

Are financially illiterate individuals all the same?

A study on incorrect and “do not know” answers to financial knowledge questions

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697

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Abstract

Purpose – Are financially illiterate individuals all the same? This study aims to answer this question. Specifically, the authors investigate whether people answering incorrectly and “do not know” to the big five questions about financial knowledge (FK), all identified by previous literature as financially illiterate, are two sides of the same coin, or rather individuals with different socio-economic and demographic characteristics, and whether this leads to different levels of risk of falling victim to financial fraud.

Design/methodology/approach – Using a large and representative sample of Italian adults, the authors run both ordered probit and probit regressions to test the determinants of financially illiterate individuals, distinguishing between those answering FK questions incorrectly and those answering “do not know”. The authors also measure the probability of falling victim to financial fraud for the two groups. To check the robustness of our results, the authors run a multinomial regression, a structural equation model and an instrumental variable regression model.

Findings – The authors demonstrate that the socio-demographic and socio-economic characteristics of individuals selecting incorrect responses to FK questions are different from those of individuals selecting the “do not know” option. Moreover, the results show that the former are more likely to be victims of financial frauds.

Practical implications – The “one-size-fits-all” approach is not suitable for financial education. It is important to consider socio-demographic and socio-economic characteristics of individuals in order to identify specific targets of education programmes aiming to reduce insecurity and excessive self-confidence as well as to increase objective FK. The study’s findings also identify vulnerable groups to which financial fraud prevention schemes should be targeted.

Originality/value – To date, financial illiteracy has been measured as the sum of incorrect and “do not know” responses given to FK questions. This approach does not allow to observe the socio-demographic and socio-economic differences between people choosing the “do not know” option and those answering incorrectly. The paper aims to overcome this limit by investigating the socio-demographic and socio-economic characteristics of individuals selecting “do not know” and incorrect responses, respectively. The authors also investigate whether the two groups have different probabilities of being victims of financial fraud.

Keywords Do not know, Incorrect answers, Objective financial knowledge, Subjective financial knowledge, Victims of financial fraud

Paper type Research paper

1. Introduction

Our study aims to establish whether financially illiterate individuals are all the same. Specifically, we investigate whether people answering incorrectly and people answering “do

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not know” to the big five questions about financial knowledge (FK) proposed by [Lusardi and Mitchell \(2011\)](#) [1], indistinctly identified by previous literature as financially illiterate, are two sides of the same coin, or whether they are individuals with different socio-demographic and socio-economic characteristics, and whether this leads to different financial behaviours.

People’s ability to make financial decisions can be effectively measured by their level of financial literacy ([Santini et al., 2019](#)). The Organisation for Economic Co-operation and Development (OECD) in fact defines financial literacy as a combination of awareness, knowledge, skill, attitude, and behaviour necessary to make sound financial decisions and, ultimately, achieve individual financial wellbeing.

Nowadays financial literacy is important for several reasons. First, financial engineering has amplified the complexity of financial products in which individuals can invest. Second, the possibilities for independent access to financial markets by retail investors have significantly increased, for example, in access to crowdfunding and online trading platforms. Third, many countries have in recent years introduced financial and pension reforms which shift the responsibility for financial and retirement decision making to the individual. Retail investors are therefore increasingly involved in financial choices made independently, and their financial literacy is often crucial to adequate financial decision making.

Although financial literacy is made up of different components, i.e. awareness, FK, skill, financial attitude, and financial behaviour ([OECD INFE, 2011](#)), several studies on financial literacy focus only on FK, measured as the sum of the correct answers to the big five questions. Individuals who answer all FK questions correctly should not however be considered experts in finance: they simply have the basic knowledge to make informed financial decisions ([Lusardi, 2019](#)). The surveys on financial literacy include, along with defined responses to the big five questions, the answer “do not know”, and previous studies classify this response as an incorrect answer. We find that this approach is open to criticism, given that a respondent who feels him/herself as not fully knowledgeable can choose between two options: “do not know” and a definite answer. His/her choice depends on two main factors: his/her knowledge level and his/her management of uncertainty, as suggested by previous literature in political science ([Mondak, 2000](#); [Mondak and Davis, 2001](#)). The “do not know” option could thus be selected by some respondents out of ignorance, and by others out of insecurity, i.e. fear of giving the incorrect answer even though they think they know the right one. Classifying both “do not know” and incorrect responses as equally incorrect thus neglects the effect of “do not know” responses and could lead to misleading results ([Kim and Mountain, 2019](#)).

Extant papers identify the main socio-demographic and socio-economic characteristics underpinning FK ([Lusardi and Tufano, 2015](#); [Hasler and Lusardi, 2017](#)). However, there is little previous literature on individuals characterized by low FK or their specific characteristics. As male, middle-age, and high-income people are shown to be the more financially literate by extant studies ([Van Rooij et al., 2011](#); [Van Campenhout, 2015](#)), it is often said that less financially literate people are female, young, elderly, and poorer. This however assumes that the individuals answering “do not know” and those giving incorrect responses are equally financially illiterate, which may not be true. Moreover, because most previous literature considered that women, the young, the elderly and the poor all belonged to a single category of financially illiterate, financial education programs have so far been indiscriminately addressed to these targets. No effort has been made to date by academics or institutions to investigate the specific socio-demographic and socio-economic characteristics of people answering “do not know”. It has never yet been clarified whether these individuals are characterized by low FK, whether they are aware of being so, or whether they actually have not a low FK, but are insecure. They might have moderate level of FK. Our paper aims to fill this gap by investigating the socio-demographic and socio-economic characteristics of people selecting “do not know” and incorrect responses, respectively. Our

evidence should be useful to plan future financial education programs which take the psychological and/or social characteristics of individuals into account. Efficient financial education courses should in fact not only provide notions to increase FK, but also reduce insecurity and excessive self-confidence.

Furthermore, financial illiteracy can significantly affect financial behaviour. Previous literature shows that financially illiterate individuals are less able to engage in day-to-day financial management activities, such as retirement planning and wealth accumulation (Lusardi and Mitchell, 2007a, b, 2011; Klapper and Panos, 2011), less likely to participate in financial markets (Van Rooij *et al.*, 2011), worse equipped to face macroeconomic shocks (Klapper and Panos, 2013), more likely to engage in costly financial behaviours (Disney and Gathergood, 2013; Agarwal *et al.*, 2015), more likely to opt to default (Agnew and Szykman, 2005) and more likely to be victims of financial fraud (Lokanan, 2014; Gamble *et al.*, 2014; Kadoya *et al.*, 2021; Xiao *et al.*, 2022). Financial fraud unfortunately has become widespread in Europe in the last decade. Through various channels, consumers today are targeted by sophisticated misleading or fraudulent practices and scams (Reurink, 2018). Individuals are increasingly exposed to emotional, financial and/or physical harm, and their expenditure and investment behaviour is seriously affected. The Survey on “Scam and Fraud experienced by consumers” (Bijwaard, 2020) estimates that the adult population of the EU28 suffered approximately 24 billion euros of total financial loss from scams and fraud over a two-year period. In order to prevent financial fraud, it is important for authorities to identify the most vulnerable individuals, and previous literature shows that financially illiterate people are among them (Lokanan, 2014; Gamble *et al.*, 2014; Kadoya *et al.*, 2021; Xiao *et al.*, 2022). However, once again financially illiterate are identified by extant papers with those who gave both incorrect and “do not know” answers to the FK questions. This approach may not be correct, as it assumes that all individuals choosing “do not know” select this option exclusively out of ignorance, and not out of insecurity. We aim to overcome this limit, investigating whether individuals giving incorrect and “do not know” answers tend to be victims of financial fraud. Our findings should help the regulator target fraud prevention schemes to specific population targets shown as vulnerable.

Specifically, we select a representative sample of the Italian population consisting of 2,036 Italian adults, aged between 18 and 79, who took part in a survey conducted by the Bank of Italy in 2020. The focus on Italy is particularly interesting as Italian adults show a very low level of financial literacy compared with the G20 average (D'Alessio *et al.*, 2021). Therefore, this sample represents a perfect case-study to detect the characteristics of financially illiterate people. Respondents answered the big five questions on FK. We consider separately correct, incorrect and “do not know” answers. Using both ordered probit and probit regressions, we demonstrate that the socio-demographic and socio-economic characteristics of individuals selecting incorrect responses are different from those of individuals selecting the “do not know” option. Moreover, our results show that the former are more likely to be victims of financial fraud.

We innovate previous literature from different points of view. First, to our knowledge we are the first to differentiate people giving incorrect and “do not know” responses to FK questions and identify their socio-demographic and socio-economic characteristics. Second, we test the role of subjective FK in determining incorrect and “do not know” answers among these two groups. Finally, we study the impact of these responses on financial behaviour, and specifically on the probability of falling victim to financial fraud.

The rest of the paper is structured as follows. Section 2 describes the literature review and the research questions. Section 3 shows the data, while Section 4 defines the empirical methodology. Sections 5 and 6 report our results and the discussion, respectively. Finally, Section 7 contains the additional analysis and robustness checks, and Section 8 concludes the paper.

2. Literature review and research questions

FK, i.e. the understanding of basic financial concepts and economic principles that facilitate the financial decision-making process (Lusardi, 2008), is one of the components of financial literacy, together with awareness, skill, behaviour, and attitude (OECD-INFE, 2011). Within personal finance literacy, an overwhelming majority of theoretical research perceives FK as the core of the construct (Huston, 2010; Warmath and Zimmerman, 2019; Xiao and Porto, 2017).

So far, the wide empirical literature on FK can be divided into different strands. Among these, we focus on three main research areas: (1) measurement and determinants of FK; (2) the linkage between objective and subjective FK; and (3) the relationship between FK and financial behaviour.

Our first research area focuses on the measurement of FK and the investigation of its determinants (Lusardi and Mitchell, 2011, 2014; Nicolini *et al.*, 2013). Almost all surveys in this field quantify FK by the sum of correct answers to the “big five” questions proposed by Lusardi and Mitchell (2011) and include, along with defined responses, the answer “do not know”, which is almost always classified as incorrect. Extant studies in this area identify the main socio-demographic and socio-economic characteristics of individuals characterized by high FK (Lusardi and Tufano, 2015; Hasler and Lusardi, 2017; Cucinelli *et al.*, 2019), and demonstrate that more financially literate persons are middle-age, male, and with high family income. On the basis of this evidence, these studies infer that female, young, elderly, and poorer people are all less financially literate (Van Rooij *et al.*, 2011; Van Campenhout, 2015).

It may however be unwarranted to infer that all the respondents who do not answer FK questions correctly are financially illiterate, as the category includes individuals supplying “do not know” as well as incorrect answers. Those answering incorrectly will certainly have low FK, but this does not necessarily apply to those selecting “do not know”. Previous research in political science (Mondak, 2000; Mondak and Davis, 2001) in fact finds that when a respondent who is not fully knowledgeable chooses between a definite answer and “do not know”, his/her choice will depend on two main factors: his/her level of knowledge and his/her management of uncertainty. The “do not know” option will be therefore selected by some individuals out of ignorance, and by others out of a feeling of insecurity (Kim and Mountain, 2019).

To our knowledge, very few empirical studies to date have investigated this issue (Chen and Garand, 2018; Kim and Mountain, 2019; Bucher-Koenen *et al.*, 2021; Endo and Chinen, 2021), and all of them demonstrate that respondents to FK questions, especially women, give “do not know” answers out of indecision or insecurity rather than ignorance. So, it is important to distinguish clearly between individuals responding “do not know” and those responding incorrectly. Kim and Mountain (2019) and Bucher-Koenen *et al.* (2021) in fact suggest new latent regression models which include an improved measure for FK which takes account of both correct and “do not know” responses associated with a high probability of correct answers. However, these authors do not investigate the determinants of incorrect and “do not know” responses, and do not examine the characteristics of people choosing these different options. To our knowledge, so far only Chen and Garand (2018) have considered “do not know” and incorrect answers separately, but their focus is on the role of these answers in shaping the financial gender gap among Americans. There is thus a gap in the literature on the determinants of incorrect and “do not know” responses, and it is necessary to investigate the characteristics of individuals choosing the different options.

The second strand of literature focuses on the link between objective and subjective FK. Objective or actual FK is a cognitive construct measured as the sum of the correct answers to questions, typically the big five, on financial topics. Subjective or perceived FK, often defined as “self-confidence”, has a more affective nature and is usually measured on a Likert scale through a single item addressing respondents’ self-assessment of their knowledge on, or their

familiarity with, financial issues (Lusardi and Tufano, 2015; Carlson *et al.*, 2009; Porto and Xiao, 2016; Bannier and Schwarz, 2018; Bialowolski *et al.*, 2021).

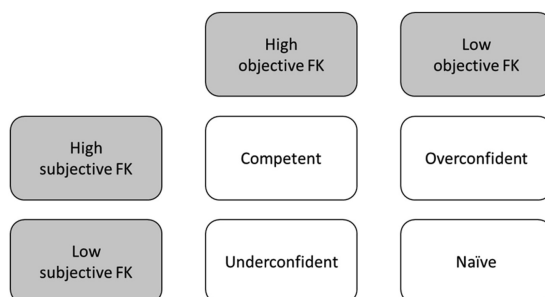
To date it is not clear whether the relationship between objective and subjective FK is insignificant (O'Connor, 2019; Bialowolski *et al.*, 2021), low (Henager and Cude, 2019), modest (Parker *et al.*, 2012), or significantly positive (Sekita, 2011; Lusardi and Mitchell, 2017). The relationship is found to depend on the individual characteristics of respondents (Agnew and Szykman, 2005; O'Connor, 2019). Previous literature shows that subjective FK conveys additional information that is above and beyond objective FK (Parker *et al.*, 2012; O'Connor, 2019; Bialowolski *et al.*, 2021). So, although the two constructs may be correlated, they are distinct (Hadar *et al.*, 2013), and can lead to different financial decisions.

Using the distinction between objective and subjective FK, Xia *et al.* (2014) and Porto and Xiao (2016) classify four different categories of consumer according to their low/high level of objective and subjective FK, as shown in Figure 1: (1) Competent (high objective and high subjective FK), (2) Overconfident (low objective FK and high subjective FK), (3), Underconfident (high objective FK and low subjective FK) and (4) Naïve (low objective and low subjective FK).

This classification assumes that people giving incorrect responses and people choosing the “do not know” option are characterized by very low objective FK, which may however not be true. Moreover, people with high and people with low subjective FK can all answer “do not know”. We therefore re-interpret the categories in Figure 1 as below in Figure 2, which shows respondents answering incorrectly separately from those answering “do not know”.

Specifically, we classify people answering the FK questions incorrectly, characterized by high and low subjective FK, as Pure Overconfident (2) and Naïve (4) respectively. People answering “do not know” are instead classified into two distinct categories according to their subjective FK. The first of these contains Insecure and Cautious Overconfident people and the second contains those we call “Socratic”. Category (5) includes the Insecure and the Cautious Overconfident (high subjective FK), i.e. people afraid of giving the incorrect answer even though they think they know the right one (insecure) as well as people who *ex ante* did not realize they do not know (overconfident) [2]. Category (6) includes the Socratic (low subjective FK), i.e. those who know that they do not know.

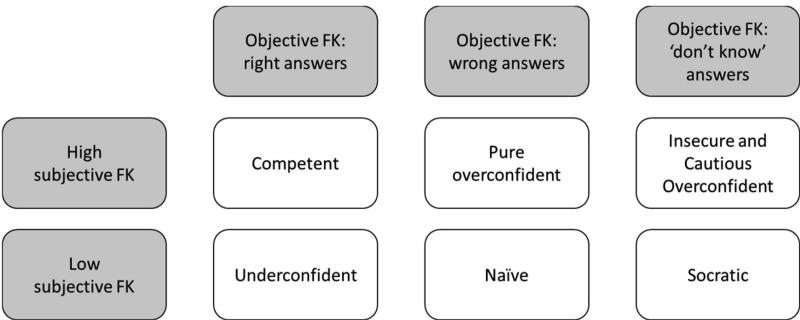
Our first research question investigates whether individuals selecting “do not know” and incorrect responses to the questions on objective FK are all the same, or whether they have different socio-demographic and socio-economic characteristics, taking into account their subjective FK.



Note(s): Own Elaboration. Figure shows the groups of individuals considering the level of objective and subjective financial knowledge identified by Xia *et al.* (2014) and Porto and Xiao (2016)

Figure 1.
Objective and
subjective FK

Figure 2.
Reinterpreting
objective and
subjective FK



Note(s): Own Elaboration. Figure shows the groups of individuals considering the level of objective and subjective financial knowledge

The third strand of literature focuses on the impact of both objective and subjective FK on financial behaviour (Wagner and Walstad, 2019; Bongini and Cucinelli, 2019; Gallego-Losada *et al.*, 2022; Yamori and Ueyama, 2022). The level of FK in fact alters people’s ability to apply this knowledge in financial decision making (Santini *et al.*, 2019). For example, previous studies show that in both developed and developing countries (Hasler and Lusardi, 2017), individuals with higher objective FK are less indebted (Lusardi and Tufano, 2015), are better able to save and to build assets (Letkiewicz and Fox, 2014), choose low-interest mortgages (Moore, 2003), plan for their retirement (Lusardi and Mitchell, 2007a, b, 2011; Bongini and Cucinelli, 2019; Xu *et al.*, 2022; Gallego-Losada *et al.*, 2022), are less financially fragile (Chhatwani and Mishra, 2021) and show greater financial well-being (Tahir *et al.*, 2021). Some recent studies show that during the COVID-19 pandemic consumers with higher objective FK were also less likely to delay their mortgage repayments (Chhatwani, 2022). There is also research evidence that subjective FK often influences both long- and short-term financial behaviours more than objective FK (Robb and Woodyard, 2011; Xiao *et al.*, 2011; Henager and Cude, 2016; Anderson *et al.*, 2017; Bialowolski *et al.*, 2021).

Low objective FK and high overconfidence, measured as the gap between subjective and objective FK, have been associated with detrimental behaviours, including behaviors related to financial fraud. Previous literature shows, on the one hand, that low objective FK negatively affects the ability to detect investment scams and frauds (Anderson, 2016; Andreou and Philip, 2018; Engels *et al.*, 2020; Wei *et al.*, 2021) and, on the other hand, that investors who are more vulnerable to these are individuals with limited objective FK (Lokanan, 2014; Engels *et al.*, 2020; Kadoya *et al.*, 2021) and high overconfidence (Gamble *et al.*, 2014; Anderson, 2016; Xiao *et al.*, 2022).

However, with one exception [3], the research outlined above again identifies low objective FK using a combination of both incorrect and “do not know” responses. As noted previously, this is a serious weakness and our second research question thus investigates whether individuals selecting “do not know” and individuals selecting incorrect responses to objective FK questions have the same probabilities of falling victim to financial fraud, also taking account of subjective FK.

3. Data

Our sample, shown in Table 1, is composed of 2,036 Italian adults aged between 18 and 79. Who took part in a survey conducted by the Bank of Italy using computer assisted personal

Table 1.
Sample distribution

Variable	Category	2,036 Individuals	1,051 Financially illiterate	222 TOP_ DNK	140 TOP_ INCORRECT	71 NAIVE	154 SOCRATICS	62 PURE_ OVER CONFIDENT	23 INSEC_COUT_ OVERCONFIDENT
Gender	Female	51.84%	52.71%	59.01%	44.29%	43.66%	60.39%	45.16%	60.87%
	Male	48.15%	47.29%	40.99%	55.71%	56.34%	39.61%	54.84%	39.13%
Marital_status	Married	58.48%	60.89%	50.90%	60.71%	60.56%	51.30%	59.68%	69.57%
	Single	26.54%	24.26%	26.58%	23.57%	21.13%	26.62%	29.03%	17.39%
	Divorced_Widowed	14.96%	14.84%	22.52%	15.71%	18.31%	22.08%	11.29%	13.04%
Income (euro)	up to 644	1.58%	2.47%	3.60%	2.14%	4.23%	2.60%	0.00%	4.35%
	645-1,059	11.02%	15.70%	21.62%	16.43%	22.54%	24.03%	11.29%	17.39%
	1,060-1,559	32.34%	39.49%	45.05%	45.00%	47.89%	46.10%	40.32%	39.13%
	1,560-3,875	49.09%	38.15%	26.58%	30.71%	23.94%	23.38%	38.71%	34.78%
	more than 3,875	5.94%	4.19%	3.15%	5.71%	1.41%	3.90%	9.68%	4.35%
Education	Degree	15.55%	10.37%	7.21%	11.43%	11.27%	3.90%	11.29%	13.04%
	High school	46.82%	43.01%	34.23%	50.00%	39.44%	31.82%	59.68%	56.52%
	Secondary school	25.55%	30.35%	28.38%	23.57%	25.35%	29.87%	22.58%	21.74%
	Primary school	10.47%	12.37%	19.82%	10.00%	16.90%	24.03%	3.23%	4.35%
	No school	1.58%	3.90%	10.36%	5.00%	7.04%	10.39%	3.23%	4.35%
Geographical area	North East	26.74%	21.41%	17.57%	13.57%	12.68%	18.83%	12.90%	13.04%
	North West	19.31%	14.75%	4.50%	22.86%	14.08%	1.95%	30.65%	17.39%
	Centre	20.01%	22.45%	23.42%	23.57%	21.13%	18.83%	29.03%	34.78%
	South	22.94%	20.93%	21.62%	27.14%	32.39%	20.78%	22.58%	17.39%
	Islands	10.98%	20.46%	32.88%	12.86%	19.72%	39.61%	4.84%	17.39%
N_children	0	77.01%	80.30%	86.04%	80.71%	83.10%	86.36%	77.42%	78.26%
	1	13.46%	11.04%	8.56%	9.29%	11.27%	8.44%	8.06%	17.39%
	2	8.55%	7.99%	5.41%	10.00%	5.63%	5.19%	14.52%	4.35%
	3	0.93%	0.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	4	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Employment status	employed	50.10%	45.29%	31.53%	55.00%	46.48%	27.92%	67.74%	43.48%
	looking for a job	6.20%	6.18%	6.76%	2.14%	4.23%	7.79%	0.00%	8.70%
	not employed	43.70%	48.53%	61.71%	42.86%	49.30%	64.29%	32.26%	47.83%

(continued)

Table 1.

Variable	Category	2,036 Individuals	1,051 Financially illiterate	222 TOP_ DNK	140 TOP_ INCORRECT	71 NAIVE	154 SOCRATICS	62 PURE_ OVERCONFIDENT	23 INSEC_COUT_ OVERCONFIDENT
Age	18-25	8.69%	8.47%	10.81%	5.00%	4.23%	11.69%	4.84%	8.70%
	25-45	27.65%	25.40%	19.37%	28.57%	30.99%	20.78%	29.03%	17.39%
	46-65	39.73%	38.06%	28.83%	39.29%	33.80%	25.32%	46.77%	47.83%
	>65	23.92%	28.07%	40.99%	27.14%	30.99%	42.21%	19.35%	26.09%

Note(s): Own elaboration. Table reports the description of socio-economic and socio-demographic variables included in the analysis. The Table shows the distribution of our main subsamples of adults that takes part to the survey and the subsample of individuals that have a FK lower than the sample average, individuals that answer at least 4 “do not know” (TOP_DNK) or incorrectly (TOP_WORST) to the questions on financial knowledge. The last four columns refer to individuals that are TOP_DNK or TOP_WORST and that have high or low subjective financial knowledge. NAIVE are TOP_WORST individuals with low subjective financial knowledge; SOCRATICS are TOP_DNK individuals with low subjective financial knowledge; PURE_OVERCONFIDENT are TOP_WORST individuals with high subjective financial knowledge; and INSEC_CAUT_OVERCONFIDENT are TOP_DNK individuals with high subjective financial knowledge

interviews at the beginning of 2020. The survey units were subjected to post-stratification and weighted to make the composition of the sample coincide with that of the population, according to socio-demographic parameters of gender, age, and geographical area. The sample is representative of the Italian population in 2020. Respondents answered five questions on FK, among other questions reported in [Appendix 1](#). The five questions are those identified by [OECD \(2013\)](#) for the measurement of FK of adults. Respondents could choose to give a definite answer or choose the “do not know” option. They were thus not obliged to give what could have been a random response ([Bongini and Cucinelli, 2019](#)); this was expected to minimize guessing ([Fornero and Monticone, 2011](#)).

Among the 2,036 respondents, we identify those (1,051 individuals) showing a level of objective FK lower than the sample average. These were separated into those giving “do not know” answers at least 4 times out of 5 (TOP_DNK) (222 individuals) and those giving incorrect answers at least 4 times out of 5 (TOP_INCORRECT) (140 individuals). These two groups of respondents represent the tertile of participants with the lowest objective FK.

As described in [Section 2](#), previous literature ([Porto and Xiao, 2016](#)) is extended by our taking into account both objective and subjective FK. This makes it possible to identify four clusters among the tertile of participants with the lowest objective FK: (1) Pure Overconfident, i.e. individuals answering the FK questions incorrectly and characterized by high subjective FK (PURE_OVERCONFIDENT); (2) Naïve, i.e. individuals answering the FK questions incorrectly and characterized by low subjective FK (NAÏVE); (3) Insecure and Cautious Overconfident, i.e. individuals answering the FK questions with “do not know” and characterized by high subjective FK (INSEC_CAUT_OVERCONFIDENT). This sub-sample includes respondents afraid of giving the incorrect answer even though they think they know the right one (insecure) and individuals who *ex ante* did not know they do not know (cautious overconfident); (4) Socratic, i.e. individuals answering the FK questions with “do not know” and characterized by low subjective FK (SOCRATIC).

The characteristics of the sub-groups are reported in [Table 1](#). As indicated by previous studies, women are found to be more financially illiterate than men, and individuals with lower income and lower education are also more financially illiterate. Surprisingly, married individuals are more illiterate than others. [Table 1](#) also shows that the higher the number of children, the higher the level of FK. In terms of geographical area, people living on the Islands (Sicily and Sardinia) are the least financially literate in Italy. In terms of employment status, individuals not in employment are characterized by the lowest FK, and it is also low among elderly respondents.

Focusing on individuals giving either “do not know” (TOP_DNK) or incorrect answers (TOP_INCORRECT) at least 4 times out of 5, some important differences emerge. Specifically, women are more likely to choose the “do not know” option than men, who are more willing to supply incorrect answers. Looking at marital status, married people tend to select more incorrect responses than “do not know”, which is however preferred by divorced people. Less educated individuals (up to secondary school level) are more likely, and more highly educated individuals are less likely, to answer “do not know”. Finally, people living on the Islands tend to prefer the “do not know” option, as do unemployed and elderly respondents.

There are other significant differences between the four clusters in terms of both objective and subjective FK. One is in gender: the Socratics, the Insecure and the Cautious Overconfident are more likely to be women, while the Pure Overconfident and the Naïve are often men. The geographical area is also very significant: the Naïve are concentrated in the South of Italy, the Socratics in the Islands, the Insecure and the Cautious Overconfident in the Centre of Italy, and the Pure Overconfident in the Centre and the North-West of the country.

4. Empirical method

4.1 *The determinants of financial illiteracy*

We initially run an ordered probit regressions on the whole sample of 2,036 individuals. Ordered probit is an example of generalized linear models (GLMs), which are generally used when the dependent variable is an ordered categorical variable. We test [Equation \(1\)](#):

$$\Omega_i = \alpha_i + \sum_i^n \beta_i X_i + \varepsilon_i \quad (1)$$

where Ω represents the number of incorrect or “do not know” answers, respectively, X includes the independent socio-demographic and economic variables suggested by previous literature ([Atkinson and Messy, 2012](#); [Chen and Garand, 2018](#)).

Among the socio-demographic variables we include: (1) a dummy variable that equals 1 when the respondent is a male, 0 otherwise (MALE); (2) two dummy variables referring to the marital status, where the first dummy equals 1 if the respondent is single, and 0 otherwise (SINGLE), and the second equals 1 if the respondent is widowed or divorced, and 0 otherwise (DIVORCED_WIDOWED). The reference category is married individuals; (3) three dummy variables related to the education level, where the first dummy equals 1 if the respondent has at least a degree, and 0 otherwise (DEGREE), the second equals 1 if the respondent has a diploma, and 0 otherwise (DIPLOMA), and the third equals 1 if the respondent attended secondary school, and 0 otherwise (SECONDARY SCHOOL). The reference category is respondents who completed the primary education level or a lower education level; (4) the employment status is measured by three dummy variables: the first equals 1 if respondent is not employed, and 0 otherwise (NOT_EMPLOYED); the second dummy variable equals 1 if the respondent is looking for a job, and 0 otherwise (LOOKING_FOR_A_JOB). The reference category is people in employment; (5) the geographical area in which the respondent lives is measured by three dummy variables: the first equals 1 if the respondent lives in the North-West, and 0 otherwise (NORTH_WEST), the second equals 1 if the respondent lives in the North-East, and 0 otherwise (NORTH_EAST), and the third variable equals 1 if the respondent lives in the centre of Italy, and 0 otherwise (CENTRE). The reference category is respondents living in the South and Islands (Sicily and Sardinia); (6) the number of children living with the respondent is considered using three dummy variables: the first equals 1 if the respondent does not live with any children, 0 otherwise (NO_CHILDREN), the second equals 1 if the respondent lives with one child, 0 otherwise (ONE_CHILD), and the reference category is individuals living with two children or more; finally, (7) the age of the respondent is measured using three dummy variables: the first equals 1 if the respondent is between 18 and 25 years old, 0 otherwise; the second equals 1 if the respondent is between 25 and 45 years old, 0 otherwise, and the third equals 1 if the respondent is between 46 and 65 years old, 0 otherwise. The reference category is age over 65 years old.

As a socio-economic measure we include in Regression (1) the income of the respondent, measured using the natural logarithm of his/her family income (INCOME). The description of all variables and expected relationships between independent and dependent variables are summarized in [Appendix 2](#).

A second analysis focusses only on the 1,051 financially illiterate individuals. We run a probit regression similar to [Equation \(1\)](#), using as a dependent variable the 222 and 140 individuals giving “do not know” (TOP_DNK) and incorrect answers (TOP_INCORRECT) at least 4 times out of 5.

4.2 *Financial illiteracy and financial fraud victimization*

To investigate the relationship between financial illiteracy and the probability of falling victim to financial fraud, we run some probit regressions where the dependent variable

equals 1 if the respondent is involved at least in one financial fraud, and 0 otherwise. To define involvement in financial fraud, respondents were invited to answer either “Yes” or “No” as to whether the following statements were true for them: (1) “Accepted advice to invest in a financial product that you later found to be a scam, such as a Ponzi scheme”; (2) “Accidentally provided financial information in response to an email or phone call that you later found out was not genuine”; (3) “Lost money as a result of hackers or phishing scams”. We test Equation (2):

$$Q_i = \alpha_i + \eta_i FI_i + \sum_i^n \beta_i X_i + \gamma_i RISK_PROPENSITY_i + \varepsilon_i \quad (2)$$

where Q is the dependent variable that takes value 1 if the respondent was victim of a financial fraud, 0 otherwise. FI measures financial illiteracy, estimated using different variables: (1) a dummy variable that equals 1 if the respondent has an objective FK lower than the sample average, 0 otherwise; (2) a categorical variable that sums the number of “do not know” answers and spans from 0 to 5 (do not know); (3) a categorical variable that sums the number of incorrect answers and spans from 0 to 5 (incorrect); (4) a dummy variable that equals 1 if the respondent answers “do not know” (TOP_DNK) at least 4 times out of 5; and finally (5) a dummy variable that equals 1 if the respondent gives incorrect answers ($TOP_INCORRECT$) at least 4 times out of 5. All these independent variables are included alternatively in Regression (2).

As control variables we include the socio-demographic and socio-economic variables used in Equation (1) (vector X). In addition, following previous literature (Saridakis *et al.*, 2016; Moody *et al.*, 2017), we insert the individual risk propensity ($RISK_PROPENSITY$), measured by a categorical variable that takes values from 1 to 5 and refers to the response to the following sentence “I am ready to risk some of my money when I save or make an investment”, where 1 is completely disagree and 5 is completely agree. The higher the value, the higher is the individual’s risk propensity.

Finally, we run Equation (2) using other measures of financial illiteracy, taking both objective and subjective FK as independent variables. First, we consider the 222 and 140 individuals giving “do not know” (TOP_DNK) and incorrect answers ($TOP_INCORRECT$) at least 4 times out of 5. Second, we consider the four clusters described in Section 3, i.e. Pure Overconfident, Naïve, Insecure and Cautious Overconfident, and Socratic.

5. Results

5.1 The characteristics of the financially illiterate

Our main results, reported in Table 2, show that socio-demographic and socio-economic characteristics of individuals giving incorrect or “do not know” answers are different.

Specifically, women are more likely to answer “do not know” than men although there are no gender differences relating to incorrect answers. Singles are found to give incorrect answers more frequently than married individuals, although this result has low statistical significance. The level of education matters in choosing incorrect or “do not know” responses: the higher the educational level, the lower the propensity to select “do not know”. However, individuals with a secondary school level of education or a diploma tend to give more incorrect answers than people with a lower education level (primary school or less). Neither does employment status contribute significantly to explaining the preference for either “do not know” or incorrect responses. Although individuals looking for a job give more incorrect answers than those in employment, the coefficient of the variable has low statistical significance. Geographical factors also help to bring into relief differences in the choice of “do not know” and incorrect answers. Specifically, people living in the North-West and in the

Table 2.
Ordered probit results:
determinants of
financial illiteracy
distinguishing
between do not know
and incorrect answers

Variables	(a) Do not know	(b) Incorrect
MALE	−0.188*** (0.0519)	0.0556 (0.0496)
SINGLE	0.0738 (0.0752)	0.133* (0.0760)
DIVORCED_WIDOWED	−0.0243 (0.0830)	−0.130 (0.0812)
DEGREE	−0.627*** (0.126)	0.148 (0.120)
DIPLOMA	−0.606*** (0.100)	0.192** (0.0978)
SECONDARY SCHOOL	−0.358*** (0.0964)	0.166* (0.0958)
NOT EMPLOYED	0.0293 (0.0706)	−0.0480 (0.0645)
LOOKING FOR A JOB	0.0678 (0.108)	0.155* (0.0264)
NORTH_WEST	0.171** (0.0702)	−0.0998 (0.0660)
NORTH_EAST	0.000532 (0.0813)	0.467*** (0.0761)
CENTRE	0.116* (0.0692)	−0.00636 (0.0642)
AGE 18–25	−0.0486 (0.130)	0.160 (0.123)
AGE 25–45	0.0113 (0.102)	0.0673 (0.103)
AGE 46–65	−0.0910* (0.0257)	−0.127* (0.0246)
INCOME	−0.210*** (0.0357)	−0.182*** (0.0342)
NO_CHILDREN	0.166 (0.248)	0.537** (0.227)
ONE_CHILD	0.0646 (0.249)	0.521** (0.227)
Observations	2,036	2,036
Adj_R-squared	0.0334	0.0167

Note(s): Own elaboration. Table reports the ordered probit regression on the determinants of financial illiteracy.
*, **, *** significant at 0.1, 0.05, 0.01

Centre of Italy select the “do not know” option more frequently than those living in the South or on the Islands who, in turn, choose fewer incorrect answers than those living in the North-East. Age does not significantly explain the preference for either “do not know” or incorrect responses. Individuals aged between 46 and 65 give fewer incorrect and “do not know” answers than other respondents, but this result too has low statistical significance. Moreover, our results show that the higher the income, the fewer are the “do not know” and incorrect responses. Finally, individuals living with two children or more tend to give fewer incorrect answers than others.

We next focus on respondents giving “do not know” (TOP_DNK) and incorrect answers (TOP_INCORRECT) at least 4 times out of 5. Our results, reported in Table 3(a–b), are consistent with findings shown in Tables 1 and 2 Women, people who are divorced or widowed, people with a low education level (primary school or lower), living in the Centre

Variables	(a) TOP_ DNK	(b) TOP_ INCORRECT	(c) NAÏVE	(d) SOCRATICS	(e) PURE_ OVERCONFIDENT	(f) INSEC_CAUT_ OVERCONFIDENT
MALE	−0.0510** (0.0246)	0.0410* (0.0213)	0.0296* (0.0156)	−0.0462** (0.0213)	0.0140 (0.0159)	−0.00678 (0.00882)
SINGLE	0.0592 (0.0372)	0.001* (0.0319)	−0.0205 (0.0228)	0.0416 (0.0316)	0.0326* (0.0027)	−0.0152 (0.0150)
DIVORCED_ WIDOWED	0.0823** (0.0356)	0.0136 (0.0319)	0.00593 (0.0227)	0.0517* (0.0311)	−0.00223 (0.0247)	−0.00657 (0.0134)
DEGREE	−0.133** (0.0577)	0.0606 (0.0469)	0.0108 (0.0322)	−0.208*** (0.0567)	0.0391 (0.0389)	0.0345 (0.0211)
DIPLOMA	−0.112*** (0.0410)	0.0529 (0.0363)	−0.0169 (0.0236)	−0.129*** (0.0336)	0.0591* (0.0327)	0.0285* (0.0173)
SECONDARY SCHOOL	−0.112*** (0.0385)	0.0103 (0.0357)	−0.0251 (0.0237)	−0.113*** (0.0321)	0.0381 (0.0324)	0.0121 (0.0180)
NOT EMPLOYED	0.0155 (0.0352)	−0.0265 (0.0312)	−0.00649 (0.0229)	0.0205 (0.0306)	−0.0230 (0.0237)	0.000959 (0.0113)
LOOKING FOR A JOB	0.0143 (0.0551)	0.162*** (0.0596)	0.0508 (0.0186)	0.0262 (0.0444)	− (0.0235)	0.0149 (0.0058)
NORTH_ WEST	−0.0848** (0.0349)	−0.0577* (0.0325)	−0.0322 (0.0239)	−0.0542* (0.0289)	−0.0259 (0.0235)	−0.00143* (0.0045)
NORTH_ EAST	−0.242*** (0.0467)	0.0548* (0.0305)	−0.00811 (0.0245)	−0.252*** (0.0530)	0.0522** (0.0211)	0.00899 (0.0134)
CENTRE	−0.0414 (0.0321)	−0.00933 (0.0274)	−0.0189 (0.0200)	−0.0648** (0.0274)	0.0218 (0.0199)	0.0148 (0.0115)
AGE 18–25	0.00675 (0.0603)	−0.0524 (0.0574)	−0.00238 (0.0413)	0.0376 (0.0507)	−0.0559 (0.0419)	−0.00529 (0.0235)
AGE 25–45	−0.0620* (0.0489)	−0.00133* (0.0437)	0.0436 (0.0300)	−0.000875* (0.0025)	−0.0252 (0.0355)	−0.0189* (0.0051)
AGE 46–65	−0.0608* (0.0391)	−0.0110* (0.0354)	0.0146 (0.0246)	−0.0327* (0.0339)	−0.0117* (0.0285)	−0.00551 (0.0122)
INCOME	0.00268 (0.0159)	−0.0240* (0.0145)	−0.0282*** (0.00988)	0.0120 (0.0134)	0.00363 (0.0117)	−0.00642* (0.00106)
NO_ CHILDREN	0.0299 (0.0506)	−0.0201 (0.0396)	0.0452 (0.0316)	0.0304 (0.0448)	−0.0425 (0.0259)	0.0140 (0.0211)
ONE_CHILD	0.0146 (0.0591)	−0.0497 (0.0473)	0.0385 (0.0363)	0.0211 (0.0523)	−0.0599* (0.0330)	0.0235 (0.0225)
Pseudo R ²	0.085	0.098	0.118	0.0817	0.0741	0.0521
Observations	1,051	1,051	1,051	1,051	1,051	1,051

Note(s): Own elaboration Table reports the probit regression on the determinants of financial illiteracy, distinguishing between individuals that choose at least 4 do not know answers out of 5 (TOP_DNK) and individuals that choose at least 4 out of 5 incorrect answers (TOP_INCORRECT). Moreover, considering the subjective FK, we distinguish between naïve, socratics, pure overconfident and insecure and couscous overconfident. *, **, *** significant at 0.1, 0.05, 0.01

Table 3.
Probit regression on
the subsample of
illiterate individuals

of Italy, in the South or on the Islands and aged under 25 and over 65 are more likely to be in the group of people choosing the “do not know” option (Table 3a). Furthermore, individuals looking for a job, male, single, living in the North-East of Italy, aged under 25 or over 65 and with low income are more likely to be in the group of those answering incorrectly (Table 3b).

Looking at both objective and subjective FK we next investigate the main socio-demographic and socio-economic characteristics of individuals belonging to the four clusters identified in [Section 2](#). Our results are reported in [Table 3\(c–f\)](#), which shows that men, and those on a low income are more likely to be in the Naïve group, while women, with a low education level (primary school or lower), living in the South or on the Islands, aged under 25 or over 65 are more likely to be in the Socratic group. Pure Overconfident individuals are shown to be mostly single, holding a diploma and living in the North-East. Finally, albeit with a low statistical significance, respondents with a diploma and a low income are more likely to be in the Insecure and Conscious Overconfident group.

5.2 The relationship between financial illiteracy and the probability of falling victim to financial fraud

The results reported in [Section 5.1](#) show that socio-demographic and socio-economic characteristics of individuals giving incorrect or “do not know” answers are different. In this section we investigate whether these responses have different impacts on financial behaviours, and specifically on the probability of falling victim to financial fraud.

We focused on both the whole sample ([Table 4](#)) and the financially illiterate subsample, i.e. people giving “do not know” (TOP_DNK) and incorrect answers (TOP_INCORRECT) at least 4 times out of 5.

[Table 4](#) shows that, although at a first glance financial illiteracy shows a positive relationship (+5.4%) with the probability of being a financial fraud victim, more in-depth analysis demonstrates that this relationship is statistically significant (+2.3%) only for individuals giving incorrect answers to objective FK questions, and not for those choosing the “do not know” option. [Table 5](#) illustrates that the probability of victimization rises (+4.8%) if we consider only people giving incorrect answers (TOP_INCORRECT) at least 4 times out of 5, and especially for respondents characterized by high subjective FK (Pure Overconfident) (+7.9%). Moreover, [Table 5](#) shows that people choosing the “do not know” option (TOP_DNK) at least 4 times out of 5, and especially those characterized by low subjective FK (Socratic), have a lower probability (−9.7%) of falling victim to financial fraud than other financially illiterate respondents.

Both risk propensity and living in the North-East display a positive statistically significant relationship with the probability of being a financial fraud victim ([Tables 4](#) and [5](#)). But the probability shows a negative link with income and certain socio-demographic variables, specifically being divorced or widowed and being unemployed or looking for a job ([Tables 4](#) and [5](#)). A statistically significant negative relationship between the probability of being a financial fraud victim and an age between 46 and 65 also emerges, but coefficients are so low that this variable can be neglected.

6. Discussion

Our findings demonstrate that there is significant heterogeneity across individuals giving incorrect or “do not know” answers to objective FK questions.

Focussing on the socio-demographic and socio-economic characteristics, women are shown to prefer the “do not know” option to a definite answer, as suggested by [Chen and Garand \(2018\)](#), [Kim and Mountain \(2019\)](#) and [Bucher-Koenen et al. \(2021\)](#), and to be characterized by a low subjective FK, in other words, they are aware of not knowing. This finding on low self-confidence is consistent with the study by [Bucher-Koenen et al. \(2021\)](#), which demonstrate that when “do not know” is unavailable as an option, females often respond correctly. Previous studies explain this result by the fact that women are more risk-adverse than men ([Croson and Gneezy, 2009](#)), tend to avoid competitive settings ([Niederle and](#)

Variables	(a)	(b)	(c)
ILLITERATE	0.054*** (0.011)	—	—
Do not know	—	−0.003 (0.004)	—
Incorrect	—	—	0.023*** (0.004)
TOP_DNK	—	—	—
TOP_INCORRECT	—	—	—
RISK_PROPENSITY	0.044*** (0.005)	0.046*** (0.005)	0.043*** (0.005)
MALE	0.005 (0.011)	0.001 (0.011)	0.001 (0.011)
SINGLE	−0.026* (0.016)	−0.026 (0.016)	−0.024 (0.016)
DIVORCED_WIDOWED	−0.056*** (0.021)	−0.058*** (0.021)	−0.054*** (0.021)
DEGREE	0.016 (0.028)	0.012 (0.028)	0.008 (0.027)
DIPLOMA	0.021 (0.023)	0.015 (0.024)	0.010 (0.023)
SECONDARY SCHOOL	0.023 (0.023)	0.020 (0.024)	0.018 (0.023)
NOT EMPLOYED	−0.031** (0.015)	−0.032** (0.015)	−0.030** (0.015)
LOOKING FOR A JOB	−0.071** (0.031)	−0.080*** (0.031)	−0.070** (0.030)
NORTH_WEST	−0.001 (0.017)	0.003 (0.017)	0.009 (0.017)
NORTH_EAST	0.088*** (0.015)	0.096*** (0.015)	0.084*** (0.015)
CENTRE	0.003 (0.015)	0.010 (0.015)	0.012 (0.015)
AGE 18–25	0.011 (0.027)	0.013 (0.027)	0.013 (0.026)
AGE 25–45	0.007 (0.023)	0.008 (0.023)	0.009 (0.022)
AGE 46–65	−0.011* (0.000)	−0.009* (0.000)	−0.011* (0.000)
INCOME	−0.019** (0.008)	−0.030*** (0.008)	−0.024*** (0.008)
NO_CHILDREN	0.005 (0.020)	0.003 (0.020)	0.004 (0.020)
ONE_CHILD	−0.002 (0.022)	−0.007 (0.022)	−0.001 (0.022)
Pseudo R ²	0.2077	0.1870	0.2159
Observations	2,036	2,036	2,036

Note(s): *Own elaboration* Tables show results of the probit regression of the determinants of being victim of financial fraud. Model (a) includes the level of illiteracy as independent variable; model (b) considers the number of do not know answers; model (c) considers the number of incorrect answers. Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 4.
Probit regression
determinants of being
victim of financial
frauds

Vesterlund, 2007, 2010) and are less self-confident and willing to contribute to duties perceived as male-specific (Coffman, 2014), such as finance (Chen and Volpe, 2002; Boggio et al., 2015). Our results suggest that female preference for the “do not know” option may

Table 5.
Probit regression on
the subsample of
illiterate individuals;
determinants of being
victim of
financial fraud

Variables	(a) TOP_DNK	(b) TOP_INCORRECT	(c) SOCRATICS	(d) INSEC_CAUT_OVERCONFIDENT	(e) NAIVE	(f) PURE_OVERCONFIDENT
TOP_DNK	-0.067** (0.027)	-	-	-	-	-
TOP_INCORRECT	-	0.048** (0.023)	-	-	-	-
SOCRATICS	-	-	-0.097** (0.042)	-	-	-
INSEC_CAUT_OVERCONFIDENT	-	-	-	0.014 (0.049)	-	-
NAIVE	-	-	-	-	0.013 (0.034)	-
PURE_OVERCONFIDENT	-	-	-	-	-	0.079*** (0.030)
RISK PROPENSITY	0.060*** (0.008)	0.060*** (0.008)	0.059*** (0.008)	0.060*** (0.008)	0.061*** (0.008)	0.059*** (0.008)
MALE	0.002 (0.018)	0.002 (0.018)	0.001 (0.018)	0.003 (0.018)	0.003 (0.018)	0.003 (0.018)
SINGLE	-0.025 (0.025)	-0.027 (0.024)	-0.025 (0.025)	-0.025 (0.025)	-0.026 (0.025)	-0.031 (0.024)
DIVORCED_WIDOWED	-0.085** (0.034)	-0.094*** (0.034)	-0.086** (0.034)	-0.093*** (0.034)	-0.093*** (0.034)	-0.096*** (0.035)
DEGREE	0.028 (0.040)	0.028 (0.040)	0.025 (0.040)	0.034 (0.040)	0.034 (0.040)	0.031 (0.039)
DIPLOMA	0.007 (0.034)	0.005 (0.034)	0.006 (0.034)	0.010 (0.034)	0.011 (0.034)	0.003 (0.033)
SECONDARY SCHOOL	0.011 (0.034)	0.012 (0.033)	0.009 (0.034)	0.015 (0.033)	0.016 (0.033)	0.009 (0.033)
NOT EMPLOYED	-0.045* (0.024)	-0.047** (0.024)	-0.047** (0.024)	-0.049** (0.024)	-0.048** (0.024)	-0.046* (0.024)
LOOKING FOR A JOB	-0.148*** (0.051)	-0.146*** (0.050)	-0.149*** (0.051)	-0.152*** (0.051)	-0.152*** (0.051)	-0.142*** (0.051)
NORTH_WEST	0.013	0.023	0.012	0.016	0.017	0.022

(continued)

Table 5.

Variables	(a) TOP_DNK	(b) TOP_INCORRECT	(c) SOCRATICS	(d) INSEC_CAUT_OVERCONFIDENT	(e) NAIVE	(f) PURE_OVERCONFIDENT
NORTH_EAST	(0.028) 0.099***	(0.027) 0.110***	(0.028) 0.098***	(0.028) 0.110***	(0.028) 0.111***	(0.027) 0.107***
CENTRE	(0.026) 0.024	(0.026) 0.026	(0.026) 0.019	(0.026) 0.024	(0.026) 0.025	(0.026) 0.024
AGE 18-25	(0.024) 0.037	(0.023) 0.041	(0.024) 0.038	(0.023) 0.034	(0.024) 0.034	(0.023) 0.042
AGE 25-45	(0.042) 0.021	(0.041) 0.027	(0.041) 0.023	(0.042) 0.024	(0.042) 0.024	(0.041) 0.029
AGE 46-65	(0.034) -0.007*	(0.034) -0.001*	(0.034) -0.006*	(0.034) -0.005*	(0.034) -0.004*	(0.033) -0.002*
INCOME	(0.009) -0.038***	(0.009) -0.038***	(0.000) -0.037***	(0.000) -0.037***	(0.000) -0.037***	(0.009) -0.040***
NO_CHILDREN	(0.012) -0.017	(0.012) -0.018	(0.012) -0.017	(0.012) -0.019	(0.012) -0.020	(0.012) -0.013
ONE_CHILD	(0.031) -0.007	(0.031) -0.006	(0.031) -0.008	(0.031) -0.011	(0.031) -0.011	(0.031) -0.003
Pseudo R2	(0.035) 0.2170	(0.035) 0.1876	(0.036) 0.2176	(0.035) 0.1916	(0.035) 0.1986	(0.035) 0.1976
Observations	1,051	1,051	1,051	1,051	1,051	1,051

Note(s): *Own elaboration* Tables show results of the probit regression of the determinants of being victim of financial fraud on the subsample of financial illiterate individuals. Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

depend on their underconfidence, as suggested by previous literature (Chen and Garand, 2018; Kim and Mountain, 2019; Cupàk *et al.*, 2021), or on their objectivity in recognizing themselves as financially illiterate. All things being equal, men characterized by low financial self-confidence tend to select more incorrect answers than women, probably because males are more risk-oriented (Croson and Gneezy, 2009) and more optimistic about their relative performance (Niederle and Vesterlund, 2007, 2010).

Moreover, the higher the educational level, the lower the propensity to choose “do not know”, especially for individuals with low self-confidence. This suggests that education significantly contributes to increasing self-confidence, as previously shown by Loibl *et al.* (2009). This result is particularly interesting as previous literature finds that more highly educated people show higher objective FK and infers from this that less educated individuals are all characterized by low objective FK. Our results suggest however that things are more complex, less educated individuals tend to prefer the “do not know” option to a definite answer, especially when they have low self-confidence. This may reflect excessive low self-confidence or objectivity in recognizing themselves as financially illiterate.

Most people know that they do not know, and therefore they prefer answering don't know. This reflects the fact that these areas of Italy are characterized by lower levels of education as reported on the website of the Italian National Institute of Statistics (ISTAT, 2022) [4].

The higher the income, the fewer are “do not know” responses and incorrect answers. This confirms previous evidence that low-income individuals are particularly at risk of financial illiteracy (Jacob *et al.*, 2000). This may be due to their limited access to financial and community institutions, which may exacerbate the knowledge gap (Zhan *et al.*, 2006).

Our findings show further interesting evidence related to the relationship between financial illiteracy and the probability of falling victim to financial fraud.

Previous studies find that financial illiteracy makes people more vulnerable to financial scams and fraud (Lokanan, 2014; Engels *et al.*, 2020; Kadoya *et al.*, 2021). Our paper extends these findings by clarifying that individuals giving incorrect answers to objective FK questions have a higher probability of falling prey financial fraud while people preferring the “do not know” option have a lower probability. This can be explained by psychological behavioural dynamics and, specifically, by self-confidence. Previous studies demonstrate in fact the positive relationship between overconfidence and being a victim of financial fraud (Gamble *et al.*, 2014; Anderson, 2016; Xiao *et al.*, 2022). We find, on the one hand, that among people giving incorrect responses, the Pure Overconfident (i.e. those characterized by high self-confidence) are more vulnerable to financial scams and frauds and, on the other hand, that among people preferring the “do not know” option, those characterized by low self-confidence (i.e. the Socratic) are less exposed to financial fraud. This can be explained considering the information set. Overconfident individuals may be less likely than others to follow financial news, including news about financial frauds, which would decrease their awareness of the issue and make them vulnerable to deception in the future (Wei *et al.*, 2021). They may also assess the credibility of financial information they encounter less accurately (Wei *et al.*, 2021) or lack the skills to disentangle genuine from fraudulent information (Engels *et al.*, 2020), which would further increase the probability of being scammed. Another explanation could be that overconfidence encourages the illusion of control so that individuals shy away from taking precautionary action in their financial lives (Porto and Xiao, 2016). This may make them seek less financial advice and make them more vulnerable to financial fraud (Porto and Xiao, 2016).

These results are particularly interesting because they suggest that, although low objective FK is in general a negative condition for an individual, when it is associated with high self-confidence it creates the ideal conditions for becoming a financial fraud victim. This means

that in order to reduce scams, it may be more important to make people aware of their ignorance on financial topics than to increase levels of objective FK among overconfident individuals.

The greater likelihood of being a financial fraud victim for more risk-oriented people confirms previous results by [Saridakis et al. \(2016\)](#) and can be explained by the fact that risk-lovers are less likely to pay attention to the peripheral aspects of messages, which may cue the possibility of deception. This makes them more likely to be scam victims ([Gasper, 2004](#)).

Furthermore, as suggested by previous literature ([Lokanan, 2014](#); [Kadoya et al., 2021](#)), people on a low income, like people looking for a job or unemployed, are likely victims of financial fraud. The explanation could be that such individuals are attracted to refund proposals used by fraudsters.

Finally, divorced and widowed people have a higher probability of falling victim to financial fraud. A possible explanation is that loneliness can weaken cognitive ability and thus make them psychologically vulnerable ([Kadoya et al., 2021](#)).

7. Additional analysis and robustness checks

Objective FK can be increased by specific financial education programmes. In order to identify content, and target individuals for such programmes, we conduct an additional analysis and investigate the determinants of incorrect answers given to each question by the whole sample of 2,036 respondents. [Table 6](#) reports the distribution of correct, incorrect and “do not know” answers to each FK question. Data show that the percentage of individuals giving incorrect responses changes according to the questions. The topic causing most difficulty is the compound interest rate, and that giving least difficulty is the relationship between risk and return.

We run a probit regression for each question about FK, where the dependent variable equals 1 if the individual provides an incorrect answer, and 0 if correct. The independent variables are those used in [Equation \(1\)](#). [Table 7](#) reports our results. Our findings show that the issue of inflation should be explored by men, and divorced, widowed and less educated people. Financial education programmes about the simple interest rate should be addressed to less educated and low-income individuals, while other programmes on compound interest rates should be targeted at married, under 65 and low-income people. It would also be useful to target schemes explaining the relationship between risk and return in investment at women and people with a low family income. And it would be useful to target low-income groups, as well as individuals living in the North-East of Italy, with financial education programmes on diversification.

To check the robustness of our main results, we run an alternative regression model. Because of their construction, “do not know” and incorrect answers may be related, so we run a structural equation model (SEM) that considers the relationship between these two dependent variables. As shown in [Table 8](#), our main results are confirmed. The SEM is reported in [Appendix 2](#).

As a second robustness check, we run a multinomial logit regression to identify the probability of being in the group of individuals giving “do not know” (TOP_DNK) and incorrect answers (TOP_INCORRECT) at least 4 times out of 5, compared to the base group of

	Inflation	Simple interest rate	Compound interest rate	Risk return	Diversification
Correct	43.86%	55.75%	29.27%	63.11%	50.15%
Incorrect	37.87%	17.68%	47.59%	17.88%	23.33%
Do not know	18.27%	26.57%	23.13%	19.01%	26.52%

Note(s): Own elaboration Tables shows the percentage of correct, incorrect and do not know answers to the big five questions

Table 6.
Percentage of correct,
incorrect and DNK
answers for each FK
question

Variables	(1) Inflation	(2) Simple interest	(3) Compound interest	(4) Risk- return	(5) Diversification
MALE	0.022* (0.011)	−0.001 (0.024)	0.035 (0.031)	−0.022* (0.012)	0.017 (0.025)
SINGLE	0.022 (0.048)	−0.010 (0.036)	−0.124** (0.050)	0.052 (0.033)	−0.036 (0.041)
DIVORCED_ WIDOWED	0.084* (0.048)	−0.005 (0.038)	−0.036 (0.050)	−0.034 (0.037)	0.005 (0.038)
DEGREE	−0.164** (0.079)	−0.095* (0.054)	0.007 (0.080)	0.016 (0.053)	−0.031 (0.061)
DIPLOMA	−0.072 (0.069)	−0.100** (0.045)	0.020 (0.071)	0.010 (0.043)	−0.050 (0.052)
SECONDARY SCHOOL	−0.089 (0.069)	−0.092** (0.045)	0.028 (0.071)	0.020 (0.043)	−0.026 (0.051)
NOT EMPLOYED	−0.014 (0.043)	−0.013 (0.033)	0.057 (0.045)	−0.025 (0.029)	0.042 (0.034)
LOOKING FOR A JOB	−0.071 (0.074)	−0.099* (0.059)	0.052 (0.078)	0.001 (0.051)	−0.020 (0.059)
NORTH_WEST	−0.026 (0.041)	0.026 (0.031)	−0.063 (0.042)	−0.049 (0.034)	−0.120*** (0.036)
NORTH_EAST	0.025 (0.049)	−0.019 (0.038)	−0.030 (0.051)	0.033 (0.034)	0.165*** (0.035)
CENTRE	0.004 (0.040)	0.002 (0.030)	−0.096** (0.040)	0.028 (0.027)	−0.040 (0.032)
AGE 18–25	0.073 (0.082)	−0.024 (0.062)	0.214*** (0.083)	−0.070 (0.056)	0.066 (0.067)
AGE 25–45	−0.024 (0.065)	−0.030 (0.050)	0.210*** (0.067)	−0.065 (0.046)	0.019 (0.054)
AGE 46–65	−0.037 (0.055)	−0.006 (0.043)	0.194*** (0.056)	−0.066* (0.038)	−0.098** (0.044)
INCOME	0.023 (0.024)	−0.068*** (0.017)	−0.073*** (0.025)	−0.024* (0.016)	−0.065*** (0.018)
NO_CHILDREN	0.031 (0.054)	−0.022 (0.040)	0.101* (0.053)	0.021 (0.042)	−0.028 (0.044)
ONE_CHILD	0.058 (0.059)	−0.033 (0.045)	0.070 (0.059)	0.030 (0.046)	−0.036 (0.047)
SIMPLE INTEREST	0.131*** (0.040)		0.119*** (0.044)	0.067** (0.026)	0.067** (0.030)
COMPOUND INTEREST	0.154*** (0.029)	0.066*** (0.024)		0.020 (0.022)	0.039 (0.025)
RISK RETURN	0.092** (0.042)	0.077*** (0.028)	0.025 (0.045)		0.273*** (0.026)
DIVERSIFICATION	0.118*** (0.037)	0.053** (0.026)	0.045 (0.039)	0.213*** (0.021)	
INFLATION		0.078*** (0.023)	0.159*** (0.030)	0.057*** (0.022)	0.082*** (0.024)
Pseudo R2	0.0173	0.0183	0.023	0.0298	0.0191
Observations	1,007	1,007	1,007	1,007	1,007

Table 7.
Probit regression on
each FK question
(margins)

Note(s): Own elaboration Table reports the logit regression on the determinants of incorrect answers. Dependent variables equals 1 if respondent provides the incorrect answer, zero if answer is correct. The do not know answers are not considered in this analysis *, **, *** significant at 0.1, 0.05, 0.01

Variables	(1) Do not know	(2) Incorrect	(4) SEM
MALE	-0.219*** (0.064)	0.042 (0.055)	—
SINGLE	0.088 (0.095)	-0.122 (0.082)	—
DIVORCED_WIDOWED	0.015 (0.101)	-0.128 (0.086)	—
DEGREE	-0.872*** (0.150)	0.169 (0.128)	—
DIPLOMA	-0.872*** (0.122)	0.230** (0.105)	—
SECONDARY SCHOOL	-0.586*** (0.119)	0.188* (0.101)	—
NOT EMPLOYED	0.029 (0.089)	-0.026 (0.076)	—
LOOKING FOR A JOB	-0.009 (0.140)	-0.181 (0.120)	—
NORTH_WEST	0.147* (0.087)	-0.113 (0.074)	—
NORTH_EAST	-0.097 (0.102)	0.492*** (0.087)	—
CENTRE	0.082 (0.084)	-0.051 (0.071)	—
AGE 18–25	-0.008 (0.161)	0.108 (0.138)	—
AGE 25–45	-0.018 (0.011)	-0.018* (0.012)	—
AGE 46–65	-0.103 (0.018)	-0.126* (0.093)	—
INCOME	-0.253*** (0.044)	-0.201*** (0.038)	—
NO_CHILDREN	0.063 (0.116)	-0.009 (0.099)	—
ONE_CHILD	-0.087 (0.131)	-0.060 (0.112)	—
var(e.sbagliate)	—	—	1.382*** (0.043)
var(e.nonsosomma)	—	—	1.894*** (0.059)
Constant	2.761*** (0.235)	1.694*** (0.201)	—
Log Likelihood		-19532.205	
Observations	2,036	2,036	2,036

Note(s): *Own elaboration* Table reports the structural equation model regression on the determinants of individuals that answer DNK and individuals that give incorrect answers. *, **, *** significant at 0.1, 0.05, 0.01. Standard errors are reported in parentheses. var(e.do notknow) and var(e.incorrect) are the variance of do not know and incorrect variables respectively. cov(e.do notknow,e.incorrect) is the covariance between do not know and wrong variables

Table 8.
Structural
equation model

individuals giving correct responses (TOP_FK) at least 4 times out of 5. The multinomial logistic model is used when the dependent variable takes more than two categorical values, e.g. 1, 2, and 3, and these values do not refer to a quantity (i.e. 2 is not greater than 1 and 3 is not greater than 2), but simply distinguish the three groups of individuals. Results are reported in [Table 9](#) and confirm our main findings.

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Variables	(1) TOP_FK	(2) TOP_DNK	(3) TOP_INCORRECT
MALE	0.054* (0.031)	−0.097*** (0.027)	0.043* (0.024)
SINGLE	−0.008 (0.043)	0.022 (0.038)	−0.013 (0.033)
DIVORCED_WIDOWED	0.005 (0.047)	0.020 (0.039)	−0.024 (0.036)
DEGREE	0.214*** (0.070)	−0.233*** (0.060)	0.019 (0.054)
DIPLOMA	0.208*** (0.056)	−0.198*** (0.044)	−0.010 (0.043)
SECONDARY SCHOOL	0.161*** (0.056)	−0.132*** (0.042)	−0.029 (0.043)
NOT EMPLOYED	−0.009 (0.043)	0.020 (0.037)	−0.011 (0.034)
LOOKING FOR A JOB	0.179** (0.077)	0.037 (0.060)	−0.215*** (0.076)
NORTH_WEST	0.046 (0.043)	−0.034 (0.038)	−0.012 (0.037)
NORTH_EAST	−0.038 (0.056)	−0.145*** (0.055)	0.183*** (0.033)
CENTRE	0.004 (0.038)	−0.033 (0.033)	0.029 (0.030)
AGE 18–25	−0.029 (0.075)	0.065 (0.061)	−0.037 (0.064)
AGE 25–45	0.013* (0.012)	−0.029 (0.054)	−0.042* (0.049)
AGE 46–65	0.014* (0.012)	−0.046 (0.044)	−0.031* (0.042)
INCOME	0.157*** (0.021)	−0.069*** (0.018)	−0.089*** (0.017)
NO_CHILDREN	−2.911 (156.793)	1.662 (162.523)	1.249 (153.969)
ONE_CHILD	−2.851 (156.793)	1.619 (162.523)	1.232 (153.969)
Pseudo R ²	0.1432		
Observations	933	933	933

Table 9.

Multinomial logit results – margins

Note(s): Own elaboration Table reports the Multinomial logit regression on the determinants of individuals with the highest financial knowledge, the highest “do not know” answers and the highest incorrect answers. Table reports margins. *, **, *** significant at 0.1, 0.05, 0.01

As a final robustness check, we consider the potential issue of endogeneity of FK. [Jappelli and Padula \(2013\)](#) theoretically investigate the endogeneity of financial literacy concerning saving decisions, and show that there may be a problem of omitted variables. In our analysis on the probability of being a financial fraud victim, financial illiteracy endogeneity may derive from an individual’s effort to learn to manage money, to invest in financial products and, more in general, to take financial decisions. To address this problem, we run an instrumental variable probit regression (IV-probit regression). Following the literature, we use as instrumental variables both the average FK at the geographical level in which the respondent lives and the frequency of Internet use. We argue that the average FK at the geographical level is an ideal instrumental variable, since individuals can improve their FK by learning from others around them

(Bucher-Koenen and Lusardi, 2011; Calcagno and Monticone, 2015). Our results, shown in Table 10, are in line with previous findings and confirm that individuals giving more incorrect answers are more exposed to financial fraud, and those answering “do not know” are less so.

Variables	(1) Do not know	(2) Incorrect
RISK PROPENSITY	0.054*** (0.005)	0.035*** (0.011)
Do not know	–0.020 (0.060)	–
Incorrect	–	0.172** (0.081)
MALE	–0.002 (0.018)	–0.005 (0.014)
SINGLE	–0.032* (0.018)	–0.013 (0.023)
DIVORCED_WIDOWED	–0.054*** (0.018)	–0.032 (0.024)
DEGREE	0.000 (0.059)	–0.012 (0.035)
DIPLOMA	0.007 (0.057)	–0.015 (0.032)
SECONDARY SCHOOL	0.014 (0.041)	–0.007 (0.030)
NOT EMPLOYED	–0.029* (0.016)	–0.025 (0.019)
LOOKING FOR A JOB	–0.075*** (0.025)	–0.043 (0.034)
NORTH_WEST	0.007 (0.018)	0.023 (0.021)
NORTH_EAST	0.137*** (0.019)	0.054 (0.045)
CENTRE	0.005 (0.016)	0.013 (0.019)
AGE 18–25	0.015 (0.029)	–0.003 (0.036)
AGE 25–45	–0.007 (0.024)	–0.004* (0.029)
AGE 46–65	–0.012 (0.021)	–0.032* (0.026)
INCOME	–0.036** (0.017)	0.004 (0.019)
NO_CHILDREN	0.015 (0.021)	0.015 (0.025)
ONE_CHILD	0.005 (0.024)	0.017 (0.029)
Constant	0.104 (0.170)	–0.242* (0.146)
Observations	2,036	2,036
R-squared	0.099	0.132

Note(s): Own elaboration Table reports the Instrumental Variable ordered probit regression on the determinants of being victim of financial frauds. *, **, *** significant at 0.1, 0.05, 0.01

Table 10.
IV probit-regression
second step:
instrumental variables
Internet and average
financial knowledge
of geographical area

8. Conclusions and policy implications

FK has become a crucial topic in recent years, and institutions, regulators and academics have focused on analysing its determinants. However, the differences between individuals that tend to answer incorrectly and those that prefer “do not know” responses have so far received very little academic attention. We aim to fill this gap and demonstrate that financially illiterate people are not all the same. Specifically, we show that the socio-demographic and socio-economic characteristics of individuals selecting incorrect and “do not know” responses to objective FK questions are different. We also show that subjective FK matters in choosing incorrect and “do not know” answers and find that overconfidence is a significant risk factor for falling victim to financial fraud.

The implications of our results are numerous. Overall, our evidence shows that the “one-size-fits-all” model does not work for financial education programmes. It suggests first that financial education schemes targeting specific groups, i.e. women, low educated people and individuals living in the South of Italy and on the Islands, would have limited success if focused only on improving consumers’ objective FK. These programmes also need to take into account how these programmes influence the metacognitive feeling of knowing, i.e. subjective FK (Hadar *et al.*, 2013), and therefore be designed to instil self-confidence in the participants. Second, our results identify the socio-demographic and socio-economic characteristics of individuals providing incorrect answers to questions on specific financial topics, and this could be useful for defining the contents of financial education programmes and identifying target individuals needing to improve their objective FK. Third, we demonstrate that the risk of falling victim to financial fraud is much increased by overconfidence, which is typically neglected in traditional financial education initiatives. Fraud prevention programs should focus more on the reduction of high victimization risk owing to overconfidence biases.

Notes

1. The big five questions are reported in the Appendix.
2. The composition of this category reflects the fact that the self-assessment question precedes the five FK questions in the Bank of Italy survey.
3. The exception is Wei *et al.* (2021), who code incorrect and “do not know” responses separately and exclude the ‘do not knows’ from their analysis.
4. http://dati-censimentopopolazione.istat.it/Index.aspx?DataSetCode=DICA_GRADOISTR1

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Appendix 1
Financial knowledge questions (Banca d'Italia Questionnaire, 2020)

A study on
financial
literacy
measurement

725

(1) Inflation

Suppose you had €100 in a savings account. During the year, the inflation rate is steady at 2%. After 1 years with the 100€ on your account you could buy:

- More than today;
- Exactly the same as today;
- Less than today;
- Do not know;
- Refusal;
- Other.

(2) Simple interest ...

a) Suppose you put \$100 into a savings account with a guaranteed interest rate of 2% per year. You don't make any further payments into this account and you don't withdraw any money. How much would be in the account at the end of the first year, once the interest payment is made?

- Num:
- Do not know;
- Refusal.

... and compound interest.

b) And how much would be in the account at the end of five years [add if necessary: remembering there are no fees or tax deductions]? Would it be:

- More than €110;
- Exactly €110;
- Less than €110;
- I cannot say on the basis of the given information;
- Do not know;
- Refusal.

(3) Risk–return relation

True or false? An investment with a high return is likely to be high risk

- true;
- false;
- do not know;
- refuse to answer.

(4) Diversification

Do you think that the following statement is true or false? It is usually possible to reduce the risk of investing in the stock market by buying a wide range of stocks and shares:

- true;
- false;

- do not know;
- refuse to answer.

Appendix 2

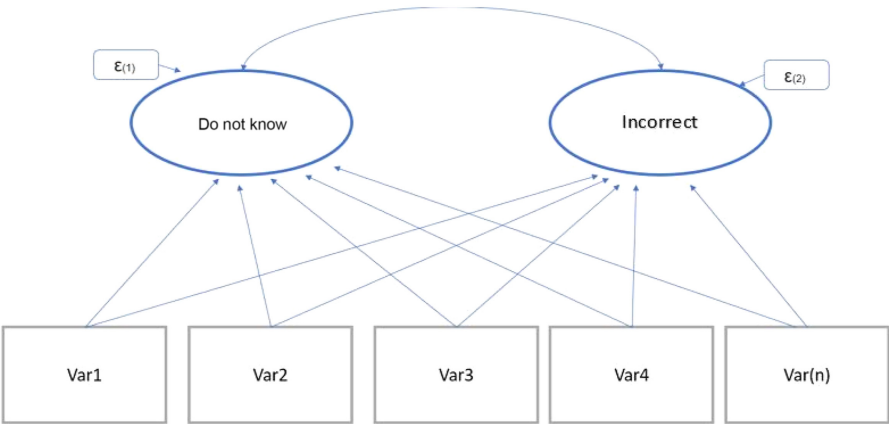


Figure A1.
Figure of structural
equation model

Note(s): Own Elaboration. Figure shows the relationship between dependent variables “do not know” and “wrong”. Moreover, figure underlines the relationship between independent variables. These variables are related to both dependent variables

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