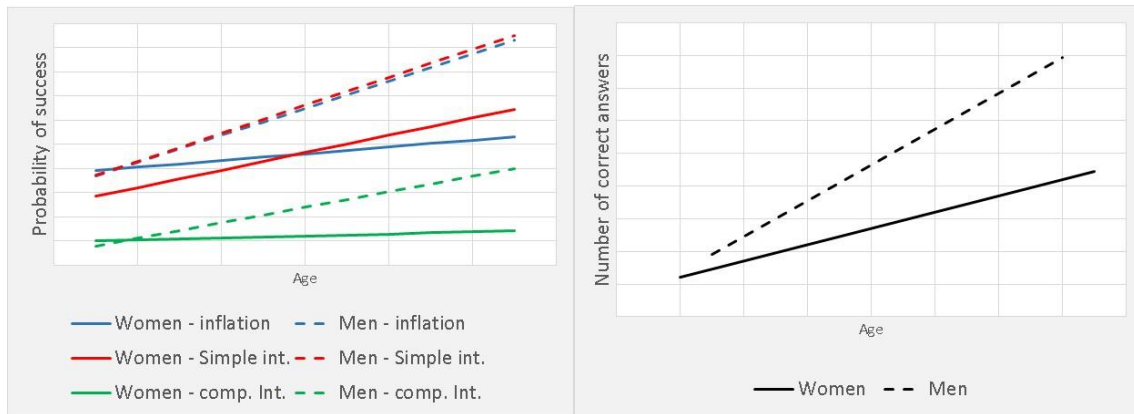
	Inflation	Simple Int.	Compound Int.	Risk	Number of hits
Intercept					
Male	0.63 [8.49]***	0.65 [7.86]***	-0.94 [-15.64]***	0.47 [8.85]***	0.09 [2.82]**
Female	0.53 [7.23]***	0.11 [1.32]	-0.97 [-16.57]***	0.38 [7.23]***	-0.06 [-2.07]*
Wald test	4.72**	120.10***	0.41 (n.s.)	4.73**	60.15***
Slope					
Age (male)	0.28 [5.32]***	0.29 [4.95]***	0.16 [3.95]***	-0.08 [-1.90]	0.11 [6.17]***
Age (female)	0.07 [2.10]*	0.18 [4.57]***	0.02 [0.51]	0.02 [0.52]	0.05 [4.08]***
Wald test	13.37***	2.76*	9.07***	-	6.82***
Control					
Amusing presentation	0.07 [2.18]*	0.09 [2.23]*	0.04 [1.17]	0.01 [0.32]	0.04 [2.83]**
Self-perceived level	0.11 [3.39]***	0.08 [2.28]*	0.03 [0.73]	0.06 [1.78]	0.05 [3.48]***
Course evaluation	0.03 [0.83]	0.09 [2.46]*	0.00 [-0.04]	0.04 [1.21]	0.03 [2.23]*
Previous studies	0.14 [3.41]***	0.16 [3.51]***	0.00 [-0.01]	0.06 [1.77]	0.07 [4.83]***

[t-statistic in brackets]. *: p<0,1; **: p<0,05; ***: p<0,01.
Source: own elaboration.

Secondly, our results suggest that age positively and significantly affects the probability of success in almost all questions and the total number of correct answers in the test for both men and women. So, we can conclude that part of the knowledge acquired by students could be due to his own life experience, except in the investment risk question. This could be because students generally have no prior investment experience, which means that all their investment risk knowledge comes from educational activities rather than prior life experience. The relationship between age and the probability of getting a correct answer to the compound interest question in the female group was not significant either. This might suggest that, in contrast to men, female students in these courses do not have so much life experience with the compound interest rates knowledge either.

Third, Wald test for age coefficients of men and women were significant in all the models, except for investment risk. It is also observed that the effect of age on the probability of getting the first three questions right, and on the total number of correct answers, is significantly higher in men than in women, suggesting that gender moderates the effect of age on the probability of success in the first three questions, and on the total number of correct answers in the test, as shown in Figure 2.

FIGURE 2

Moderation effects

Source: own elaboration.

Specifically, males have a higher probability of getting the inflation question right (0.63^{***} vs. 0.53^{***}), with statistically significant differences (Wald: 4.72^{**}). Age also affects this probability in both men (0.28^{***}) and women (0.07^*), although it is the male group where the effect is more relevant, with very significant differences (Wald: 13.37^{***}).

Gender effect on the probability of getting the simple interest question right is even stronger (0.65^{***} for men vs. 0.11^{***} for women, Wald: 120.10^{***}). However, the gender difference in the effect of age on this probability is, although weakly significant, much smaller in this case than in the previous one (0.29^{***} for men vs. 0.18^{***} for women, Wald: 2.76^*).

Regarding the question on compound interest, it is observed that there are no significant gender differences (-0.94^{***} for males vs. -0.97^{***} for females, Wald: 0.41), but these differences are significant in terms of the effect of age on the probability of success in each of the two groups (Wald: 9.07^{***}). Specifically, age affects positively and significantly in the male group (0.16^{**}) and is not significant in the female group (0.02).

Unlike in the previous case, the question on investment risk shows that there are significant gender differences, so men (0.47^{***}) are more likely to be successful than women (0.38^{**}) (Wald: 4.73^{**}). However, the effect of age is not significant for either gender (-0.08 for men and 0.02 for women), suggesting that age is not relevant for answering this question correctly.

Finally, the total number of correct questions in the test is significantly higher in the male group (0.09^{**}) than in the female group (-0.06^*) (Wald: 60.15^{***}). Moreover, age is a much more relevant variable for men (0.11^{***}) than for women (0.05^{***}) for the number of correct answers in the test (Wald: 6.82^{***}).

With respect to the control variables, it is observed that all of them significantly predict the total number of correct questions in the test. Nevertheless, analyzing the probability of correct answers for each question individually, it is observed that the control variables affect the questions on inflation and simple interest but not the questions corresponding to compound interest and risk.

Specifically, in the first place, having shown interest in the training activity has a positive effect on passing the test (0.04^{**}), due to the fact that more correct answers are given to the questions on inflation (0.07^*) and simple interest (0.09^*), but not to the questions on compound interest and risk.

Secondly, and similarly, the level of previous knowledge to the training activity, reported by participants, significantly affects the number of correct answers (0.05^{***}) and the probability of correct answers on the inflation (0.1^{***}) and simple interest (0.08^*) questions, but not on the rest of the questions. Consequently, the students' self-perception of financial knowledge does not seem to affect the more complex concepts, but only the simpler topics.

Thirdly, the evaluation of the training action, by the students who have done it, does not seem to significantly affect the probability of success in any of the specific questions, except for a weak significance in the simple interest question (0.09*), although in the total number of correct answers it is also weakly significant (0.03*). As it is relevant for only one question, and with a low significance, it could be thought to be a spurious result.

Finally, having studied economics prior to the training course is very relevant both for the probability of correct answers to the question on inflation (0.14***) and simple interest (0.16***) and for the total number of correct answers in the test (0.07***), in line with what might be logical. However, such studies do not seem to have trained the student in complex concepts such as compound interest rates and investment risk.

4. Conclusions

The results of this paper help to achieve a better understanding of the key factors of the financial education at a pre-college stage as it identifies significant differences in both gender and age. Likewise, these findings evidence that there are also significant differences in the understanding of financial knowledge between men and women based on age, which indicates the existence of a gender impact: age affects has a higher impact in the results obtained in the tests conducted by male students rather than by female students. These conclusions are in line with previous studies and ratify that there are still important differences in the education of men and women, and/or in the influence exercised by parents.

Additionally, this study has valuable implications for teachers, students, heads of educational centers, and those responsible for educational plans. First of all, teachers will be able to identify the guidelines that facilitate the understanding of financial knowledge and adapt their teaching practices to the needs of each group. Secondly, students will be able to take the appropriate measures that facilitate the acquisition of knowledge to make their own financial decisions with confidence. Thirdly, the directors of educational centers will be able to adapt the specific activities to develop financial knowledge, both in curricular and extra-curricular activities, to the profile of the student to which they are directed. Finally, Government officials who are responsible of educational plans are provided with the necessary evidence to propose the adaptation of certain actions to the different student profiles.

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Appendix A. Results of the test validation

Firstly, we checked that the four items were normally distributed by applying Ferguson's Delta index, which obtained a value of 0.909, very close to 0.90, the value of the index that represents the normality of its distribution. This value allows us to interpret the results according to the Classical Test Theory (CTT).

Secondly, a factor analysis was performed using iterations from the tetrachoric correlations in which all the factors obtained had less than one Eigen values, and the uniqueness of the variables ranged between 0.67 and 0.98, with alpha and KMO indices less than 0.70, namely 0.12 and 0.47 respectively. This result suggests that the questions asked measure different dimensions of financial knowledge, limiting the interpretability of the results obtained on the basis of Item Response Theory (IRT) by violating one of its basic assumptions.

Thirdly, we analyzed the proportion of correct answers for each variable and their correlations, all of which were less than 20%; we then estimated the ability of the questions to distinguish between individuals by applying Loevinger's H index, where only the first two were significant and all of them were less than 0.3.

Item scores were then estimated according to the one- and two-logistic IRT. From the application of the one-logistic IRT method, it appears that the most difficult question was the one on compound interest, and the easiest was the one on inflation. Moreover, there seem to be significant differences in the difficulty of the questions. From the application of the two-logistic IRT method, it can be inferred that the ability to discriminate between individuals is very significant in the questions on simple interest rates and inflation, significant in the question on compound interest rates, and weak in the question on risk.

Tables A.1 and A.2 summarize the results obtained.

TABLE A.1

Items analysis (I)

	% Aciertos	TetrachoricCorr.				Loevingher Test		
		I	II	III	IV	H	z	p
I Inflation	61,4%	1				0,09	12,45	***
II Simple interest	58,1%	0,26	1			0,06	8,42	***
III Compound interest	29,3%	0,06	-0,06	1		-0,01	-0,68	0,75
IV Risk	59,2%	0,02	0,03	-0,02	1	0,01	1,21	0,11
Set							7,67	***

***: $p < 0.01$.

Source: own elaboration.

TABLE A.2

Items analysis (II)

	IRT 1pl		IRT 2pl			
	Dif.	z	Discrim.	z	Dif.	z
Inflation	-1,26	-12,20***	0,62	8,69***	-0,82	-9,26***
Simple interest	-0,89	-10,80***	1,75	5,94***	-0,29	-10,40***
Compound interest	2,39	13,63***	-0,08	-2,20**	-10,49	-2,21**
Risk	-1,00	-11,30***	0,07	1,91*	-5,63	-1,90*
Set	0,38	13,60***				

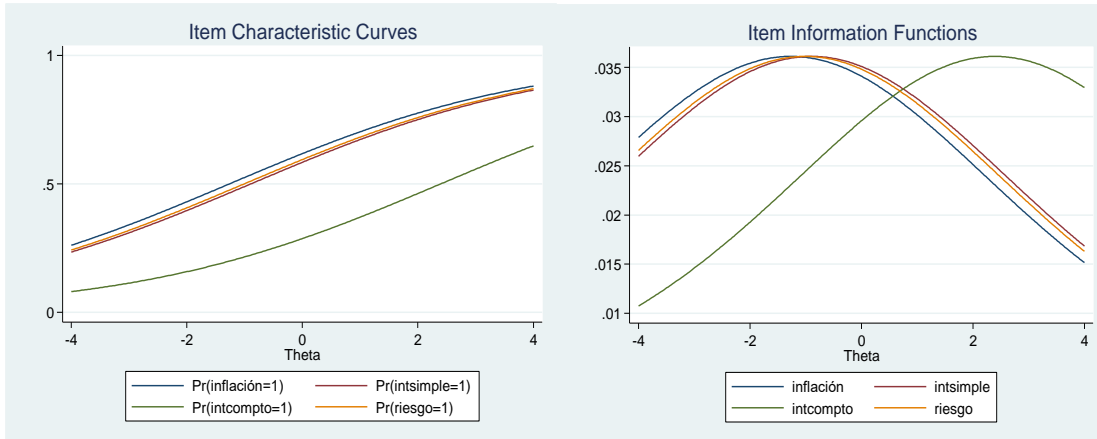
*: $p < 0,1$, **: $p < 0,05$; ***: $p < 0,01$.

Source: own elaboration.

This preliminary analysis is concluded with a graphical analysis of the items, showing both their characteristic curves and their information functions in figure B.2. The question regarding compound interest was much more difficult for the students and this question has very different values from the rest of the questions in the test.

FIGURE A.1.

Characteristic curves and ítem information functions



Source: own elaboration.