

Determinants of Financial Literacy: The Role of Behavioral Biases, Experience, and Sociodemographic Factors¹

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Abstract

This paper examines the determinants of financial literacy among Portuguese individuals, with particular emphasis on the role of behavioral biases. Using survey data from 1,850 respondents, we investigate how cognitive abilities, experience, and behavioral traits such as overconfidence and loss aversion influence different measures of financial literacy. The analysis uses probit and ordered probit regressions with marginal effects to examine three complementary measures of financial literacy: an objective knowledge index, a behavioral index, and a perceived knowledge index. The findings reveal that financial literacy is positively associated with investment experience and with the relative weight of securities in individual wealth, suggesting that knowledge grows through financial exposure. Cognitive reflection is also positively related to literacy, while overconfidence and loss aversion have negative effects. Financial literacy is higher among men, wealthier individuals, and residents in metropolitan areas. By testing alternative measures of financial literacy, we find that the magnitude and significance of determinants vary depending on the definition adopted. These results show the importance of considering multidimensional approaches when assessing financial literacy and designing financial education policies.

Keywords: Financial Literacy; Behavioral Biases; Overconfidence, Loss Aversion, Cognitive Reflection

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1. Introduction

In their daily lives, individuals are confronted with numerous decisions, ranging from routine matters to highly complex financial choices. The quality of these financial decisions is influenced not only by the level of financial literacy but also by the presence of behavioral biases and other contextual factors. A higher degree of financial literacy brings several advantages, such as promoting a stronger propensity to save for the future, supporting better household budget management, enhancing awareness of financial risks, and reducing the likelihood of over-indebtedness and exposure to excessive interest rates (Banco de Portugal, 2011; Lusardi & Kaiser, 2025). However, the overall level of financial literacy remains low for a substantial share of the population, often insufficient to ensure sound financial decisions. This deficit is associated with problematic behaviors, including high household indebtedness, limited participation in savings, misperceptions of risk diversification, and inefficient allocation of capital (Calcagno & Monticone, 2015; Georgarakos & Inderst, 2011; Lusardi & Mitchell, 2011, 2014; Stolper, 2018; Shi, Ali, & Leong, 2025). The lack of financial literacy, combined with the growing complexity of financial products and instruments, as emphasized by Van Rooij et al. (2011), creates a particularly risky environment for households and investors.

This study aims to provide a deeper understanding of the determinants of financial literacy in Portugal. In particular, it explores the role of behavioral biases, namely overconfidence and loss aversion—alongside sociodemographic characteristics and cognitive factors. Given the absence of a universally accepted definition of financial literacy, we also examine how results vary depending on the measure employed, thus addressing an important gap in the literature. Using a quantitative research strategy, the analysis pursues two main objectives: (1) to identify the determinants of financial literacy levels; and (2) to assess the extent to which alternative measures of financial literacy influence these outcomes. The empirical analysis relies on data from 1,850 Portuguese individuals who completed a survey administered by CMVM in 2021. To evaluate the determinants of financial literacy, several probit and ordered probit regressions are estimated.

Our findings show that financial literacy in Portugal is positively associated with investment experience and with the proportion of wealth allocated to securities, suggesting that knowledge develops through financial exposure and practice. Cognitive reflection also emerges as a significant positive determinant, reinforcing the importance of analytical reasoning in financial decision-making. In contrast, behavioral biases such as overconfidence and loss aversion exert a negative influence on financial literacy levels, highlighting the adverse impact of these traits. Moreover, sociodemographic factors play a relevant role: men, wealthier individuals, and those living in metropolitan areas are more likely to display higher levels of financial literacy, even after controlling for differences in overconfidence across genders. Finally, the results vary according to the measure of

financial literacy adopted, highlighting the importance of considering multidimensional definitions that go beyond financial knowledge alone.

This study makes three main contributions to the literature on financial literacy. First, it provides the most recent large-scale evidence for Portugal, based on a nationwide survey of 1,850 individuals collected by CMVM in 2021, thereby updating and extending previous findings in a context where financial literacy remains relatively low. Second, it explicitly examines the role of behavioral biases—overconfidence and loss aversion—on financial literacy, showing that these biases consistently reduce the likelihood of higher literacy levels, an effect that is often assumed but rarely demonstrated empirically. Third, by testing alternative measures of financial literacy, the study shows that results are sensitive to the definition adopted: narrow knowledge-based measures tend to overestimate the effects of explanatory variables, while multidimensional definitions incorporating behavior and self-perceptions provide a more nuanced understanding. These findings underline the importance of integrating behavioral perspectives and multidimensional constructs when designing financial education policies and evaluating their effectiveness.

The remainder of this paper is organized as follows. Section 2 reviews the literature. Section 3 presents the methodology, and Section 4 describes the data. Section 5 presents the empirical results, where the hypotheses previously held are tested and discussed. Section 6 concludes.

2. Review of the literature

2.1 Financial literacy

2.1.1. Concept and benefits

Financial literacy is widely acknowledged as a key competence for individuals to manage financial decisions effectively, particularly in increasingly complex economic environments. Higher literacy levels are associated with stronger saving habits, better household budget management, a deeper understanding of financial risks, and a reduced likelihood of over-indebtedness and exposure to excessive interest rates (Banco de Portugal, 2011; Lusardi & Kaiser, 2025). Empirical evidence also shows that individuals with higher financial literacy are more resilient to economic shocks, maintain higher savings, and are less likely to engage in unsuitable or costly financial practices (Hung et al., 2009; Klapper et al., 2013; Lusardi & Messy, 2023).

Despite these advantages, there is no universal definition or measure of financial literacy, which complicates comparisons across studies. The concept is often used interchangeably with financial knowledge or education, although these dimensions are distinct (Huston, 2010). Definitions vary, with some focusing on knowledge, others on the ability to apply it, on perceived competence, or on observed financial behavior (Hung et al., 2009; Remund, 2010). The most widely used measure is Lusardi and Mitchell's

(2011) “big three” questions, which capture basic concepts such as interest compounding, inflation, and risk diversification, although this approach may be influenced by factors such as numeracy (Schmeiser & Seligman, 2013). Broader frameworks, such as OECD (2019), extend the concept to include knowledge, behaviors, and attitudes, acknowledging that financial literacy requires not only cognitive and practical skills but also motivation, values, and self-perceptions. Evidence also suggests that combining objective and subjective measures provides a more accurate link between literacy and behavior (Allgood & Walstad, 2016; Martins et al., 2021).

Overall, the literature establishes financial literacy as a multidimensional construct with important benefits for individual well-being and for economic stability more broadly (Hilgert et al., 2003; Klapper et al., 2013; Kumar et al., 2023).

2.1.2 Determinants of Financial Literacy

The determinants of financial literacy have been extensively studied, with consistent evidence highlighting the role of sociodemographic, cognitive, experiential, and attitudinal factors. Age, gender, and income frequently emerge as significant predictors, although results are sometimes mixed. Several studies report higher literacy among men compared to women (Lusardi & Mitchell, 2008, 2011; Fonseca et al., 2012; Bannier & Neubert, 2016), with part of this gap linked to differences in confidence rather than actual knowledge (Bucher-Koenen et al., 2017). Income and wealth are generally positively associated with literacy, reflecting both access to financial resources and incentives to acquire knowledge (Lusardi & Mitchell, 2014; Stolper & Walter, 2017). Evidence on age is less consistent: while some studies suggest an inverted U-shape, with literacy peaking in midlife (Lusardi & Mitchell, 2011; Agarwal et al., 2009), others find no clear pattern (van Rooij et al., 2011).

Education and the field of study are also crucial. Individuals with backgrounds in economics, management, or quantitative fields typically show higher financial literacy (Lusardi & Mitchell, 2011; Behrman et al., 2012). Relatedly, cognitive ability, particularly numeracy and analytical reasoning, is strongly linked to literacy (McArdle et al., 2009; Klapper et al., 2013; Fornero & Monticone, 2011). The Cognitive Reflection Test (Frederick, 2005) has been shown to be a robust predictor, as it captures the ability to override intuitive but incorrect answers in favor of deliberate reasoning (Topa et al., 2018).

Experience also matters. Individuals with greater exposure to financial products and markets tend to achieve higher literacy scores (van Rooij et al., 2011; Lusardi & Tufano, 2015). Similarly, financial socialization—through family or peer interactions—plays a role in shaping early attitudes and skills (Shim et al., 2010). Risk preferences have also been linked to financial literacy: individuals with higher tolerance to risk are more likely to engage with financial markets and accumulate knowledge, whereas more risk-averse individuals tend to avoid financial products, limiting opportunities to learn (van

Rooij et al., 2011; Lusardi & Mitchell, 2014). Nonetheless, low literacy persists even in advanced economies (OECD, 2016, 2020), indicating that structural factors such as access to education and cultural attitudes also remain relevant. At a broader level, literacy outcomes are shaped by macroeconomic and institutional factors, including the availability of financial education and national policy initiatives (Jappelli, 2010; Crossan et al., 2011).

In sum, financial literacy results from the interplay of demographic characteristics, education, cognitive skills, financial experience, risk preferences, and institutional settings, with cross-country studies showing both universal patterns and context-specific differences (Klapper et al., 2015).

2.1.3 Financial literacy in Portugal

Empirical evidence shows that Portugal records relatively low levels of financial literacy when compared internationally. Results from the Household Finance and Consumption Survey (HFCS) highlight significant weaknesses in basic financial concepts such as inflation, interest compounding, and risk diversification (Christelis et al., 2010; Lusardi & Mitchell, 2014). Likewise, the OECD/INFE surveys report that Portuguese adults systematically underperform relative to the OECD average, not only in financial knowledge but also in financial behavior and attitudes (OECD, 2016, 2020).

National reports reinforce this diagnosis. The Banco de Portugal (2011) identified widespread difficulties in budget management, savings, and understanding credit conditions. More recent evidence from the CMVM (2019) indicates persistent knowledge gaps regarding investment products, risk-return trade-offs, and diversification, with significant segments of the population showing limited financial capability.

To address these challenges, the National Plan for Financial Education (PNFF), launched in 2011, has promoted educational initiatives in schools, training programs, and awareness campaigns (Banco de Portugal, 2011; OECD, 2016). Nevertheless, disparities remain across population groups: lower literacy levels are consistently observed among women, older individuals, and those with lower incomes (Rodrigues et al., 2021). These persistent inequalities make Portugal a relevant case study to examine the determinants of financial literacy and the impact of behavioral biases.

2.2 Behavioral Biases

Research in behavioral finance demonstrates that cognitive limitations and psychological biases systematically influence financial decision-making, often leading to deviations from rational models (Kahneman & Tversky, 1979; Barberis & Thaler, 2003). Among the wide range of biases studied, overconfidence and loss aversion are particularly relevant, given their persistent effects on judgment and financial outcomes.

2.2.1 Overconfidence

Overconfidence reflects the tendency of individuals to overestimate their knowledge, underestimate risks, or exaggerate their ability to predict outcomes (De Bondt & Thaler, 1995; Barber & Odean, 2001). In financial contexts, it is associated with excessive trading, under-diversification, and misjudgment of probabilities (Barber & Odean, 2000; Glaser & Weber, 2007). Evidence also suggests that men are generally more overconfident than women, contributing to gender differences in financial behaviors (Barber & Odean, 2001; Niederle & Vesterlund, 2007). In the context of financial literacy, overconfidence can distort self-assessment of knowledge, leading individuals to make financial decisions based on perceived rather than actual competence (Parker et al., 2012; Lusardi & Mitchell, 2014).

2.2.2 Loss aversion

Loss aversion, central to Prospect Theory, refers to the asymmetric perception of gains and losses, where losses are weighted more heavily than equivalent gains (Kahneman & Tversky, 1979). This bias helps explain why individuals may hold on to losing investments too long or avoid risky but potentially beneficial opportunities (Odean, 1998; Barberis & Huang, 2001). Experimental and survey evidence show that loss-averse individuals display lower participation in financial markets and more conservative portfolio choices (Dimmock & Kouwenberg, 2010). In terms of financial literacy, strong loss aversion can hinder the willingness to engage with financial products and thus limit opportunities to acquire knowledge, reinforcing the gap between theoretical understanding and practical financial behavior (Korniotis & Kumar, 2011; Baker et al., 2019).

Overall, the literature shows that financial literacy depends on sociodemographic, cognitive, and experiential factors, while behavioral biases such as overconfidence and loss aversion can undermine its development. Yet, evidence for Portugal remains scarce, and few studies explicitly link these biases to financial literacy. This study addresses both gaps by examining Portuguese data and testing the influence of behavioral biases across alternative measures of financial literacy.

3. Methodology

This study adopts a quantitative research design to examine the determinants of financial literacy in Portugal. The empirical analysis relies on cross-sectional data collected through a nationwide survey conducted by CMVM in 2021, covering a representative sample of 1,850 individuals. To evaluate the relationship between financial literacy and its potential determinants, we estimate probit and ordered probit models, depending on the nature of the dependent variable.

3.1 Hypotheses

Drawing on the literature, we test the following three hypotheses:

H1: Financial literacy increases with financial experience and exposure.

This hypothesis considers both investment experience and the proportion of wealth invested in securities, assuming that practical engagement with financial markets fosters knowledge acquisition (van Rooij et al., 2011; Lusardi & Tufano, 2015).

H2: Cognitive skills improve, while behavioral biases reduce, financial literacy.

This hypothesis reflects the dual role of individual traits. Higher cognitive reflection is expected to improve literacy, consistent with Frederick (2005) and Topa et al. (2018). Conversely, behavioral biases are expected to undermine literacy: overconfidence, defined as the gap between perceived and actual knowledge, may lead individuals to misjudge their competence (Barber & Odean, 2001; Parker et al., 2012; Lusardi & Mitchell, 2014), while loss aversion may discourage engagement with financial products, limiting opportunities to learn (Kahneman & Tversky, 1979; Dimmock & Kouwenberg, 2010; Korniotis & Kumar, 2011).

H3: Sociodemographic and attitudinal characteristics significantly impact financial literacy.

This hypothesis encompasses gender, income, education, residence, age, and risk preferences. Men have consistently been found to score higher than women (Lusardi & Mitchell, 2008, 2011; Fonseca et al., 2012; Bannier & Neubert, 2016; Bucher-Koenen et al., 2017). Financial literacy also tends to be positively associated with income and education, particularly in economics, management, mathematics, or engineering (Behrman et al., 2012; Klapper et al., 2013). Evidence on age is mixed: some studies suggest an inverted U-shape, with literacy peaking in midlife (Agarwal et al., 2009; Lusardi & Mitchell, 2011), while others find no clear pattern (van Rooij et al., 2011). Regional differences are also relevant, with metropolitan residents typically scoring higher (Rodrigues et al., 2021). Finally, individuals with higher risk tolerance are more likely to engage in financial activities that foster knowledge (van Rooij et al., 2011; Lusardi & Mitchell, 2014).

3.2 Econometric Approach

Financial literacy is measured using three alternative indicators: (i) an objective financial knowledge index based on correct answers to financial concepts (*finknow*) based on the Big Five Financial Literacy Index; (ii) a behavioral index reflecting self-reported financial practices (*finbehav*); and (iii) a subjective measure of perceived financial knowledge (*perceived*). The multidimensional definition of financial literacy follows Huston (2010), Remund (2010), Lusardi and Mitchell (2011), and OECD (2016, 2019, 2020), acknowledging that literacy involves not only knowledge but also behaviors and perceptions. Since the first two variables are ordered categorical outcomes, we estimate ordered probit regressions. For binary measures, standard probit regressions are used. In all cases, marginal effects are computed and reported to facilitate the interpretation of the magnitude of the relationships. Robust standard errors are also presented. The general specification of the models is:

$$FL^*_i = \alpha + \beta X_i + \gamma B_i + \delta S_i + \varepsilon_i$$

where FL^*_i represents the latent financial literacy of individual i ; X_i is a set of variables capturing financial experience and exposure; B_i denotes a vector of behavioral and cognitive traits, including cognitive reflection, overconfidence, and loss aversion; S_i represents a vector of sociodemographic and attitudinal controls; and ε_i is the error term. The observed dependent variable is categorical or binary, depending on the literacy measure.

The variables included in the models are defined as follows. Financial experience and exposure are captured by *experience*, a categorical variable distinguishing low, medium, and high levels of financial experience, and *securities_share*, the proportion of financial wealth allocated to securities. Sociodemographic and control variables comprise *male* (a gender dummy equal to 1 for male and 0 for female), *age* (respondent's age in years), *education* (categorical variable with six levels: ≤ 4 years, 5–9 years, 10–12 years, Bachelor, Master, and PhD), *field* (field of study: Economics/Management, Mathematics/Engineering, or Other), *income* (categorical monthly household income: $<€500$; €500–999; €1000–1999; $\geq €2000$), *metro* (dummy for residence in a metropolitan area), and *risk_profile* (categorical self-reported willingness to take financial risks: risk averse, moderate risk tolerance, or high risk tolerance).

To ensure robustness, all models include sociodemographic and attitudinal controls. We also test the sensitivity of results to alternative measures of financial literacy (objective, behavioral, and subjective), since prior literature highlights that the significance of determinants may vary with the definition of literacy (Huston, 2010; Allgood & Walstad, 2016; Martins et al., 2021). This multidimensional approach allows us to capture a more nuanced understanding of financial literacy and its determinants.

4. Data

4.1 Survey Design

The data used in this study were collected through a survey conducted by the Portuguese Securities Market Commission (CMVM) in 2021. The survey was designed to assess financial knowledge, attitudes, and behaviors of the Portuguese population, and is aligned with the OECD/INFE methodology for financial literacy measurement (OECD, 2016, 2020). The sample includes 1,850 individuals aged 18 or older and is representative of the Portuguese adult population.

Financial literacy is assessed using three complementary measures, following international best practices (Huston, 2010; Lusardi & Mitchell, 2011; OECD, 2016, 2019). First, the objective financial knowledge index (finknow) is based on correct responses to questions covering concepts such as interest compounding, inflation, risk diversification, and investment principles, consistent with widely adopted measures (Lusardi & Mitchell, 2011; van Rooij et al., 2011). Second, the behavioral index (finbehav) captures self-reported financial practices related to saving, budgeting, and investing, in line with OECD (2016, 2020). Third, the subjective measure (perceived) is based on individuals' self-assessment of their financial knowledge, which provides complementary information to objective measures (Allgood & Walstad, 2016; Martins et al., 2021).

The internal consistency of the financial literacy indices was assessed using Cronbach's alpha. The results indicate satisfactory reliability, with values exceeding the commonly accepted threshold of 0.70 (Nunnally & Bernstein, 1994). This confirms that the items used to construct the indices are sufficiently correlated and capture a coherent latent dimension. In addition, exploratory factor analysis supports the multidimensional structure of financial literacy, distinguishing between knowledge-based, behavioral, and perceived components, consistent with prior studies (Remund, 2010; OECD, 2019).

Behavioral biases and cognitive traits were also measured through the survey. Cognitive reflection was assessed using the three-item Cognitive Reflection Test (CRT) developed by Frederick (2005), which has been shown to be a reliable predictor of financial reasoning (Topa et al., 2018). Overconfidence was measured as the gap between self-reported and actual financial knowledge, following Barber and Odean (2001) and Parker et al. (2012). Loss aversion was derived from hypothetical choice questions where participants weighed potential gains against potential losses, consistent with Kahneman and Tversky (1979) and Dimmock and Kouwenberg (2010).

Sociodemographic and attitudinal variables include gender, age, income, education, and place of residence. Education is classified by field of study (economics/management, mathematics/engineering, and others), given evidence that specialized academic backgrounds are associated with higher literacy (Behrman et al.,

2012; Klapper et al., 2013). Risk preferences were measured through self-reported willingness to take financial risks, following van Rooij et al. (2011) and Lusardi & Mitchell (2014), capturing the role of individual attitudes towards uncertainty in shaping financial decision-making.

4.2 Descriptive Analysis

The variables used in the empirical analysis are derived directly from survey responses. The objective literacy index (*finknow*) is based on six financial knowledge questions, while the behavioral index (*finbehav*) aggregates items on saving, budgeting, and investment practices. The subjective measure (*perceived*) reflects self-assessed knowledge on a five-point scale. Cognitive reflection is measured with the three-item CRT (Frederick, 2005), and numeracy with a basic calculation question. Overconfidence is defined as the difference between perceived and actual knowledge scores, whereas loss aversion is captured by responses to hypothetical choice questions involving gains and losses. Risk preferences are measured by a self-reported scale of willingness to take financial risks. Finally, sociodemographic variables include gender, age, education, income, and place of residence.

Table 1 reports the sociodemographic characteristics of the sample. The gender distribution is relatively balanced, with women representing slightly more than half of respondents. The average age is 32 years, ranging from 18 to 77, which ensures heterogeneity across the life cycle. Education levels are comparatively high, with more than one-third of respondents holding postgraduate degrees and nearly two-thirds reporting tertiary education. Almost half of the sample has a background in economics or management, 12.8% in mathematics or engineering, and the remainder in other fields. In terms of income, a large proportion of respondents fall into lower income brackets, with 29% reporting monthly income below €500. Geographically, 60% live outside metropolitan areas. Regarding occupational status, nearly half are students, while 40% are employed. Finally, risk attitudes reveal a predominantly risk-averse profile: more than 60% describe themselves as unwilling to take financial risks, whereas fewer than 2% identify as high risk-takers.

Table 1. Sociodemographic characteristics of respondents (N = 1,850)

Variable	Categories	% / Mean
Age (years)	—	31.72
Gender	Female	53.60
	Male	46.40
Education	Middle school or lower	0.38
	High school	6.82
	Attending college	37.82
	College degree	19.91
	Post-graduation / Master's / MBA / PhD	35.06
Field of study	Non-economic or mathematical	37.89
	Mathematics/Engineering	12.76
	Economics/Management	49.35
Income (€)	< 500	28.92
	501–1000	22.65
	1001–1500	18.87
	1501–2000	11.32
	2001–2500	9.18
	2501–3500	5.05
	3501–5000	1.97
	> 5001	2.03
Metropolitan area	Yes	39.95
Risk profile	Very risk averse	14.43
	Risk averse	46.96
	Neutral to risk	21.76
	Risk taker	15.68
	High risk taker	1.17
Occupation	Self-employed	4.42
	Employee	39.99
	Unemployed	2.73
	Retired	0.98
	Student	48.06
	Other	3.82

Note: Percentages reported for categorical variables; mean reported for age.

Table 2 presents summary statistics for the financial literacy measures. The average score on the objective knowledge index (finknow) is 3.37 out of 6, confirming modest levels of financial knowledge. The CRT score averages 0.78, indicating that most respondents answer fewer than one of the three questions correctly, consistent with limited reliance on reflective reasoning (Frederick, 2005; Topa et al., 2018). The numeracy question was answered correctly by approximately half of the respondents, suggesting significant heterogeneity in basic quantitative skills. Self-assessed literacy

(perceived) shows a discrepancy: while objective financial knowledge is modest, the majority of respondents rate their knowledge as “low” or “moderate”, with a non-negligible fraction considering themselves “knowledgeable”. This misalignment between actual and perceived knowledge is consistent with evidence of overconfidence in financial settings (Parker et al., 2012; Lusardi & Mitchell, 2014). Finally, financial experience is limited: more than 80% of respondents fall into the “low experience” category, with less than 1% reporting “high experience”.

Table 2: Financial literacy measures, cognitive variables, self-assessment, and experience

	Mean
Finknow	3.368
CRT (Cognitive Reflection Test)	.783
Numeracy	.507
Self-assessment:	
Not knowledgeable	12.57
Little knowledgeable	37.46
Moderately knowledgeable	31.40
Knowledgeable	14.88
Very knowledgeable	3.69
Financial Experience:	
Zero	6.32
Low	82.70
Medium	10.49
High	0.49

Note: Values of the categorical variables are expressed as percentages

Table 3 reports the distribution of correct answers to specific financial literacy questions. Around 52% of respondents correctly answered the compounding interest question, which is an improvement relative to the 2015 PNFF survey but still below international benchmarks (OECD, 2016). Knowledge of inflation is higher (66%), yet still lags behind international evidence. The risk–return relationship is better understood (75%), while diversification is correctly identified by 64% of respondents. By contrast, knowledge of fixed income instruments is much weaker: only 29% correctly understood the relationship between bond prices and interest rates, revealing an area of persistent difficulty. Overall, these patterns confirm that while basic concepts are partially understood, more advanced topics remain poorly mastered.

Table 3: Correct responses to individual financial literacy questions

Questions	Our data	PNFF 2015*	OECD 2015**	PNFF 2020***
Compounding interest	52,05	39,5	41	31
Inflation	66,16	87	87(a)	74,4
Relationship between risk and return	75,41	81	82	71,6
Relationship between risk and diversification	63,62	72,4	73	45,1
Structured product	50,27	-	-	-
Relationship between fixed interest bond and market interest rates	29,24	6,5	-	-

Note: This table displays the percentage of correct responses regarding other studies with Portuguese individuals. Not all studies embody all questions therefore, those that did not study specific concepts are represented with a “-”. * Plano Nacional de Formação Financeira (2016). ** OECD (2016). *** Plano Nacional de Formação Financeira (2021). (a) The inflation question in OECD (2016) is not worded similarly.

5. Empirical Results

This section presents the empirical results of the ordered probit and probit estimations. The analysis proceeds in three steps. First, we focus on the determinants of objective financial knowledge (*finknow*), the core measure of financial literacy in this study, and examine the evidence for hypotheses H1–H3. Second, we extend the analysis by including an interaction term between gender and overconfidence, in order to test whether gender differences in financial literacy are partly explained by this behavioral bias. Finally, we perform robustness checks using alternative measures of financial literacy—financial behavior (*finbehav*) and perceived knowledge (*perceived*)—to assess the sensitivity of the results to different definitions of literacy.

5.1 Determinants of Financial Literacy: Effective Knowledge

Table 4 reports the results of the ordered probit estimations for the objective financial knowledge index (*finknow*), constructed from the five core questions widely used in the literature (Lusardi & Mitchell, 2011; van Rooij et al., 2011; OECD, 2016). These questions assess understanding of compounding interest, inflation, the risk–return relationship, diversification, and the link between bond prices and interest rates. As shown in Table 3, performance is uneven across questions: while more than 70% of respondents correctly identified the risk–return trade-off, only 29% understood the inverse relationship between bond prices and interest rates. This variation highlights the importance of considering determinants of financial literacy beyond mere averages and reinforces the view of financial literacy as a multidimensional construct (Potrich et al., 2015).

Results from the ordered probit analysis provide strong evidence in support of H1. Financial experience is positively and significantly associated with higher literacy levels. Individuals reporting prior investment experience or a greater proportion of wealth allocated to financial products are more likely to answer correctly the objective knowledge questions. This finding is consistent with the notion of learning-by-doing and corroborates earlier results in other contexts (van Rooij et al., 2011; Lusardi & Tufano, 2015).

Regarding H2, the results indicate a dual role of cognitive skills and behavioral biases. As expected, performance on the Cognitive Reflection Test (CRT) is positively related to financial knowledge, suggesting that individuals who rely more on reflective rather than intuitive thinking tend to perform better (Frederick, 2005; Topa et al., 2018). By contrast, overconfidence exerts a negative effect: individuals who overestimate their financial knowledge are less likely to achieve high objective financial literacy levels, consistent with findings by Barber and Odean (2001) and Parker et al. (2012). Loss aversion also shows a negative and significant association, suggesting that a stronger preference for avoiding losses is linked to lower financial knowledge, in line with the behavioral perspective of Kahneman and Tversky (1979) and empirical evidence by Dimmock and Kouwenberg (2010).

Turning to H3, sociodemographic and attitudinal factors remain important predictors of financial literacy. Men display higher levels of financial knowledge than women, echoing the robust gender gap documented in several studies (Lusardi & Mitchell, 2008, 2011; Fonseca et al., 2012; Bannier & Neubert, 2016). Education is also positively associated with literacy, particularly among those with training in economics, management, mathematics, or engineering (Behrman et al., 2012; Klapper et al., 2013). Income exhibits a positive gradient: wealthier individuals are more likely to perform better on financial knowledge questions. Living in metropolitan areas is associated with higher literacy, consistent with evidence of regional disparities in Portugal (Sebastião et al., 2021; Rodrigues et al., 2021). Finally, risk attitudes play a significant role: respondents with higher willingness to take risks score better on financial knowledge, confirming that openness to financial risk facilitates engagement with financial products and, in turn, promotes learning (van Rooij et al., 2011; Lusardi & Mitchell, 2014).

Taken together, these results confirm the three hypotheses. Financial literacy is shaped by experiential, cognitive, and behavioral factors, while sociodemographic and attitudinal characteristics continue to condition access to financial knowledge. The evidence points to the need for policy interventions that both promote financial experience and address persistent gaps arising from behavioral biases and demographic disparities.

Table 4: Determinants of financial literacy: marginal effect from ordered probit for the objective financial knowledge index (*finknow*).

	Very Low	Low	Medium	High	Very High
Experience	-0.0161*** (0.0046)	-0.0175*** (0.0053)	-0.0379*** (0.0107)	-0.0283*** (0.0080)	0.0998*** (0.0277)
Study field (Base=other):					
Mathematics, Engineering	-0.0195*** (0.0065)	-0.0238*** (0.0085)	-0.0471*** (0.0171)	-0.0106* (0.0060)	0.1010*** (0.0364)
Economics, Management	-0.0430*** (0.0051)	-0.0540*** (0.0076)	-0.1234*** (0.0134)	-0.0683*** (0.0076)	0.2887*** (0.0238)
securities_share	-0.0108*** (0.0020)	-0.0118*** (0.0023)	-0.0255*** (0.0043)	-0.0190*** (0.0032)	0.0672*** (0.0108)
Risk profile	-0.0021 (0.0019)	-0.0022 (0.0021)	-0.0048 (0.0046)	-0.0036 (0.0034)	0.0127 (0.0120)
Overconfidence	0.0505*** (0.0044)	0.0550*** (0.0061)	0.1191*** (0.0095)	0.0889*** (0.0072)	-0.3135*** (0.0140)
Loss aversion	0.0039** (0.0020)	0.0043* (0.0022)	0.0093** (0.0046)	0.0069** (0.0035)	-0.0244** (0.0121)
numeracy	-0.0052 (0.0038)	-0.0056 (0.0041)	-0.0122 (0.0087)	-0.0091 (0.0065)	0.0321 (0.0230)
CRT	-0.0138*** (0.0025)	-0.0150*** (0.0027)	-0.0325*** (0.0055)	-0.0243*** (0.0044)	0.0856*** (0.0136)
age	-0.0003 (0.0002)	-0.0003 (0.0002)	-0.0007 (0.0005)	-0.0005 (0.0004)	0.0017 (0.0014)
gender	-0.0219*** (0.0038)	-0.0239*** (0.0046)	-0.0517*** (0.0084)	-0.0386*** (0.0060)	0.1361*** (0.0205)
income	-0.0029** (0.0013)	-0.0032** (0.0014)	-0.0069** (0.0030)	-0.0051** (0.0022)	0.0181** (0.0078)
metro	-0.0093*** (0.0033)	-0.0101*** (0.0036)	-0.0219*** (0.0076)	-0.0163*** (0.0057)	0.0575*** (0.0197)
Occupation					
self-employee	-0.0071 (0.0087)	-0.0079 (0.0097)	-0.0174 (0.0222)	-0.0144 (0.0194)	0.0467 (0.0599)
Employee	0.0000 (0.0049)	0.0000 (0.0053)	0.0000 (0.0115)	0.0000 (0.0087)	-0.0001 (0.0303)
Unemployed	-0.0025 (0.0083)	-0.0028 (0.0092)	-0.0061 (0.0202)	-0.0047 (0.0161)	0.0161 (0.0537)
Retired	0.0312 (0.0214)	0.0328 (0.0216)	0.0623* (0.0355)	0.0304*** (0.0097)	-0.1568* (0.0868)
Other	-0.0001 (0.0070)	-0.0001 (0.0076)	-0.0002 (0.0165)	-0.0001 (0.0124)	0.0005 (0.0435)
Observations (total =)	934	934	934	934	934

Note: This table shows the marginal effect of ordered probit with *finknow* as dependent variable. The variable occupation uses “Student” as a reference, and the variable studyfield uses “non-mathematic and non-economic background” as a reference. In order to mitigate possible heteroskedasticity, robust standard errors are used. Robust Standard errors are in parentheses, *** p<0.01, ** p<0.05, * p<0.1

5.2 Interaction between gender and overconfidence

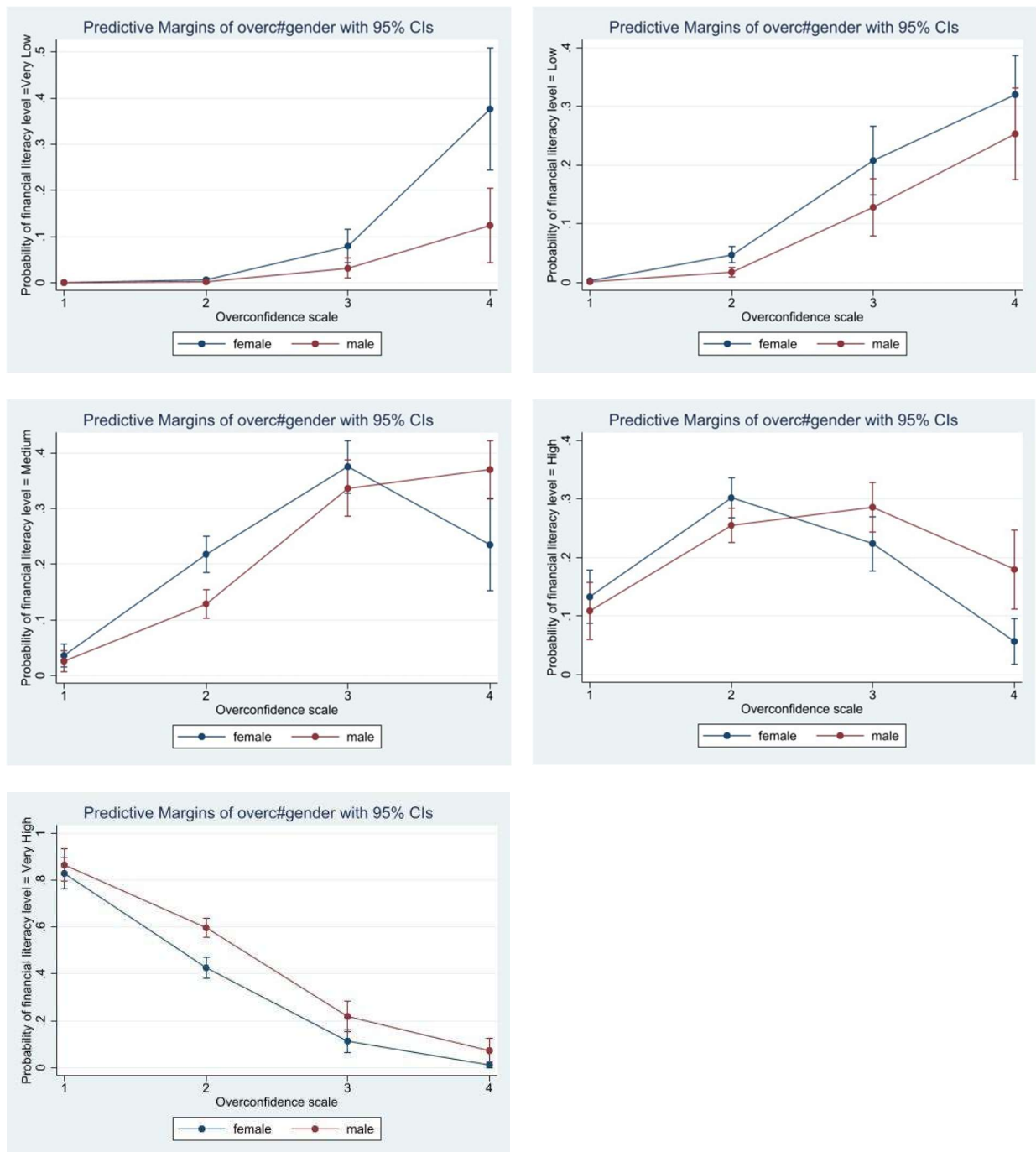
Figure 1 illustrates the marginal effect of overconfidence on financial literacy when interacted with gender, using the objective financial knowledge index (*finknow*) as the dependent variable. This specification allows testing whether the gender gap in financial literacy is partly explained by differences in the manifestation of overconfidence, a behavioral bias frequently highlighted in the literature (Barber & Odean, 2001; Niederle & Vesterlund, 2007).

The results confirm a persistent gender gap. Men exhibit higher levels of financial literacy than women, consistent with international evidence (Lusardi & Mitchell, 2008, 2011; Fonseca et al., 2012; Bannier & Neubert, 2016). However, the interaction term provides additional insight. The negative effect of overconfidence on financial literacy is significant for both genders, but its magnitude is smaller among women. In other words, while overconfidence tends to reduce the likelihood of achieving high literacy scores, this penalty is less pronounced for women than for men.

This finding suggests that the observed gender gap in financial literacy cannot be solely attributed to higher overconfidence among men. On the contrary, even after accounting for differences in confidence, men continue to score higher on financial knowledge. This result is consistent with studies showing that confidence gaps explain only part of gender differences in financial behavior and literacy (Barber & Odean, 2001; Croson & Gneezy, 2009).

Overall, the interaction analysis reinforces the robustness of the gender gap and highlights that behavioral biases such as overconfidence exacerbate inequalities but do not fully account for them. These findings show the importance of addressing both structural and behavioral factors when designing financial education initiatives aimed at reducing gender disparities.

Figure 1: Marginal effect of overconfidence on financial literacy by gender (objective knowledge index, *finknow*).



Note: This Figure shows the likelihood of achieving each level of *finknow* depending on the combination of gender and *overconfidence*. It is a representation of the marginal effects of the several combinations between these two variables.

5.3 Robustness Checks: Alternative Measures of Financial Literacy

As a robustness test, we extend the analysis by using two alternative measures of financial literacy: the behavioral index (*finbehav*) and the subjective self-assessment of financial knowledge (*perceived*). These complementary indicators capture dimensions of literacy beyond objective financial knowledge, consistent with the multidimensional perspective advocated in the literature (Potrich et al., 2015; OECD, 2016, 2020).

Table 5 reports the results for *finbehav*, which measures self-reported financial practices related to saving, budgeting, and investment. The determinants are generally consistent with those found for *finknow*: financial experience and cognitive reflection are positively associated with better financial behavior, while overconfidence and loss aversion exert negative effects. However, some differences emerge. Education and income are less strongly associated with financial behavior than with objective knowledge, suggesting that practical financial habits may depend more on exposure and attitudes than on formal education. These findings reinforce the idea that financial literacy extends beyond knowledge and incorporates behaviors shaped by contextual and experiential factors (Lusardi & Mitchell, 2014; OECD, 2020).

Table 6 presents the results for *perceived* literacy, based on respondents' self-assessment of financial knowledge. The contrast with financial knowledge (Big Five Financial Literacy Index) is striking. Overconfidence is, by construction, a key determinant: individuals with lower actual knowledge often rate themselves as more financially knowledgeable, while those with higher financial literacy tend to be more modest in their self-assessment (Allgood & Walstad, 2016). Gender differences also appear less pronounced when considering *perceived* literacy, echoing findings that women tend to underestimate their financial competence relative to men (Bannier & Neubert, 2016). These results highlight that self-perceptions of literacy are not only misaligned with actual knowledge but are also systematically shaped by behavioral biases and socio-demographic patterns.

Taken together, the robustness checks confirm the main results obtained for objective financial knowledge, while also showing that the strength and significance of determinants vary depending on the dimension of literacy considered. This supports the argument that financial literacy should be approached as a multidimensional construct (Potrich et al., 2015) and underscores the importance of integrating knowledge, behavior, and perceptions when designing financial education policies.

Table 5: Determinants of financial literacy: marginal effects from the ordered probit for the behavioral index (*finbehav*).

	Very Low	Low	Medium	High	Very High
Experience	-0.0255*** (0.0054)	-0.0789*** (0.0161)	-0.0302*** (0.0065)	0.1248*** (0.0235)	0.0098*** (0.0038)
Studyfield: Mathematics, Engineering	-0.0205*** (0.0070)	-0.0592*** (0.0212)	0.0063 (0.0044)	0.0705*** (0.0260)	0.0030 (0.0020)
Economics, Management	-0.0366*** (0.0056)	-0.1219*** (0.0151)	-0.0193*** (0.0065)	0.1668*** (0.0182)	0.0110*** (0.0037)
securities_share	-0.0177*** (0.0026)	-0.0549*** (0.0063)	-0.0210*** (0.0034)	0.0868*** (0.0091)	0.0068*** (0.0023)
Riskprofile	-0.0053*** (0.0020)	-0.0163*** (0.0059)	-0.0062** (0.0025)	0.0257*** (0.0093)	0.0020** (0.0010)
Overconfidence	0.0399*** (0.0043)	0.1237*** (0.0078)	0.0474*** (0.0079)	-0.1957*** (0.0123)	-0.0154*** (0.0050)
Loss Aversion	0.0019 (0.0019)	0.0058 (0.0060)	0.0022 (0.0023)	-0.0091 (0.0095)	-0.0007 (0.0008)
Numeracy	-0.0066* (0.0038)	-0.0204* (0.0116)	-0.0078* (0.0047)	0.0323* (0.0185)	0.0025 (0.0017)
CRT	-0.0091*** (0.0024)	-0.0282*** (0.0071)	-0.0108*** (0.0034)	0.0447*** (0.0113)	0.0035** (0.0014)
Age	-0.0004** (0.0002)	-0.0013** (0.0006)	-0.0005** (0.0002)	0.0021** (0.0010)	0.0002* (0.0001)
Gender (male)	-0.0122*** (0.0036)	-0.0377*** (0.0107)	-0.0144*** (0.0045)	0.0595*** (0.0166)	0.0047** (0.0021)
Income	-0.0050*** (0.0014)	-0.0156*** (0.0041)	-0.0060*** (0.0017)	0.0247*** (0.0064)	0.0019** (0.0008)
Metro	-0.0035 (0.0031)	-0.0108 (0.0097)	-0.0041 (0.0038)	0.0171 (0.0153)	0.0013 (0.0013)
Occupation: self-employee	-0.0223*** (0.0063)	-0.0758*** (0.0234)	-0.0444* (0.0235)	0.1340*** (0.0486)	0.0085* (0.0046)
Employee	-0.0188*** (0.0046)	-0.0618*** (0.0147)	-0.0303*** (0.0098)	0.1048*** (0.0267)	0.0060*** (0.0023)
Unemployed	-0.0159** (0.0074)	-0.0510** (0.0257)	-0.0215 (0.0177)	0.0840* (0.0470)	0.0044 (0.0035)
Retired	0.0178 (0.0206)	0.0458 (0.0478)	-0.0027 (0.0113)	-0.0590 (0.0559)	-0.0019 (0.0018)
Other	-0.0146* (0.0078)	-0.0465* (0.0263)	-0.0184 (0.0168)	0.0757 (0.0472)	0.0039 (0.0036)
Observations	934	934	934	934	934

Note: This Table shows the marginal effect of ordered probit with *finbehav* as the dependent variable. Variable *occupation* uses “Student” as reference, and the variable *studyfield* uses “non-mathematic and non-economic background” as reference. In order to mitigate possible heteroskedasticity, robust standard errors are used. Robust Standard errors are in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 6: Determinants of financial literacy: marginal effects from the probit for the perceived knowledge index (selfassessed).

		Finknowledge/Selfassess			
		H/H	L/H	H/L	L/L
Experience	*	0.0933** (0.0320)	-0.0013* (0.0007)	-0.0251*** (0.0088)	-0.0669*** (0.0232)
Studyfield:					
Mathematics, Engineering		0.0801** (0.0394) 0.3056**	0.0039** (0.0019)	-0.0095 (0.0065)	-0.0745** (0.0352)
Economics, Management	*	0.1023** (0.0278)	-0.0004 (0.0020)	-0.0832*** (0.0109)	-0.2220*** (0.0224)
Securities_share	*	0.1023** (0.0138)	-0.0014** (0.0006)	-0.0276*** (0.0041)	-0.0734*** (0.0106)
Risk profile		0.0277** (0.0140)	-0.0004 (0.0003)	-0.0075* (0.0038)	-0.0199** (0.0100)
Overconfidence		0.0368** (0.0150)	-0.0005* (0.0003)	-0.0099** (0.0044)	-0.0264** (0.0106)
Loss Aversion		-0.0076 (0.0151)	0.0001 (0.0002)	0.0020 (0.0041)	0.0054 (0.0108)
Numeracy		0.0454 (0.0276) 0.0869**	-0.0006 (0.0005)	-0.0122 (0.0075)	-0.0325 (0.0198)
CRT	*	0.0869** (0.0163)	-0.0012** (0.0006)	-0.0234*** (0.0049)	-0.0623*** (0.0117)
Age		0.0000 (0.0015) 0.1688**	-0.0000 (0.0000)	-0.0000 (0.0004)	-0.0000 (0.0011)
Gender	*	0.1688** (0.0236)	-0.0023** (0.0010)	-0.0455*** (0.0071)	-0.1210*** (0.0177)
Income		0.0070 (0.0090)	-0.0001 (0.0001)	-0.0019 (0.0024)	-0.0050 (0.0065)
Metro		0.0338 (0.0237)	-0.0005 (0.0004)	-0.0091 (0.0064)	-0.0242 (0.0170)
Occupation:					
Self-employee		0.1057 (0.0665)	-0.0031 (0.0031)	-0.0330 (0.0234)	-0.0696* (0.0405)
Employee		0.0212 (0.0354)	-0.0003 (0.0005)	-0.0057 (0.0096)	-0.0153 (0.0254)
Unemployed		0.1270* (0.0740)	-0.0042 (0.0041)	-0.0410 (0.0276)	-0.0818* (0.0428)
Retired		-0.0966 (0.1125)	-0.0010 (0.0032)	0.0192 (0.0162)	0.0784 (0.0997)
Other		-0.0197 (0.0541)	0.0001 (0.0002)	0.0049 (0.0129)	0.0148 (0.0411)
Observations		934	934	934	934

Note: Table A.2 shows the marginal effect of ordered probit with *perceived* as the dependent variable. H/H = high actual knowledge and high self-assessed knowledge; L/H = low actual knowledge but high self-assessed knowledge (overconfidence); H/L = high actual knowledge but low self-assessed knowledge (underconfidence); L/L = low actual knowledge and low self-assessed knowledge. Variable *occupation* uses “Student” as reference, and the variable *studyfield* uses “non-mathematic and non-economic background” as reference. In order to mitigate possible heteroskedasticity, robust standard errors are used. Robust Standard errors are in parentheses, *** p<0.01, ** p<0.05, * p<0.1

To resume results, Table 7 provides a comparative summary across the three measures of financial literacy. The table highlights consistent patterns, such as the positive role of financial experience and cognitive reflection, and the negative effects of behavioral biases in most specifications, thereby confirming H1 and H2. At the same time, important differences emerge. Overconfidence is negatively associated with both financial knowledge (finknow) and financial behavior (finbehav), but exerts a positive effect on perceived literacy, reflecting the tendency of less knowledgeable individuals to overstate their competence. Similarly, loss aversion reduces both financial literacy and behavioral literacy, but is not significant for perceived literacy. With respect to H3, education, income, and metropolitan residence are strong predictors of finknow, while their effects weaken for the alternative measures. Gender differences are pronounced in financial knowledge, smaller in financial behavior, and vanish in perceived literacy, in line with evidence that women tend to underestimate their financial competence (Bannier & Neubert, 2016). Risk tolerance is positively associated with financial literacy, especially for financial knowledge (finknow). Overall, the summary confirms that while the core determinants are robust, their magnitude and significance vary across dimensions, supporting the multidimensional view of financial literacy (Potrich et al., 2015; OECD, 2020; Shi et al., 2025).

Table 7: Summary of determinants of financial literacy across alternative measures

	finknow	finbehav	perceived
H1	exper (+), riskprofile (n.s.s), securities_share (+)	exper (+), riskprofile (+), securities_share (+)	exper (+), riskprofile (+), securities_share (+)
H2	numeracy (n.s.s), CRT (+), loss (-), overc (-)	numeracy (n.s.s), CRT (+), loss (n.s.s), overc (-)	numeracy (n.s.s), CRT (+), loss (n.s.s), overc (+)
H3	age (n.s.s), gender (+), income (+), studyfield (+), metro (+)	age (+), gender (+), income (+), studyfield (+), metro (n.s.s)	age (n.s.s), gender (+), income (n.s.s), studyfield (+), metro (n.s.s)

Note: This Table displays an overview of how the hypothesis holds and changes depending on the measure adopted. “n.s.s” stands for non-statistically significant. Dependent variables (literacy measures): finknow = financial knowledge index (big five questions); finbehav = financial behavior index; perceived = subjective financial literacy (self-assessment).

5. Conclusion

This study examined the determinants of financial literacy in Portugal using survey data from 1,850 individuals collected by the CMVM in 2021. We analyzed three complementary measures: financial knowledge, financial behavior, and perceived literacy, while considering cognitive skills, behavioral biases, financial experience, and sociodemographic characteristics.

The results show that financial experience and exposure are central drivers of literacy, whereas behavioral biases such as overconfidence and loss aversion reduce the likelihood of higher literacy levels. Cognitive reflection supports better outcomes, and persistent disparities remain across gender, income, education, and residence. Importantly, the interaction analysis indicates that gender gaps cannot be fully explained by confidence differences, as men continue to outperform women even after accounting for overconfidence.

Robustness checks confirm that while the main determinants hold across alternative measures, their relative magnitude varies: education and income are more influential for financial knowledge, while overconfidence shapes self-assessed literacy. These findings highlight the importance of multidimensional definitions of financial literacy and suggest that effective policies should combine financial education with behavioral insights to address persistent inequalities and improve decision-making, in line with Leal & Oliveira (2024).

From a policy perspective, the findings point to the need for financial education initiatives that move beyond knowledge-based approaches and incorporate behavioral insights. Public policy interventions should address persistent gender and regional disparities, strengthen opportunities for financial learning through experience, and counteract the adverse impact of overconfidence and loss aversion. In doing so, policymakers can promote not only higher levels of financial literacy but also more effective financial decision-making and resilience in increasingly complex markets, in line with Liu et al (2024).

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