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How does financial literacy influence undergraduates' risk-taking propensity?

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ABSTRACT

Previous evidence is contradictory about the financial literacy-individual's risk-taking propensity relationship. Therefore, this article attempts to examine the relationship between financial literacy and risk-taking propensity in a university environment, considering for the first time the financial literacy's multidimensional nature (i.e., financial knowledge, financial attitude, and financial behaviour). Applying Covariance-Based Structural Equation Models to 568 Spanish undergraduates, our results show that: (1) financial knowledge and financial behaviour directly and positively affect risk-taking propensity; (2) financial attitude indirectly and positively affects risk-taking propensity through financial behaviour. These findings are relevant since they provide new insights into the association mechanism that explains the financial literacy-undergraduates' risk-taking propensity relationship.

1. Introduction

Financial literacy arouses, in recent decades, significant international interest among public administrations, researchers, professionals, and the general population since it has a meaningful impact on financial decisions (Lusardi & Mitchell, 2007; OECD, 2017a; van Rooij, Lusardi, & Alessie, 2011a; van Rooij, Lusardi, & Alessie, 2011b) and thus not only affects individual financial well-being (Lusardi & Scheresberg, 2013; OECD, 2013) but also has positive consequences for the financial system and the economy in general (Goyal & Kumar, 2021; Lusardi & Mitchell, 2011b; Molina-García, Diéguez-Soto, Galache-Laza, & Campos-Valenzuela, 2023). In fact, the number of countries and international organizations concerned with knowing and improving the financial literacy of their citizens and how it influences their financial decisions is growing (Atkinson & Messy, 2012; Bank of Spain & CNMV, 2018; Douissa, 2020; Financial Consumer Agency of Canada, 2021; Potrich, Vieira, & Mendes-Da-Silva, 2016; U.S. Financial Literacy Commission, 2006) due to it can support global financial and economic stability (OECD, 2015a, 2015b; Widdowson and Hailwood, 2017). This concept becomes even more important in the context of COVID-19, which has amplified the challenges faced by citizens, especially those with financial vulnerabilities (Financial Consumer Agency of Canada, 2021).

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Prior literature has focused on the role of financial literacy in financial aspects such as retirement planning (Gallego-Losada, Montero-Navarro, Rodríguez-Sánchez, & González-Torres, 2022; Lusardi & Mitchell, 2011b), indebtedness (Lusardi & Scheresberg, 2013; Lusardi & Tufano, 2015), savings (Behrman, Mitchell, Soo, & Bravo, 2012; Lusardi & Mitchell, 2011a), or participation in stock markets (van Rooij et al., 2011b; Yamori & Ueyama, 2022). However, several authors call for more research on the influence that financial literacy could have on aspects intrinsically related to the behaviour of the individual (Goyal & Kumar, 2021), and in particular, with risk-taking propensity (Goyal & Kumar, 2021; Ryack, 2011; Yao, Sharpe, & Wang, 2011) due to the increasing complexity of financial environments, where decisions involve greater risk (Sutter, Weyland, Untertrifaller, & Froitzheim, 2020). In fact, risk-taking preferences play a crucial role in individual life outcomes (Mudzingiri, 2021), increasing well-being, health and life satisfaction (Becker, Deckers, Dohmen, Falk, & Kosse, 2012) since it is a pivotal factor supporting numerous financial decisions (Sun, Ni, Teh, & Lo, 2020; Sung & Hanna, 1997).

Therefore, both concepts, financial literacy and risk-taking propensity, become vital for young people (Razen, Huber, Hueber, Kirchner, & Stefan, 2021), particularly university students, for several reasons. Firstly, diverse studies have shown that young people have lower levels of financial literacy among citizens (ASIC, 2003; Lusardi, Mitchell, & Curto, 2010; OECD, 2017b), raising awareness of their financial risks (Beal & Delpachitra, 2003). Following Rosacker and Rosacker (2016), “the financial literacy crisis for young adults, especially college students, is real and a means to address it is both needed and demanded” (p. 7). Secondly, college students start to live independently at an earlier age, facing new responsibilities to manage their finances and consumption, such as managing income and expenses, paying bills or budgeting (Johan, Rowlingson, & Appleyard, 2021). Thirdly, they cope with more complex financial systems and sophisticated services and products (Ali, Rahman, & Bakar, 2015; Ergün, 2018; Johan et al., 2021) that involve riskier financial decisions. Finally, university students, taking into account the socio-demographic changes, will confront more risks due to some challenges such as increasing life expectancy, unemployment, and uncertain economic perspectives (Atkinson & Messy, 2012; Financial Consumer Agency of Canada, 2021; Sutter et al., 2020).

Despite the above, there is only slight and contradictory prior research that has analysed the effect of financial literacy on risk-taking propensity. In this sense, some authors have found that financial literacy has a positive relationship with risk-taking propensity (Gustafsson & Omark, 2015; Kanagasabai & Aggarwal, 2020; Korkmaz, Yin, Yue, & Zhou, 2021; Li, Li, & Wei, 2020; Noviarini, Coleman, Roberts, & Whiting, 2021; Ramudzuli & Muzindutsi, 2015). On the contrary, other studies have identified that financial literacy has a negative influence on risk-taking propensity (Mudzingiri, Muteba Mwamba, & Keyser, 2018, 2019; Razen et al., 2021; Sutter et al., 2020). And finally, the research of Huzdik, Béres, and Németh (2014) and Dinç Aydemir and Aren (2017) could not demonstrate any relationship between financial literacy and risk-taking propensity.

These contradictory findings could be mainly caused by the measure of financial literacy. Prior research and international organizations have defined financial literacy as a concept that involves three dimensions: financial knowledge, financial attitude and financial behaviour (Atkinson & Messy, 2012; Douissa, 2020; Johan et al., 2021; OECD, 2013; Potrich et al., 2016; Vieira, Potrich, & Mendes-Da-Silva, 2019). However, the studies mentioned above have analysed the relationship between financial literacy and risk-taking propensity only focusing on the effect of financial knowledge on risk-taking propensity, without considering the financial literacy’s multidimensional nature. Thus, this incomplete measurement does not account for the whole influence of financial literacy on risk-taking propensity, given that it only includes financial knowledge but it neglects the rest of the dimensions, namely financial attitude and financial behaviour, that are also embedded in the financial literacy concept. Moreover, prior research has highlighted that financial knowledge and financial attitude precede financial behaviour (Potrich et al., 2016; Vieira et al., 2019), so the literature mentioned above (that only considers financial knowledge) has overlooked the potential interrelationship that may arise between financial literacy dimensions and risk-taking propensity (i.e., its association mechanism).

Accordingly, this study attempts to clarify the financial literacy–risk-taking propensity relationship by adopting a more holistic and comprehensive understanding of financial literacy in a highly relevant segment of the population, namely university students, considering its three interrelated peripherals (i.e., financial knowledge, attitude and behaviour). Particularly, applying a Structural Equation Model (SEM) to a sample of 568 Spanish university students (Baber, 2021; Boubker, Arroud, & Ouajdouni, 2021), this paper analyses (i) the direct effect that each financial literacy dimension could have on undergraduates’ risk-taking propensity and (ii) the mediating role of financial behaviour from a human capital theory perspective (Becker, 1993; Schultz, 1961).

2. Theoretical background and hypothesis development

2.1. Individuals’ risk-taking propensity

Risk-taking propensity, defined as “... the participation in behaviour which involves potential negative consequences (or loss) balanced in some way by perceived positive consequences (or gain)” (Gullone & Moore, 2000, p. 393), is a research issue that always arouses interest in numerous research areas (e.g., psychology, education and economics). This relevant interest lies in the consequences that derive from risk-taking propensity at the individual level: while it plays a crucial role in individual life outcomes (Mudzingiri, 2021), increasing well-being, health and life satisfaction (Becker et al., 2012), it is a pivotal factor supporting numerous business and financial decisions (Sun et al., 2020; Sung & Hanna, 1997), such as entrepreneurship, innovation and strategic management decisions (Baird & Thomas, 1985; Kraiczy, Hack, & Kellermanns, 2015; Zhang, Li, Liu, & Ruan, 2020).

These risk-taking outcomes depend on the individual’s risk-taking propensity, as it is a (intrinsic) personal characteristic (Xu, Wang, Zhu, & Ma, 2019). Although it varies depending on the individual’s psychological attributes (Frederick, 2005), prior literature finds that risk-taking propensity is sensitive to demographics (gender, age, race), socioeconomic issues (parental background, income level) and, particularly, education (Charness, Gneezy, & Imas, 2013). Thus, education constitutes a central resource when it comes to

configuring the individual's risk-taking propensity (Santini, Ladeira, Mette, & Ponchio, 2019; Strydom & Metherell, 2012) since it is a plausible external factor that can be acquired at any stage of life in many ways (e.g., formal or informal education). However, education is very heterogeneous, being essential to identify what knowledge, skills and competencies (i.e., intangible resources acquired through education) drive individuals' risk-taking propensity. This situation is especially important in the financial sphere since individuals are exposed to continuous decision-making in terms of money management, in which it is essential to minimise failures to maximise profits and utility (Mudzingiri et al., 2018). However, optimal money management is subject to behavioural bias if individuals do not have all the information at their disposal (Capuano & Ramsay, 2011), and lack the necessary tools to deal with risk situations.

Therefore, given that knowledge, skills and competencies are essential to provide the individual with an adequate risk-taking propensity, this article analyses financial literacy as an intangible resource related to human capital that may configure (in a proper way under the financial lens) the individuals' risk-taking propensity.

2.2. Financial literacy and individuals' risk-taking propensity

Financial literacy has become an international priority in the last two decades among developed and emerging countries (G20, 2012; OECD, 2012), being understood as "... knowledge and understanding of financial concepts and risks, and the skills, motivation and confidence to apply such knowledge and understanding in order to make effective decisions across a range of financial contexts, to improve the financial well-being of individuals and society, and to enable participation in economic life" (OECD, 2013, p. 144). Furthermore, financial literacy can be acquired through financial education programs in different educational contexts (OECD, 2015a, 2015b).

Therefore, following the human capital theory, which highlights the value of education in the individuals' future outcomes (Becker, 1993; Schultz, 1961), investing in human capital through financial literacy can broaden the scope of individuals' possibilities and increase their financial well-being (Chan, Chang, & Snively, 2022; Struckell, Patel, Ojha, & Oghazi, 2022). Previous evidence shows that financial literacy positively influences savings and retirement plans (Bernheim, Garrett, & Maki, 2001; Cole, Sampson, & Zia, 2011; Lusardi, 2008). Financially literate individuals also manage their money better, participate in the stock market (choosing their portfolio more appropriately) and are more likely to select mutual funds with low fees (Deuflhard, Georgarakos, & Inderst, 2019; Hastings & Tejada-Ashton, 2008; Hilgert, Hogarth, & Beverly, 2003; Jappelli & Padula, 2013; Lusardi & Mitchell, 2008, 2011a; Stango & Zinman, 2009; van Rooij et al., 2011b; Yoong, 2011), ultimately accumulating greater wealth (Lusardi & Mitchell, 2011a) and improving the individual's financial inclusion and capability (Grohmann, Klühs, & Menkhoff, 2018; Zhu & Xiao, 2022). These benefits also go through debt management (Gutiérrez-Nieto, Serrano-Cinca, & de la Cuesta-González, 2017) since financially literate individuals opt for less expensive mortgages, avoiding high-interest payments and additional fees (Gerardi, Goette, & Meier, 2010; Lusardi & Tufano, 2015; Moore, 2003). Individual's financial literacy benefits are also reflected in the economic and financial stability at the country level since it improves competitiveness and innovation in the markets, greater efficiency in the financial services sector, a lower cost derived from financial regulation and supervision and a reduction in government aid for people who have made poor financial decisions (among other relevant issues) (OECD, 2013).

Financial literacy has been analysed through different population segments (e.g., households, investors, retirees), but it is especially relevant to young people for many reasons. Firstly, today's financial options are much more sophisticated (and complex) than before. Secondly, governments and employers are transferring certain risks to individuals, such as reduced state-supported pensions and healthcare benefits, being the youth responsible for caring about their own long-term financial security (OECD, 2013). Thirdly, these risks are complemented by other challenges with financial implications, such as increased life expectancy, serious youth employment problems and high economic uncertainty (Atkinson & Messy, 2012; Ergün, 2018). Fourthly, several studies show the low financial literacy of young people compared to the rest of citizens (Lusardi et al., 2010; OECD, 2017b). This situation leads young people to continuous (financial) decision-making in which they must assume each choice's consequences. Thus, adequate financial literacy is essential to ensure a healthy financial horizon. Furthermore, given that the educational level is considered a financial literacy heterogeneity source (Lusardi et al., 2010), and university students, in turn, are obliged to make decisions that involve their future financial independence, well-being and asset security (Potrich et al., 2016), this causes the university environment to acquire a particular research interest.

Despite the significant development of financial literacy research at the individual level, some research unknowns are currently unresolved or require further exploration, especially with the incidence of financial literacy in the individuals' psychological characteristics. Thus, recent reviews demand a deeper analysis of financial literacy on individuals' risk-taking propensity (Goyal & Kumar, 2021). This increased demand for research is caused by the relevance of the individual's risk-taking propensity (as shown in the previous subsection) and by the contradictory findings of research on financial literacy and risk-taking propensity.

Firstly, some studies find this relationship to be positive. Ramudzuli and Muzindutsi (2015) demonstrate that South African undergraduates exposed to financial literacy are more risk-tolerant. Gustafsson and Omark (2015) show that the higher the financial literacy, the higher the risk tolerance in Swedish citizens, corroborated by Noviarini et al. (2021) and Li et al. (2020) in New Zealand and China, respectively. Kanagasabai and Aggarwal (2020) find that Pakistan's financial literacy and risk tolerance are positively associated. Similarly, Korkmaz et al. (2021) state that financial literacy encourages the risk-taking behaviour of Chinese households. However, there is another research stream that reaches opposite results. Mudzingiri et al. (2018) find that South African undergraduates with low financial literacy are risk-lovers and inpatients. Later, these authors corroborated these results by stating that undergraduates with high financial literacy were more risk-averse compared to undergraduates with low financial literacy (although the variation in risk attitude is not significant) (Mudzingiri, Mwamba, Keyser, & Bara, 2019). Razen et al. (2021) show that financial

literacy positively influences the ability to delay gratification (i.e., individuals' patience) and that this, in turn, is positively associated with the ability to resist temptations, although the latter is negatively related to the adoption of risk behaviours (risk behaviours, e.g., gambling, are a measure of risk-taking propensity, as they are directly linked to individual's risk tolerance) (Razen et al., 2021; Sutter et al., 2020). These findings are identical to those obtained by Sutter et al. (2020), asserting that financial literacy makes young individuals more patient, less biased by the present, and slightly more risk averse. Finally, other studies even cannot show the existence of this relationship. Huzdik et al. (2014) find that financial literacy does not influence the risk-taking of South African and Hungarian undergraduates, similar to Dinç Aydemir and Aren (2017), who do not see that financial literacy affects the financial risk behaviour of Turkish citizens.

These findings, which demonstrate the lack of research consensus on the financial literacy-risk-taking propensity relationship, may be due to various causes: (1) heterogeneity in the sample composition (except those that focus on university students) in diverse cultural and socioeconomic environments (Noviarini et al., 2021), (2) heterogeneity in the risk-taking propensity measurement (hindering the advantages of simpler but straightforward measures),¹ and, mainly, (3) incomplete (and therefore erroneous) measurement of financial literacy solely through financial knowledge. Focusing on the latter, the extensive previous evidence shows that financial literacy is a multidimensional construct that usually encompasses three dimensions: financial knowledge, attitude and behaviour (Atkinson & Messy, 2012; Douissa, 2020; Johan et al., 2021; Çera, Khan, Rowland, & Ribeiro, 2021). Even if the individuals have extensive financial knowledge, they are not considered literate until they put it into practice in decision-making (Huston, 2010; Potrich et al., 2016). Furthermore, the relevance of considering the three financial literacy dimensions lies in analysing the possible interrelationship that may exist between them and the individual's risk-taking propensity (i.e., assess a more complex relationship to identify the association mechanism). Following Noviarini et al. (2021), "the relationships between financial literacy and risk tolerance (...) are complex and (...) indicate that assuming a simplified nature between these factors may result in misleading relationship generalisations" (p. 1), what "... can inspire further research into their interconnectedness" (p. 16). Thus, prior research states that financial behaviour is the most crucial dimension of financial literacy (Atkinson & Messy, 2012; Lusardi & Mitchell, 2014; OECD, 2013), which causes financial knowledge and financial attitude to precede financial behaviour (Çera, Khan, Rowland, & Ribeiro, 2021; Hayhoe, Leach, Allen, & Edwards, 2005; Miller & C' de Baca, 2001; Potrich et al., 2016). Therefore, this incomplete financial literacy measurement and heterogeneous instruments to measure risk-taking propensity may be the leading causes of these disparate results.

Consequently, this article aims to examine in depth the relationship between financial literacy and undergraduates' risk-taking propensity considering the financial literacy's multidimensional nature (i.e., financial knowledge, attitude and behaviour) and using a straightforward and consistent self-reported risk-taking propensity scale. Thus, we intend to shed light on the association mechanism between financial literacy and risk-taking propensity.

2.3. Financial knowledge and individuals' risk-taking propensity

Financial knowledge refers to understanding financial concepts and the ability to apply numeracy skills in a financial context (OECD, 2013). Individuals with a high level of financial knowledge could analyse more straightforward financial matters, have superior training to make appropriate decisions regarding financial issues, and better understand and assess risk (Ramudzuli & Muzindutsi, 2015). Consequently, university students would be more confident in managing and making risk decisions. In this sense, prior research shows mostly a significant positive effect of financial knowledge on risk-taking propensity (Gustafsson & Omark, 2015; Li et al., 2020; Noviarini et al., 2021; Ramudzuli & Muzindutsi, 2015). These arguments lead us to pose the following hypothesis.

H1. Financial knowledge positively influences undergraduates' risk-taking propensity.

2.4. Financial attitude and individuals' risk-taking propensity

Financial attitude can be understood as the attitude to longer-term financial horizon (OECD, 2013). This financial literacy dimension could affect risk-taking propensity since the willingness to take risks is influenced by the individual's orientation to the future (Faig, 2002; Hill, Jenkins, & Farmer, 2008). Therefore, having a financial attitude toward the long-term and future could help individuals analyse and plan their financial decisions from a global perspective, leading them to be more risk tolerant. Prior research has confirmed that individuals with long-term horizons, which means fewer preferences in the present consumption, undertake higher risk in their investment decisions (Cardak & Wilkins, 2009; Faig, 2002) or save for retirement (Rey-Ares, Fernández-López, Vivel-Búa, & Lado-Sestayo, 2022). Consequently, having a higher financial attitude, based more on a long-term planning horizon, could lead university students to have a more risk-taking propensity, so we propose the following hypothesis.

H2. Financial attitude positively influences undergraduates' risk-taking propensity.

2.5. Financial behaviour and individuals' risk-taking propensity

Financial behaviour is related to how a person behaves regarding issues that significantly impact financial situations and financial

¹ Following Charness et al. (2013), "... sometimes the advantages of complex (risk preferences) methods may well be outweighed by the disadvantage of decreased comprehension, and consequently, producing substantially noisier data. Simpler methods have the advantage of being more straightforward and capable of eliciting sensible risk preferences from a broader set of individuals" (pp. 50).

well-being (OECD, 2017a). “Financial behaviour is the capability to capture the understanding of overall impacts of financial decisions on one’s (i.e., person, family, community, country) circumstances and to make the right decisions related to the cash management, precautions, and opportunities for budget planning” (Tezel, 2015). Correct financial behaviour implies carrying out proper financial planning, paying the bills on time, exhaustive tracking of expenses, efficient credit management, and saving money or accurate budgetary control, among other actions. Regularly engaging in proper financial behaviour leads to the accumulation of experience in financial matters and their likely consequences, and thus to an increase in individuals’ confidence in being able to deal with them safely. The more financial experience individuals have, the greater their competence and expertise in financial matters and the more likely they are to make riskier decisions. In fact, prior research has shown that positive experiences in decision-making encourage a greater risk tolerance (Cardak & Wilkins, 2009), leading individuals to develop greater confidence to invest in riskier financial stocks (Barber & Odean, 2001). Thus, experience gained through financial behaviour could decrease risk perception and increase more hazardous financial choices. Therefore, a higher financial behaviour could lead to managing and understanding easier a risk situation, and having more risk-taking propensity, so we propose to analyse the following hypothesis.

H3. Financial behaviour positively influences undergraduates’ risk-taking propensity.

The financial literacy-risk-taking propensity relationship may be more complex than has been shown so far as a result of the interrelation between its dimensions (i.e., between financial knowledge, behaviour and attitude). This interrelation between the financial literacy dimensions has been analysed by previous research, with some agreement in considering that financial knowledge and financial attitude precede financial behaviour (Potrich et al., 2016; Vieira et al., 2019). These findings lead us to assess the mediating role of financial behaviour.

On the one hand, prior research demonstrated that financial knowledge influences financial practices and allows individuals to manage debt (Lusardi & Tufano, 2015) and invest (Lusardi & Mitchell, 2014). Greater financial knowledge also implies more likelihood of holding emergency savings (Robb, Babiarz, & Woodyard, 2012), saving for retirement (Lusardi, 2008), or knowing their financial capability (Çera, Khan, Rowland, & Ribeiro, 2021), which are considered financial behaviours. In this sense, most prior research has found that financial knowledge positively impacts financial behaviour (Atkinson & Messy, 2012; Potrich et al., 2016; Vieira et al., 2019), and we argued above that financial behaviour could positively affect risk-taking propensity. Therefore, financial behaviour should at least partially mediate the relationship between financial knowledge and risk-taking propensity. Thus, we put forward the following hypothesis.

H4. Financial behaviour mediates the relationship between financial knowledge and risk-taking propensity.

On the other hand, prior research indicated that financial attitude is a fundamental concept to comprehend individuals’ financial behaviour (Castro-González, Fernández-López, Rey-Ares, & Rodeiro-Pazos, 2020; Cupák, Fessler, & Schneebaum, 2021; Potrich et al., 2016; Yanto, Ismail, Kiswanto, Rahim, & Baroroh, 2021; Yap, Komalasari, & Hadiansah, 2016; Yong, Yew, & Wee, 2018; Çera, Khan, Rowland, & Ribeiro, 2021). Previous works demonstrated its influence on financial decision-making and financial management behaviour (Yap et al., 2016). Moreover, various studies showed that financial attitude influences saving money (Ali et al., 2015; Rey-Ares et al., 2022), indebtedness (Gutiérrez-Nieto et al., 2017; Koropp, Kellermanns, Grichnik, & Stanley, 2014), tracking expenses or maintaining a budget (Kidwell & Turrisi, 2004). These former actions are considered financial behaviours toward long-term financial plans and financial well-being (Atkinson & Messy, 2012; Castro-González et al., 2020; OECD, 2017a). Therefore, prior research demonstrated that financial attitude influences positively on financial behaviour (Castro-González et al., 2020; Fessler, Silgoner, & Weber, 2020; Potrich et al., 2016; Yanto et al., 2021; Çera, Khan, Mlouk, & Brabenec, 2021), and financial behaviour could affect favourably risk-taking propensity, as mentioned above. Based on that, we postulate the following hypothesis.

H5. Financial behaviour mediates the relationship between financial attitude and risk-taking propensity.

Based on all the above argumentation, this paper tries to analyse the influence of financial literacy on risk-taking propensity in a twofold sense (see Fig. 1). Firstly, this study considers the direct effect of each financial literacy dimension, i.e., financial knowledge (H1), financial attitude (H2) and financial behaviour (H3) on risk-taking propensity. Secondly, following previous research, this article analyses the mediating effect of financial behaviour in the relationship between financial knowledge/attitude (H4/H5) and risk-taking propensity.

3. Research methodology

3.1. Data collection

We conducted a survey aimed at undergraduates from degrees related to economics/business/finance (Business Administration, Finance and Accounting, Marketing and Market Research, and Tourism), as well as from other degrees not necessarily related to the matter in hand (Social Work, East Asian Studies, and Engineering).² Data collection was carried out in April, May, and June of 2021 in different Spanish public universities simultaneously. A pilot test was conducted with 22 undergraduates to ensure the consistency of the survey. Moreover, we guaranteed anonymity to reduce social acceptance bias (Fisher, 1993). The final sample consisted of 600

² The survey is divided into four parts: *demographic data* (at the individual and family level), *educational background*, *financial literacy* (basic and advanced financial knowledge, financial attitude, and financial behaviour) and *risk-taking propensity*.

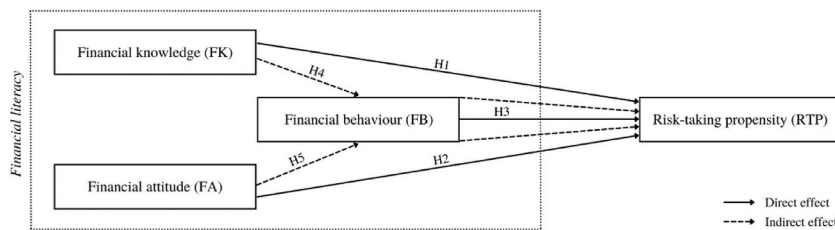


Fig. 1. Theoretical framework. Source: Authors.

undergraduates, which, after cleaning the data (e.g., missing in some variables), was reduced to 568 observations.

A post-hoc analysis was performed to determine if the sample size is adequate to test our proposed hypothesis (e.g., García-Lopera, Santos-Jaén, Palacios-Manzano, & Ruiz-Palomo, 2022). Using the latest available version of the *G*Power* software (Mayr, Erdfelder, Buchner, & Faul, 2007), it was confirmed that the statistical power³ ($1 - \beta$) of our sample is 1 (exceeding the commonly accepted limit of 0.8) (Cohen, 1988; Vargas Halabí & Mora-Esquivel, 2017). Thus, this sample is suitable for our research goals.

3.2. Measures

After an in-depth review by the authors, this section explains the measurement of the variables.

3.2.1. Risk-taking propensity

Undergraduate's risk-taking propensity was measured through the students' perception. We used the following statement to evaluate the risk-taking propensity: "Evaluate your willingness to take risks in general (e.g., I am willing to take the risk of losing money, when there is also the possibility of making money)", ranging from 1 (no willingness to take risks) to 10 (total willingness to take risks). This self-reported scale, widely used in prior studies (Caliendo, Fossen, & Kritikos, 2009; Riepe, Rudeloff, & Veer, 2022), stands out as a more comprehensible measure compared to other complex methods (Charness et al., 2013).

3.2.2. Financial knowledge

Adapting the proposal of numerous previous works (Atkinson & Messy, 2012; Lusardi & Mitchell, 2007, 2008; van Rooij et al., 2011a), we asked undergraduates ten questions to capture their financial knowledge, half basic and half advanced (Johan et al., 2021). While the basic questions measure numeracy and the understanding of economic concepts (e.g., inflation and interest rates), the advanced questions deal with more complex concepts such as the understanding of stocks and bonds, the relationship between risk and return, and the benefits of diversification. Also, most questions avoid true/false answers to minimise acquiescence response bias (Douissa, 2020). Each correct question is scored with "1" if it is basic and "2" if it is advanced (Potrich et al., 2016). Accordingly, financial knowledge variable ranges from 0 (none of the questions is right) to 15 (all questions are right). The higher the score, the greater the financial knowledge (Potrich et al., 2016).

3.2.3. Financial attitude

Following Atkinson and Messy (2012) and Douissa (2020), we asked undergraduates four questions to gather their feelings, beliefs and preferences concerning personal finance matters. Each question follows a Likert scale from 1 (never) to 7 (always). Then, we reverse the scale for data analysis. The higher the score, the better the financial attitude (Potrich et al., 2016).

3.2.4. Financial behaviour

According to Atkinson and Messy (2012) and Douissa (2020), we asked undergraduates four questions to get an insight into how people behave regarding personal finance matters. Each question follows a Likert scale from 1 (never) to 7 (always). The higher the score, the better the financial behaviour (Potrich et al., 2016).

The questions used to measure financial knowledge, financial attitude and financial behaviour are available in Appendix A.

3.2.5. Control variables

Our research controls the effect of age, gender, nationality, academic year, the average grade of the academic record and family's monthly income level (Ramudzuli & Muzindutsi, 2015; Razen et al., 2021). Despite the above, we are aware of the existence of unobservable characteristics that we are not able to include in the model, so we analyse the unobservable selection and coefficients stability through Oster's (2019) method (see Section 4.2.2).

A brief description of the variables used is provided in Table 1.

³ The statistical power of our final sample is calculated for an effect size (f^2) of 0.2243 (determined through the squared multiple correlation between predictors and outcome, ρ^2) and an error (α) of 0.05.

3.3. Data analysis

This research follows an ex-post-fact design (also known as after-the-fact research) with an empirical-analytical approach in order to confirm and explain the association mechanism between financial literacy (i.e., financial knowledge, attitude and behaviour) and risk-taking propensity. Using *Stata 14.2* software (StataCorp, 2015), we applied Covariance-Based Structural Equation Modelling (CB-SEM) (Jöreskog, 1970, 1993). CB-SEM is an advanced and flexible analysis method (widely used in organisational and management research) that integrates diverse multivariate techniques, accounts for (predictive and outcome variables) measurement error and allows testing, interpreting and comparing models quantitatively (see Zhang, Dawson, and Kline (2021) for a recent review and practical guidelines). Moreover, when the latent variables (unobserved variables) involved in the model are all reflective,⁴ CB-SEM is recommended over alternatives such as Partial-Least Squares Structural Equation Modelling (Rigdon, Sarstedt, & Ringle, 2017). As our latent variables are reflective (i.e., financial behaviour and attitude are reflective)⁵ (see Potrich et al. (2016) suggestions), CB-SEM is an appropriate method for our research purposes.

Two steps are required in the CB-SEM environment. First, it is necessary to examine the measurement model through a Confirmatory Factor Analysis (CFA). Thus, we analysed the following measurement issues: loadings of each item, reliabilities, model fit indices (also known as psychometric properties), and convergent and discriminant validity following the Fornell and Larcker (1981) criterion. According to Steenkamp and Baumgartner (2000), CFA is the appropriate approach to measure the strength of latent variables. Second, once this is secured, the hypotheses in the structural model can be tested. Therefore, we executed a bootstrap analysis (10,000 bootstrap samples with replacement) to evaluate the structural model (also known as path analysis). Particularly, our (mediation) structural model is represented by the following two expressions:

$$RTP_i = \beta_1 FK_i + \beta_2 FB_i + \beta_3 FA_i + control_i + \varepsilon_i \quad (1)$$

$$FB_i = a_1 FK_i + a_2 FA_i + control_i + \varepsilon_i \quad (2)$$

Where *RTP* is risk-taking propensity, *FK* is financial knowledge, *FB* is financial behaviour and *FA* is financial attitude. Hence, we are able to identify direct and indirect effects. On the direct effects side, we identify $FK \rightarrow RTP$ (β_1), $FB \rightarrow RTP$ (β_2), and $FA \rightarrow RTP$ (β_3) (expression 1). On the indirect effects side, we obtain $FK \rightarrow FB \rightarrow RTP$ ($a_1\beta_2$) and $FA \rightarrow FB \rightarrow RTP$ ($a_2\beta_2$) (including expression 2). Indirect effects are tested following two alternative approaches: Baron and Kenny (1986) and Zhao, Lynch, and Chen (2010). Finally, we applied Oster's (2019) robustness method (i.e., for unobservable selection and coefficient stability) to assess the robustness of our results.

4. Results

4.1. Measurement model results

This section analyses the validity of the measurement model used (Fig. 2 and Table 2). Firstly, the loading of all the items is significant and above 0.5, which means that each item is valid and loads correctly on its underlying concept (Hunjra, Boubaker, Arunachalam, & Mehmood, 2021).⁶ Secondly, the composite reliability (CR), the lower limit of internal consistency reliability, is within the generally accepted range of 0.7 and 0.95 (Netemeyer, Bearden, & Sharma, 2003). Thirdly, the model fit indices also suggest a good fit to the data: Root Mean Squared Error Approximation (RMSEA) < 0.05; Comparative Fit Index (CFI) > 0.90; Tucker-Lewis Index (TLI) > 0.90; Standardised Root Mean Squared Residual (SRMR) < 0.05 (Pituch & Stevens, 2015; Schumacker & Lomax, 2016; Worthington & Whittaker, 2006). Finally, since the Average Variance Extracted (AVE) > 0.5 and exceeds the Squared Correlation (SC) between both latent variables, there are no convergent or discriminant validity issues, respectively (Fornell & Larcker, 1981).

Based on the results obtained, we can conclude that our measurement model is correctly formed.

4.2. Structural model results

4.2.1. Hypotheses testing

This section performs a path analysis on the structural model (Fig. 3). Specifically, we run a bootstrap analysis on a bootstrap sample of 10,000 with replacement to test the direct and indirect effects proposed (Table 3). Furthermore, Variance Inflation Factor (VIF) values suggest no multicollinearity issues (Hair & Sarstedt, 2019).

On the one hand, we analyse the direct effects of each financial literacy dimension (i.e., financial knowledge, attitude and behaviour) on undergraduates-risk-taking propensity. Firstly, *financial knowledge* ($\beta = 0.118^{***}$) directly and positively influences undergraduates' risk-taking propensity (supporting H1). Secondly, *financial attitude* does not significantly influence undergraduates'

⁴ Reflective latent variables can be understood as "... common factors that are assumed to cause their indicators (observed variables)" (Zhang et al., 2021, p. 257).

⁵ Financial knowledge is an observed variable (Johan et al., 2021), so it does not participate in the measurement model.

⁶ Due to of the elimination of those invalid items with loadings < 0.5, the measure of financial behaviour is reduced to two items. However, if the two items are highly correlated and not so much with those of the other variables, the construct continues to be reliable (Worthington & Whittaker, 2006; Yong & Pearce, 2013), as is our case. Potrich et al. (2016) are a recent example in the financial literacy research domain.

Table 1
Description and descriptive statistics.

Variables	Description	Mean	SD	Min	Max
Risk-taking propensity	= 1 (risk averse) – 10 (risk loving)	6.14	2.27	1	10
Financial knowledge	= Number of correct answers (advanced questions x2)	9.41	3.75	0	15
Financial attitude	= Mean score of the four items (inverted scale)	4.37	0.95	2.25	7
Financial behaviour	= Mean score of the four items	5.70	1.11	1	7
Age	= number of years	21.23	2.59	18	34
Gender	= 1 if male	0.47	0.50	0	1
Nationality	= 1 if Spanish	0.85	0.36	0	1
Academic year (1)	= 1 (first year) – 6 (sixth year)	2.70	1.03	1	6
Average grade academic record	= 0 (fail) – 10 (outstanding)	6.67	0.95	3	9.44
Family's monthly income level (2)	= 1 (less than 700 euros) – 17 (more than 8.000 euros)	5.20	3.09	1	17
N		568			

(1) Fifth and sixth year only in double degrees. (2) Intervals that increase at a rate of 500 euros.
Source: Authors.

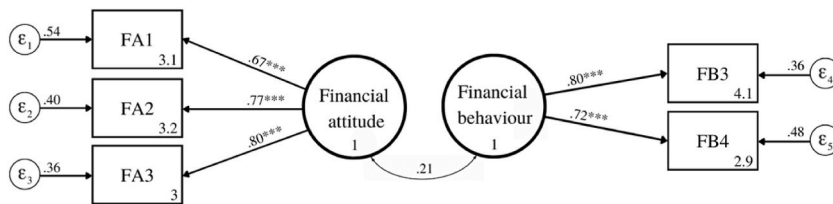


Fig. 2. Measurement model results (standardised loadings reported). Source: Authors.

Table 2
Measurement model results (CFA).

Latent variable:	Loading	t-value
Financial attitude (CR = 0.80; AVE = 0.57)		
FA1	0.67***	22.73
FA2	0.77***	28.08
FA3	0.80***	29.66
Financial behaviour (CR = 0.73; AVE = 0.58):		
FB3	0.80***	7.49
FB4	0.72***	7.40

Model fit statistics: $\chi^2 = 3.35$ df = 4; $p > 0, 1$; RMSEA [90%IC] = [0.000, 0.038]; CFI = 1.000, TLI = 1.000; SRMR = 0.017. Items FA4, FB1 and FB2 have been removed as they are not valid (loading < 0.5).

SC among latent variables: 0.046.
All the loadings are significant at a 0.001 level: ***.
Source: Authors.

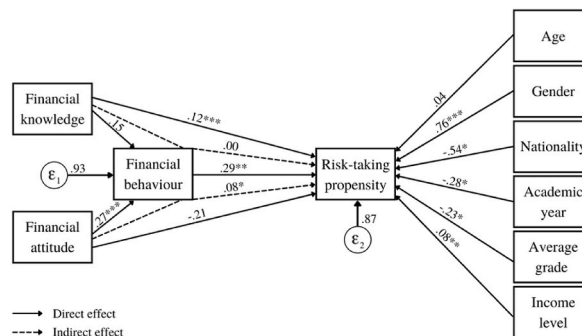


Fig. 3. Structural model results (standardised path values reported). Source: Authors.

Table 3
Structural model results.

Direct effects:	Path	Boots. SE	95% BC-CI	VIF	Supported?		
FK → FB	0.015	0.102	[-0.005, 0.035]	1.01			
FA → FB	0.272***	0.047	[0.182, 0.367]	1.01			
H1: FK → RTP	0.118***	0.027	[0.064, 0.171]	1.22	Yes		
H2: FA → RTP	-0.207	0.109	[-0.424, 0.015]	1.09	No		
H3: FB → RTP	0.287**	0.103	[0.085, 0.497]	1.10	Yes		
Indirect effects:	Path	Boots. SE	95% BC-CI	95% BCa-CI			
H4: FK → FB → RTP	0.004	0.003	[-0.001, 0.013]	[-0.001, 0.013]	No		
H5: FA → FB → RTP	0.078*	0.032	[0.025, 0.155]	[0.025, 0.155]	Yes		
Control variables:	Path	Boots. SE	VIF	Path	Boots. SE	VIF	
Age	0.044	0.043	1.40	Academic year	-0.288*	0.117	1.42
Gender	0.757***	0.181	1.13	Average grade	-0.231*	0.102	1.13
Nationality	-0.541*	0.274	1.05	Income level	0.076**	0.028	1.07

Model fit statistics: $\chi^2 = 10.369$; $df = 6$; $RMSEA = 0.036$; $CFI = 0.962$; $TLI = 0.892$; $SRMR = 0.015$.

Note: Standardised path values are reported. Boots. SE: Bootstrapped Standard Error. BC-BI: Bias-Corrected Confidence Interval. BCa-BI: Bias-Corrected Accelerated Confidence Interval. FK: financial knowledge; FA: financial attitude; FB: financial behaviour; RTP: risk-taking propensity.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Source: Authors.

risk-taking propensity (not supporting H2). Thirdly, *financial behaviour* ($\beta = 0.287^{**}$) directly and positively influences undergraduates' risk-taking propensity (supporting H3). On the other hand, we analyse the mediating role of financial behaviour in the relationship between financial knowledge/attitude and undergraduates' risk-taking propensity. While no indirect effect of financial knowledge on undergraduates' risk-taking propensity is obtained (not supporting H4), financial attitude ($\beta = 0.078^*$) indirectly and positively influences undergraduates' risk-taking propensity through financial behaviour (supporting H5). This is also corroborated by verifying that the Bias-Corrected and Bias-Corrected and Accelerated Confidence Intervals (BC-CI and BCa-CI, respectively) exclude zero (both at 95% confidence level).

Furthermore, we followed two additional approaches to confirm the indirect influence of financial attitude on undergraduates' risk-taking propensity through financial behaviour: Baron and Kenny (1986) and Zhao et al. (2010) approaches to testing mediation (see Table 4). Both methods conclude that mediation is significant and complete (full). More specifically, 61% of the total effect of financial attitude on undergraduates' risk-taking propensity is through financial behaviour. Therefore, mediation is confirmed by two approaches, supporting H5.

Finally, our results show the significant effect of all the control variables analysed (except for age). Particularly, while gender (i.e., being a man compared to being a woman) and family monthly income level drive undergraduates' risk-taking propensity ($\beta = 0.7587^{***}$ and $\beta = 0.0759^{**}$, respectively), nationality (i.e., Spanish), academic year of the degree in progress and academic record average grade detracts from undergraduates' risk-taking propensity ($\beta = -0.5411^*$, $\beta = -0.2880^*$ and $\beta = -0.2305^*$, respectively).

4.2.2. Robustness: unobservable selection and stability of the significant coefficients

Unless research is developed through an experimental environment, researchers must deal with the existence of biases in the estimates derived from the non-inclusion of unobservables characteristics of the undergraduates. In this section, we analyse to what extent our estimates are robust considering the omission of these unobservable characteristics by adapting Oster's (2019) method to CB-SEM under the assumption that "... the relationship between treatment and unobservables can be recovered from the relationship between the treatment and observables" (p. 188) (being δ the degree of selection on unobservables relative to observables). Thus, we are able to calculate an approximation of the bias-adjusted treatment effect through the following expression⁷:

$$\beta^* \approx \tilde{\beta} - \delta[\tilde{\beta} - \hat{\beta}] \frac{R_{max} - \tilde{R}}{\tilde{R} - \hat{R}}$$

where β^* is the bias-adjusted effect; $\tilde{\beta}$ and $\hat{\beta}$ are the coefficients from the regression with (controlled effects) and without control variables (baseline effects) with their respective R^2 (\tilde{R} and \hat{R} , respectively); and R_{max} is the maximum R^2 that could be reached if we were able to include all unobservable confounding factors in our model.

Under this method, we can ensure the robustness of our results as long as the coefficients obtained are stable, that is, that the set $[\tilde{\beta}, \beta^*(R_{max}, \delta)]$ excludes zero (i.e., that they do not change sign) or that it is within the $\tilde{\beta}$ confidence intervals.⁸ Following the

⁷ By treatment we understand the three financial literacy dimensions (i.e., financial knowledge, attitude and behaviour).

⁸ In those cases in which the control variables move the coefficient away from zero, the researcher should ensure that the results of the set lead to the same conclusion as the controlled estimate (Oster, 2019).

Table 4Significance testing of indirect effect: *financial attitude* → *financial behaviour* → *risk-taking propensity*.

Mediation approach:	Significant?
Baron and Kenny's approach to testing mediation^a:	
Step 1: FA → FB	Yes
Step 2: FB → RTP	Yes
Step 3: FA → RTP	No
Sobel's test: t-value: 2.515*; CI: [0.017, 0.129]	Yes
Conclusion: As step 1, step 2 and the Sobel's test are significant, and step 3 is not significant, the mediation is complete.	
Zhao, Lynch and Chen's approach to testing mediation:	
Step 1: FA → RTP	No
Step 2: FA → FB → RTP	Yes
Monte Carlo test ^b : t-value: 2.542*; CI: [0.023, 0.144]	Yes
Conclusion: As step 1 is not significant and step 2 or the Monte Carlo test is significant, there is an indirect-only mediation (full mediation).	
Indirect effect size: Ratio indirect effect/total effect = (0.078/0.128) = 0.609.	

FK: financial knowledge; FA: financial attitude; FB: financial behaviour; RTP: risk-taking propensity.

Sobel and Monte Carlo tests are significant at a 0.05 level: *.

^a Adjusted by Iacobucci, Saldanha, and Deng (2007) for structural equation modelling.^b Zhao et al. (2010) suggest a bootstrap test of the indirect effect (step 2, conducted in Table 2). However, we have also used the Monte Carlo test as an alternative to the bootstrap test to confirm the indirect effect obtained (Jose, 2013).

Source: Authors.

recommendations of Oster (2019) that are in line with the previous method of Altonji, Elder, and Taber (2005), we set an equal selection degree (i.e., $\delta = 1$) and $R_{max} = (\min\{1.3\bar{R}, 1\})$ (Di Meglio, Barge-Gil, Camiña, & Moreno, 2022). Furthermore, we further harden our assumption about R_{max} using the \bar{R} from recent experimental research by Liang, Ye, and Liu (2021) on risk-taking propensity (among other research goals), "... to argue for a level of stability consistent with randomised treatment" (Oster, 2019, p. 203).⁹

Table 5 shows the stability of our significant coefficients. Columns (3) and (4) show that the coefficients obtained from the estimates conducted in the previous section are stable even under the most restrictive assumption (i.e., the approximation to a R_{max} from an experiment). Therefore, we can confirm the robustness of our findings.

5. Discussion and conclusion

Financial literacy relevance is growing between international organizations, public entities, researchers, and citizens due to its influence on individual financial well-being and on the economy in general (Lusardi & Mitchell, 2014; Lusardi & Scheresberg, 2013; OECD, 2013, 2017a; van Rooij et al., 2011a). Moreover, the risk-taking propensity is a pivotal factor in a context of complex financial systems and sophisticated services and products exposed to a rapid evolution of generally riskier investment opportunities (Ali et al., 2015; Ergün, 2018; Johan et al., 2021). The study of these two concepts becomes even more important for university students who begin to make financial decisions at an earlier age, influencing their future financial well-being (Ergün, 2018; Johan et al., 2021). Despite its relevance, there is scarce literature that analyses the effect of financial literacy on university students' risk-taking propensity, and, to the best of our knowledge, none which deeps into this relationship considering the financial literacy's multidimensional nature. Therefore, drawing on the human capital theory, this study addresses this gap in the previous literature by considering financial literacy as an intangible resource that involves three dimensions (i.e., financial knowledge, attitude and behaviour). This multidimensional consideration allows for the identification of the association mechanism between financial literacy and undergraduates' risk-taking propensity. Given this goal, an empirical research has been executed by collecting data from a representative Spanish undergraduates survey to analyse how each financial literacy dimension influences risk-taking propensity.

Firstly, the influence of financial knowledge on undergraduates' risk-taking propensity is mainly direct since there is no evidence about its influence through financial behaviour. Thus, these findings reveal that although financial knowledge usually precedes financial behaviour (Potrich et al., 2016; Vieira et al., 2019), in the specific case of the financial knowledge-risk-taking propensity relationship, the greater weight of the presence of financial knowledge makes no significant its effect through financial behaviour. So, university students with higher financial knowledge would have a greater capacity to understand and evaluate risk, and hence they would be more risk-tolerant. These findings are in line with previous studies that found out that an augment in financial knowledge is associated with risk tolerance (Gustafsson & Omarm, 2015; Kanagasabai & Aggarwal, 2020; Korkmaz et al., 2021; Li et al., 2020; Mudzingiri, 2021; Noviarini et al., 2021; Ramudzuli & Muzindutsi, 2015). Despite the above, our findings are different from that

⁹ No research has analysed the influence of our treatment (i.e., financial literacy) on risk-taking propensity through an experimental design. Given this limitation, we have opted for Liang's et al. (2021) experimental results as an accurate approximation of R_{max} (55.5%). This is a very restrictive assumption of R_{max} since "... empirical models of financial risk-taking usually report R^2 -values at around 25%" (Cesarini, Johannesson, Lichtenstein, & Wallace, 2008; Hermansson & Jonsson, 2021, p. 5). An exception to the above is Gustafsson and Omarm (2015), who obtain an R^2 of 42.43% (although it remains below our R_{max} assumption). Therefore, using the R^2 obtained by Liang et al. (2021) we ensure our research robustness.

Table 5
Robustness through the stability of the significant coefficients.

Effect description	(1)		(2)		(3)	(4)	(5)
	Baseline effects (Boot. std. error)		Controlled effects (Boot. std. error)		Bias-adjusted β [$R_{max} = 1.3\bar{R}$]	Bias-adjusted β [$R_{max} = 0.555$]	Coefficient stability?
H1: FK → RTP	0.120***	(0.026)	0.118***	(0.118)	0.117	0.107	Yes
H3: FB → RTP	0.266**	(0.103)	0.287**	(0.104)	0.299	0.410	Yes
H5: FA → FB → RTP	0.072*	(0.032)	0.078*	(0.032)	0.081	0.111	Yes

Notes: Columns (1) and (2) show the baseline (direct and indirect effects of each financial literacy dimension on risk-taking propensity not considering control variables) and controlled effects (direct and indirect effects of each financial literacy dimension on risk-taking propensity considering control variables). Columns (3) and (4) show the bias-adjusted β under various assumptions on R_{max} (1.3 \bar{R} and 0.555, respectively).

Baseline R^2 (\bar{R}) = 0.056 and controlled R^2 (\tilde{R}) = 0.131. In both cases, only the R^2 of risk-taking propensity regression has been considered.

FK: financial knowledge; FA: financial attitude; FB: financial behaviour; RTP: risk-taking propensity.

* $\rho < 0.05$; ** $\rho < 0.01$; *** $\rho < 0.001$.

Source: Authors.

obtained by some authors showing that risk-taking propensity does not depend on the level of financial knowledge (Dinç Aydemir & Aren, 2017; Huzdik et al., 2014) or, if it does, it negatively affects it (Mudzingiri et al., 2018, 2019; Razen et al., 2021). However, this may be due to some crucial limitations. First, Huzdik et al. (2014) used questionnaires completed in 2012 and 2013, so the measured risk tolerance level could be biased by the financial and economic crisis. Second, Dinç Aydemir and Aren (2017) used a sample of individuals which were financially independent and already had any risky investment, unlike our research sample, which is composed of undergraduates regardless of their financial independence and investments. Third and last, the remaining three studies have analysed the financial knowledge-risk-taking propensity relationship through complex risk-taking propensity methods (e.g., lotteries or multiple price lists), which can hinder obtaining consistent findings since these methods are sometimes poorly comprehensible by individuals (Charness et al., 2013). Despite this, it is interesting that future research on financial literacy and risk-taking propensity delve into the latter from a comparative perspective (e.g., combining objective and subjective methods).

Secondly, our financial attitude finding is in line with prior research and identifies its influence on undergraduates' risk-taking propensity through financial behaviour. That confirms the mediating role of financial behaviour in the financial attitude-risk-taking propensity relationship. Our research supports the idea that financial attitude precedes financial behaviour (Potrich et al., 2016; Vieira et al., 2019; Çera, Khan, Mlouk, & Brabenc, 2021), since a long-term horizon (related to financial attitude), leads undergraduates to set financial actions (related to financial behaviour) increasing their risk-taking propensity (Cardak & Wilkins, 2009), such as higher-risk investment decisions (Cardak & Wilkins, 2009).

Thirdly, an increase in proper financial behaviours affects direct and positively on undergraduates' risk-taking propensity. Therefore, undergraduates could gain more experience through financial behaviour that leads them to analyse financial situations and risks better and develop higher confidence to make riskier decisions, such as financial stock investments (Barber & Odean, 2001). Thus, our finding is in line with previous studies, suggesting that the experience gained in decision-making through suitable financial behaviours increases risk-taking propensity (Barber & Odean, 2001; Cardak & Wilkins, 2009).

Our results thus reveal that financial literacy is an essential driver of undergraduates' risk-taking propensity. However, the association mechanism between financial literacy and undergraduates' risk-taking propensity is articulated differently given its three dimensions: while financial knowledge and financial behaviour positively influence undergraduates' risk-taking propensity, financial attitude positively influences through financial behaviour. Consequently, this article contributes to previous evidence in two crucial domains. First, we provide a novel way to explain the association mechanism through which financial literacy positively affects undergraduates' risk-taking propensity taking into account its multidimensional nature. Second, we addressed this analysis to a relevant segment of the population, namely university students, clarifying the contradictory results obtained in previous literature. Therefore, our findings are relevant to the financial literacy research community.

Furthermore, this article provides several educational and policy implications. Regarding educational implications, in order to effectively influence the undergraduates' risk-taking propensity (and thereby achieve greater well-being, health and life satisfaction), undergraduates' financial literacy programmes should not only focus on the provision of financial knowledge (traditional programmes) but also consider enhancing financial attitude and behaviour, crucial dimensions in the financial literacy-risk-taking propensity relationship. Concerning policy implications, it is essential to implement public initiatives to improve the financial literacy of the whole university community (whether or not related to economics/finance/business) in order to properly analyse the increasing risk involved in today's decision-making, reverberating its benefits in the financial well-being of the next-generation and, ultimately, to the efficiency of the global financial and economic sector.

Our research has its own set of limitations that should be explored in future research. In this sense, regarding the measurement of risk-taking propensity of undergraduates, we can be able to measure it considering only its subjective component. So, it could be interesting for further studies to analyse and to compare how each dimension of financial literacy could influence on both, the subjective and objective components of risk-taking propensity. Moreover, taking into account financial literacy, we have measured its objective aspect, but it could be very interesting to analyse its subjective component. Comparing both, we could detect those students who are overconfident, i.e., students who think that they have higher financial literacy (subjective financial literacy) than they really

have (objective financial literacy) and those with a lack of confidence, i.e., students that believe that they have lower financial literacy than they really have. This could provide information about how this (financial literacy) overconfidence or lack of it could affect risk-taking propensity of undergraduates. Furthermore, although we expect the findings to be similar to other countries, it may be interesting to replicate our model in different countries or even in multi-country databases (e.g., Donleavy et al., 2018), which offers new possibilities for future research. Finally, our findings reveal the association mechanism between financial literacy and risk-taking propensity. Given that previous literature has shown that the undergraduates' risk-taking propensity is crucial in developing entrepreneurial intentions (Sun et al., 2020; Zhang et al., 2020), a future research line could address how our findings relate to undergraduates' entrepreneurial intentions (boosting economic growth) (Taylor, 2008).

In conclusion, these findings are relevant for researchers and policymakers since they provide a novel way to explain the mechanism through which financial literacy influences undergraduates' risk-taking propensity considering its multidimensional nature. Adequate financial literacy is essential to ensure a healthy financial horizon. Therefore, it is crucial that future studies continue developing this research area which has many relevant implications for society and, particularly, for young people and university students.

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Software application

STATA v.14.2.

Authors' contributions

Conceptualisation: AM-G, AJC-R, MDL-S, JD-S; Methodology: AM-G; Formal analysis and investigation: AM-G, AJC-R, MDL-S; Writing - original draft preparation: AM-G, AJC-R, MDL-S, JD-S; Writing - review and editing: AM-G, AJC-R, MDL-S, JD-S; Supervision: JD-S.

Declaration of conflicting interest

The authors declared no potential conflicts of interest respect to the research, authorship, and/or publication of this article.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

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References

- Ali, A., Rahman, M. S. A., & Bakar, A. (2015). Financial satisfaction and the influence of financial literacy in Malaysia. *Social Indicators Research*, 120(1), 137–156. <https://doi.org/10.1007/s11205-014-0583-0>
- Altonji, J. G., Elder, T. E., & Taber, C. R. (2005). An evaluation of instrumental variable strategies for estimating the effects of catholic schooling. *Journal of Human Resources*, 40(4), 791–821.
- ASIC. (2003). Financial literacy in schools: ASIC discussion paper. *Financial Literacy in Schools* (June).
- Baber, H. (2021). Modelling the acceptance of e-learning during the pandemic of COVID-19-A study of South Korea. *International Journal of Management in Education*, 19(2), Article 100503. <https://doi.org/10.1016/j.ijme.2021.100503>
- Baird, I. S., & Thomas, H. (1985). Toward a contingency model of strategic risk taking. *Academy of Management Review*, 10(2), 230–243. <https://doi.org/10.5465/amr.1985.4278108>
- Bank of Spain, CNMV. (2018). *Financial education plan 2018-2021. Auxiliary services of Bank of Spain*. https://www.cnmv.es/DocPortal/Publicaciones/PlanEducacion/PlanEducacion18_21en.pdf
- Barber, B. M., & Odean, T. (2001). Boys will be boys: Gender, overconfidence, and common stock investment. *Quarterly Journal of Economics*, 116(1), 261–292. <https://doi.org/10.1162/003355301556400>

- Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51(6), 1173–1182. <https://doi.org/10.1037/0022-3514.51.6.1173>
- Beal, D. J., & Delpachitra, S. B. (2003). Financial literacy among Australian university students. *Economic Papers: A Journal of Applied Economics and Policy*, 22(1), 65–78. <https://doi.org/10.1111/j.1759-3441.2003.tb00337.x>
- Becker, G. (1993). *Human capital: A theoretical and empirical analysis, with special reference to education* (3rd ed.). University of Chicago press.
- Becker, A., Deckers, T., Dohmen, T., Falk, A., & Kosse, F. (2012). The relationship between economic preferences and psychological personality measures. *Annual Review of Economics*, 4(1), 453–478. <https://doi.org/10.1146/annurev-economics-080511-110922>
- Behrman, J. R., Mitchell, O. S., Soo, C. K., & Bravo, D. (2012). How financial literacy affects household wealth accumulation. *The American Economic Review*, 102(3), 300–304. <https://doi.org/10.1257/aer.102.3.300>
- Bernheim, B. D., Garrett, D. M., & Maki, D. M. (2001). Education and saving: The long-term effects of high school financial curriculum mandates. *Journal of Public Economics*, 80(3), 435–465. [https://doi.org/10.1016/S0047-2727\(00\)00120-1](https://doi.org/10.1016/S0047-2727(00)00120-1)
- Boubker, O., Arroud, M., & Ouajdouni, A. (2021). Entrepreneurship education versus management students' entrepreneurial intentions. A PLS-SEM approach. *International Journal of Management in Education*, 19(1), Article 100450. <https://doi.org/10.1016/j.ijme.2020.100450>
- Caliendo, M., Fossen, F. M., & Kritikos, A. S. (2009). Risk attitudes of nascent entrepreneurs—new evidence from an experimentally validated survey. *Small Business Economics*, 32(2), 153–167. <https://doi.org/10.1007/s11187-007-9078-6>
- Capuano, A., & Ramsay, I. (2011). *What causes suboptimal financial behaviour? An exploration of financial literacy, social influences and behavioural economics*.
- Cardak, B. A., & Wilkins, R. (2009). The determinants of household risky asset holdings: Australian evidence on background risk and other factors. *Journal of Banking & Finance*, 33(5), 850–860. <https://doi.org/10.1016/j.jbankfin.2008.09.021>
- Castro-González, S., Fernández-López, S., Rey-Ares, L., & Rodeiro-Pazos, D. (2020). The influence of attitude to money on individuals' financial well-being. *Social Indicators Research*, 148(3), 747–764. <https://doi.org/10.1007/s11205-019-02219-4>
- Çera, G., Khan, K. A., Mlouk, A., & Brabenc, T. (2021). Improving financial capability: The mediating role of financial behaviour. *Economic Research-Ekonomska Istraživanja*, 34(1), 1265–1282. <https://doi.org/10.1080/1331677X.2020.1820362>
- Çera, G., Khan, K. A., Rowland, Z., & Ribeiro, H. N. R. (2021). Financial advice, literacy, inclusion and risk tolerance: The moderating effect of uncertainty avoidance. *E+M Ekonomie a Management*, 24(4), 105–123. <https://doi.org/10.15240/tul/001/2021-4-007>
- Cesarini, D., Johansson, M., Lichtenstein, Ö. S., & Wallace, B. (2008). *Is financial risk-taking behavior genetically transmitted?*. No. 765.
- Chan, K. C., Chang, S., & Snavely, J. C. (2022). Effects of financial literacy on graduate school attitudes amidst COVID-19. *Managerial and Decision Economics*, 43(6), 2003–2015. <https://doi.org/10.1002/mde.3504>
- Charness, G., Gneezy, U., & Imas, A. (2013). Experimental methods: Eliciting risk preferences. *Journal of Economic Behavior & Organization*, 87, 43–51. <https://doi.org/10.1016/j.jebo.2012.12.023>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Routledge. <https://doi.org/10.4324/9780203771587>
- Cole, S., Sampson, T., & Zia, B. (2011). Prices or knowledge? What drives demand for financial services in emerging markets? *The Journal of Finance*, 66(6), 1933–1967. <https://doi.org/10.1111/j.1540-6261.2011.01696.x>
- Cupák, A., Fessler, P., & Schneebaum, A. (2021). Gender differences in risky asset behavior: The importance of self-confidence and financial literacy. *Finance Research Letters*, 42(October 2021), Article 101880. <https://doi.org/10.1016/j.frl.2020.101880>
- Deuffhard, F., Georgarakos, D., & Inderst, R. (2019). Financial literacy and savings account returns. *Journal of the European Economic Association*, 17(1), 131–164. <https://doi.org/10.1093/jeaa/jvy003>
- Di Meglio, G., Barge-Gil, A., Camiña, E., & Moreno, L. (2022). Knocking on employment's door: Internships and job attainment. *Higher Education*, 83(1), 137–161. <https://doi.org/10.1007/s10734-020-00643-x>
- Diñç Aydemir, S., & Aren, S. (2017). Do the effects of individual factors on financial risk-taking behavior diversify with financial literacy? *Kybernetes*, 46(10), 1706–1734. <https://doi.org/10.1108/K-10-2016-0281>
- Donleavy, G. D., Poli, P. M., Conover, T. L., Albu, C. N., Dahawy, K., Iatridis, G., et al. (2018). How numeracy mediates cash flow format preferences: A worldwide study. *International Journal of Management in Education*, 16(2), 180–192. <https://doi.org/10.1016/j.ijme.2018.01.004>
- Douissa, I. B. (2020). Factors affecting College students' multidimensional financial literacy in the Middle East. *International Review of Economics Education*, 35 (November 2020), Article 100173. <https://doi.org/10.1016/j.iree.2019.100173>
- Ergün, K. (2018). Financial literacy among university students: A study in eight European countries. *International Journal of Consumer Studies*, 42(1), 2–15. <https://doi.org/10.1111/ijcs.12408>
- Faig, M. (2002). *¿Cómo invierten su riqueza las economías domésticas?* Centre de Recerca en economia internacional. Barcelona, Spain: Universitat Pompeu Fabra.
- Fessler, P., Silgoner, M., & Weber, R. (2020). Financial knowledge, attitude and behavior: Evidence from the Austrian survey of financial literacy. *Empirica*, 47(4), 929–947. <https://doi.org/10.1007/s10663-019-09465-2>
- Financial Consumer Agency of Canada. (2021). *Make change that counts: National financial literacy strategy 2021 - 2026*. Financial Consumer Agency of Canada.
- Fisher, R. J. (1993). Social desirability bias and the validity of indirect questioning. *Journal of Consumer Research*, 20(2), 303. <https://doi.org/10.1086/209351>
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39. <https://doi.org/10.2307/3151312>
- Frederick, S. (2005). Cognitive reflection and decision making. *The Journal of Economic Perspectives*, 19(4), 25–42. <https://doi.org/10.1257/089533005775196732>
- G20. (2012). *G20 leaders declaration*. www.g20mexico.org/images/stories/docs/g20/conclu/G20_Leaders_Declaration_2012.pdf
- Gallego-Losada, R., Montero-Navarro, A., Rodríguez-Sánchez, J.-L., & González-Torres, T. (2022). Retirement planning and financial literacy, at the crossroads. A bibliometric analysis. *Finance Research Letters*, 44(January 2022), Article 102109. <https://doi.org/10.1016/j.frl.2021.102109>
- García-Lopera, F., Santos-Jaén, J. M., Palacios-Manzano, M., & Ruiz-Palomo, D. (2022). Exploring the effect of professionalization, risk-taking and technological innovation on business performance. *PLoS One*, 17(Febuary 2022), Article e0263694. <https://doi.org/10.1371/journal.pone.0263694>
- Gerardi, K., Goette, L., & Meier, S. (2010). *Financial literacy and subprime mortgage delinquency: Evidence from a survey matched to administrative data*. Working Paper 2010-10. www.frbatlanta.org/pubs/WP/. Working Paper 2010-10.
- Goyal, K., & Kumar, S. (2021). Financial literacy: A systematic review and bibliometric analysis. *International Journal of Consumer Studies*, 45(1), 80–105. <https://doi.org/10.1111/ijcs.12605>
- Grohmann, A., Klühs, T., & Menkhoff, L. (2018). Does financial literacy improve financial inclusion? Cross country evidence. *World Development*, 111, 84–96. <https://doi.org/10.1016/j.worlddev.2018.06.020>
- Gullone, E., & Moore, S. (2000). Adolescent risk-taking and the five-factor model of personality. *Journal of Adolescence*, 23(4), 393–407. <https://doi.org/10.1006/jado.2000.0327>
- Gustafsson, C., & Omark, L. (2015). *Financial literacy's effect on financial risk tolerance: A quantitative study on whether financial literacy has an increasing or decreasing impact on financial risk tolerance* (pp. 1–76).
- Gutiérrez-Nieto, B., Serrano-Cinca, C., & de la Cuesta-González, M. (2017). A multivariate study of over-indebtedness' causes and consequences. *International Journal of Consumer Studies*, 41(2), 188–198. <https://doi.org/10.1111/ijcs.12324>
- Hair, J. F., & Sarstedt, M. (2019). Factors versus composites: Guidelines for choosing the right structural equation modeling method. *Project Management Journal*, 50(6), 619–624. <https://doi.org/10.1177/8756972819882132>
- Hastings, J., & Tejada-Ashton, L. (2008). Financial literacy, information, and demand elasticity: Survey and experimental evidence from Mexico. *National Bureau of Economic Research Working Paper Series*, 14538. <https://doi.org/10.3386/w14538>
- Hayhoe, C. R., Leach, L., Allen, M. W., & Edwards, R. (2005). Credit cards held by college students. *Journal of Financial Counseling and Planning*, 16(1), 1–10.
- Hermanson, C., & Jonsson, S. (2021). The impact of financial literacy and financial interest on risk tolerance. *Journal of Behavioral and Experimental Finance*, 29, Article 100450. <https://doi.org/10.1016/j.jbef.2020.100450>
- Hilgert, M. A., Hogarth, J. M., & Beverly, S. (2003). *Household financial management: The connection between knowledge and behavior*. Jul: Federal Reserve Bulletin.

- Hill, E. M., Jenkins, J., & Farmer, L. (2008). Family unpredictability, future discounting, and risk taking. *The Journal of Socio-Economics*, 37(4), 1381–1396. <https://doi.org/10.1016/j.soec.2006.12.081>
- Hunja, A. I., Boubaker, S., Arunachalam, M., & Mehmood, A. (2021). How does CSR mediate the relationship between culture, religiosity and firm performance? *Finance Research Letters*, 39(March 2021), Article 101587. <https://doi.org/10.1016/j.frl.2020.101587>
- Huston, S. J. (2010). Measuring financial literacy. *Journal of Consumer Affairs*, 44(2), 296–316. <https://doi.org/10.1111/j.1745-6606.2010.01170.x>
- Huzdik, K., Béres, D., & Németh, E. (2014). An empirical study of financial literacy versus risk tolerance among higher education students. *Pénzügyi Szemle/Public Finance Quarterly*, 59(4), 476–488.
- Iacobucci, D., Saldanha, N., & Deng, X. (2007). A meditation on mediation: Evidence that structural equations models perform better than regressions. *Journal of Consumer Psychology*, 17(2), 139–153. [https://doi.org/10.1016/S1057-7408\(07\)70020-7](https://doi.org/10.1016/S1057-7408(07)70020-7)
- Jappelli, T., & Padula, M. (2013). Investment in financial literacy and saving decisions. *Journal of Banking & Finance*, 37(8), 2779–2792. <https://doi.org/10.1016/j.jbankfin.2013.03.019>
- Johan, I., Rowlingson, K., & Appleyard, L. (2021). The effect of personal finance education on the financial knowledge, attitudes and behaviour of university students in Indonesia. *Journal of Family and Economic Issues*, 42(2), 351–367. <https://doi.org/10.1007/s10834-020-09721-9>
- Jöreskog, K. G. (1970). A general method for estimating A linear structural equation system. *ETS Research Bulletin Series*, 1970(2), i–41. <https://doi.org/10.1002/j.2333-8504.1970.tb00783.x>
- Jöreskog, K. G. (1993). Testing structural equation models. In J. S. Bollen, K. A., & Long (Eds.), *Testing structural equation models* (pp. 294–316). Newbury Park: Sage.
- Jose, P. E. (2013). *Doing statistical mediation and moderation*. Guilford Press.
- Kanagasabai, B., & Aggarwal, V. (2020). The mediating role of risk tolerance in the relationship between financial literacy and investment performance. *Colombo Business Journal*, 11(1), 83. <https://doi.org/10.4038/cbj.v11i1.58>
- Kidwell, B., & Turrisi, R. (2004). An examination of college student money management tendencies. *Journal of Economic Psychology*, 25(5), 601–616. [https://doi.org/10.1016/S0167-4870\(03\)00073-4](https://doi.org/10.1016/S0167-4870(03)00073-4)
- Korkmaz, A. G., Yin, Z., Yue, P., & Zhou, H. (2021). Does financial literacy alleviate risk attitude and risk behavior inconsistency? *International Review of Economics & Finance*, 74(July 2021), 293–310. <https://doi.org/10.1016/j.iref.2021.03.002>
- Koropp, C., Kellermanns, F. W., Grichnik, D., & Stanley, L. (2014). Financial decision making in family firms: An adaptation of the theory of planned behavior. *Family Business Review*, 27(4), 307–327. <https://doi.org/10.1177/0894486514522483>
- Kraczy, N. D., Hack, A., & Kellermanns, F. W. (2015). What makes a family firm innovative? CEO risk-taking propensity and the organizational context of family firms. *Journal of Product Innovation Management*, 32(3), 334–348. <https://doi.org/10.1111/jpim.12203>
- Liang, S., Ye, D., & Liu, Y. (2021). The effect of perceived scarcity: Experiencing scarcity increases risk taking. *Journal of Psychology*, 155(1), 59–89. <https://doi.org/10.1080/00223980.2020.1822770>
- Li, J., Li, Q., & Wei, X. (2020). Financial literacy, household portfolio choice and investment return. *Pacific-Basin Finance Journal*, 62(September 2020), Article 101370. <https://doi.org/10.1016/j.pacfin.2020.101370>
- Lusardi, A. (2008). Household saving behavior: The role of financial literacy, information, and financial education programs. In C. Foote, L. Goette, & S. Meier (Eds.), *National bureau of economic research* (Vol. 13824). Federal Reserve Bank of Boston. <https://doi.org/10.3386/w13824>.
- Lusardi, A., & Mitchell, O. S. (2007). Financial literacy and retirement preparedness: Evidence and implications for financial education. *Business Economics*, 42(1), 35–44. <https://doi.org/10.2145/20070104>
- Lusardi, A., & Mitchell, O. S. (2008). Planning and financial literacy: How do women fare? *The American Economic Review*, 98(2), 413–417. <https://doi.org/10.1257/aer.98.2.413>
- Lusardi, A., & Mitchell, O. S. (2011a). Financial literacy and planning: Implications for retirement well-being. In A. Lusardi, & O. S. Mitchell (Eds.), *Financial literacy: Implications for retirement security and the financial marketplace*. Oxford University Press.
- Lusardi, A., & Mitchell, O. S. (2011b). Financial literacy and retirement planning in the United States. *Journal of Pension Economics and Finance*, 10(4), 509–525. <https://doi.org/10.1017/S147474721100045X>
- Lusardi, A., & Mitchell, O. S. (2014). The economic importance of financial literacy: Theory and evidence. *Journal of Economic Literature*, 52(1), 5–44. <https://doi.org/10.1257/jel.52.1.5>
- Lusardi, A., Mitchell, O. S., & Curto, V. (2010). Financial literacy among the young. *Journal of Consumer Affairs*, 44(2), 358–380. <https://doi.org/10.1111/j.1745-6606.2010.01173.x>
- Lusardi, A., & Scheresberg, C. de B. (2013). *Financial literacy and high-cost borrowing in the United States* (Vols. 1–41). National Bureau of Economic Research.
- Lusardi, A., & Tufano, P. (2015). Debt literacy, financial experiences, and overindebtedness. *Journal of Pension Economics and Finance*, 14(4), 332–368. <https://doi.org/10.1017/S1474747215000232>
- Mayr, S., Erdfelder, E., Buchner, A., & Faul, F. (2007). A short tutorial of GPower. *Tutorials in Quantitative Methods for Psychology*, 3(2), 51–59. <https://doi.org/10.20982/tqmp.03.2.p051>
- Miller, W. R., & C' de Baca, J. (2001). *Quantum change: When epiphanies and sudden insights transform ordinary lives*. Guilford Press.
- Molina-García, A., Diéguez-Soto, J., Galache-Laza, M. T., & Campos-Valenzuela, M. (2023). Financial literacy in SMEs: A bibliometric analysis and a systematic literature review of an emerging research field. *Review of Managerial Science*, 17(3), 787–826. <https://doi.org/10.1007/s11846-022-00556-2>
- Moore, D. L. (2003). *Survey of financial literacy in Washington state: Knowledge, behavior, attitudes, and experiences*. <https://doi.org/10.13140/2.1.4729.4722>
- Mudzingiri, C. (2021). The impact of financial literacy on risk seeking and patient attitudes of university students. *Development Southern Africa*, 38(5), 845–861. <https://doi.org/10.1080/0376835X.2021.1945431>
- Mudzingiri, C., Muteba Mwamba, J. W., & Keyser, J. N. (2018). Financial behavior, confidence, risk preferences and financial literacy of university students. *Cogent Economics & Finance*, 6(1), Article 1512366. <https://doi.org/10.1080/23322039.2018.1512366>
- Mudzingiri, C., Mwamba, J. W. M., Keyser, J. N., & Bara, A. (2019). Indecisiveness on risk preference and time preference choices. Does financial literacy matter? *Cogent Psychology*, 6(1). <https://doi.org/10.1080/23311908.2019.1647817>
- Netemeyer, R., Bearden, W., & Sharma, S. (2003). *Scaling procedures*. SAGE Publications, Inc. <https://doi.org/10.4135/9781412985772>
- Noviarini, J., Coleman, A., Roberts, H., & Whiting, R. H. (2021). Financial literacy, debt, risk tolerance and retirement preparedness: Evidence from New Zealand. *Pacific-Basin Finance Journal*, 68(September 2021), Article 101598. <https://doi.org/10.1016/j.pacfin.2021.101598>
- OECD. (2012). *OECD/INFE high-level principles on national strategies for financial education*.
- OECD. (2013). *PISA 2012 assessment and analytical framework: Mathematics, reading, science, problem solving and financial literacy*. OECD Publishing. <https://doi.org/10.1787/9789264190511-en>
- OECD. (2015a). *National strategies for financial education. OECD/INFE policy handbook*.
- OECD. (2015b). *Recommendation on principles and good practices for financial education*.
- OECD. (2017a). *G20/OECD INFE report on adult financial literacy in G20 countries*.
- OECD. (2017b). *PISA 2015 results (volume IV): Students' financial literacy*, PISA. Paris: OECD Publishing. <https://doi.org/10.1787/9789264270282-en>
- Oster, E. (2019). Unobservable selection and coefficient stability: Theory and evidence. *Journal of Business & Economic Statistics*, 37(2), 187–204. <https://doi.org/10.1080/07350015.2016.1227711>
- Pituch, K. A., & Stevens, J. P. (2015). *Applied multivariate statistics for the social sciences*. Routledge. <https://doi.org/10.4324/9781315814919>
- Potrich, A. C. G., Vieira, K. M., & Mendes-Da-Silva, W. (2016). Development of a financial literacy model for university students. *Management Research Review*, 39(3), 356–376. <https://doi.org/10.1108/MRR-06-2014-0143>
- Ramudzuli, P. M., & Muzindutsi, P.-F. (2015). Financial knowledge and subjective financial risk tolerance (among students at a South African University). *Risk Governance and Control: Financial Markets & Institutions*, 5(3), 180–185. <https://doi.org/10.22495/rgcv5i3c2art3>
- Razen, M., Huber, J., Hueber, L., Kirchlner, M., & Stefan, M. (2021). Financial literacy, economic preferences, and adolescents' field behavior. *Finance Research Letters*, 40(May 2021), Article 101728. <https://doi.org/10.1016/j.frl.2020.101728>

- Rey-Ares, L., Fernández-López, S., Vivel-Búa, M. M., & Lado-Sestayo, R. (2022). The early bird catches the retirement savings. *Qualitative Research in Financial Markets*, 14(2), 289–305. <https://doi.org/10.1108/QRFM-03-2018-0030>
- Riepe, J., Rudeloff, M., & Veer, T. (2022). Financial literacy and entrepreneurial risk aversion. *Journal of Small Business Management*, 60(2), 289–308. <https://doi.org/10.1080/00472778.2019.1709380>
- Rigdon, E. E., Sarstedt, M., & Ringle, C. M. (2017). On comparing results from CB-SEM and PLS-SEM: Five perspectives and five recommendations. *Marketing ZFP*, 39(3), 4–16. <https://doi.org/10.15358/0344-1369-2017-3-4>
- Robb, C. A., Babiarz, P., & Woodyard, A. (2012). The demand for financial professionals' advice: The role of financial knowledge, satisfaction, and confidence. *Financial Services Review*, 21(21), 291–305.
- van Rooij, M., Lusardi, A., & Alessie, R. (2011a). Financial literacy and retirement planning in The Netherlands. *Journal of Economic Psychology*, 32(4), 593–608. <https://doi.org/10.1016/j.joep.2011.02.004>
- van Rooij, M., Lusardi, A., & Alessie, R. (2011b). Financial literacy and stock market participation. *Journal of Financial Economics*, 101(2), 449–472. <https://doi.org/10.1016/j.jfineco.2011.03.006>
- Rosacker, K. M., & Rosacker, R. E. (2016). An exploratory study of financial literacy training for accounting and business majors. *International Journal of Management in Education*, 14(1), 1–7. <https://doi.org/10.1016/j.ijme.2015.11.002>
- Ryack, K. (2011). The impact of family relationships and financial education on financial risk tolerance. *Financial Services Review*, 20, 181–193.
- Santini, F. D. O., Ladeira, W. J., Mette, F. M. B., & Ponchio, M. C. (2019). The antecedents and consequences of financial literacy: A meta-analysis. *International Journal of Bank Marketing*, 37(6), 1462–1479. <https://doi.org/10.1108/IJBM-10-2018-0281>
- Schultz, T. W. (1961). Investment in human capital. *American Economic Association*, 51(5), 1035–1039.
- Schumacker, R., & Lomax, R. (2016). *A beginner's guide to structural equation modeling* (4th ed.). Routledge. <https://doi.org/10.4324/9780203851319>
- Stango, V., & Zinman, J. (2009). Exponential growth bias and household finance. *The Journal of Finance*, 64(6), 2807–2849. <https://doi.org/10.1111/j.1540-6261.2009.01518.x>
- StataCorp. (2015). *Stata statistical software: Release 14*. College Station, TX: StataCorp LP.
- Steenkamp, J.-B. E., & Baumgartner, H. (2000). On the use of structural equation models for marketing modeling. *International Journal of Research in Marketing*, 17(2–3), 195–202. [https://doi.org/10.1016/S0167-8116\(00\)00016-1](https://doi.org/10.1016/S0167-8116(00)00016-1)
- Struckell, E. M., Patel, P. C., Ojha, D., & Oghazi, P. (2022). Financial literacy and self employment – the moderating effect of gender and race. *Journal of Business Research*, 139(April 2021), 639–653. <https://doi.org/10.1016/j.jbusres.2021.10.003>
- Strydom, B., & Metherell, C. (2012). *Demographic factors affecting subjective financial risk tolerance: South African evidence*. Working Paper 01-2012.
- Sung, J., & Hanna, S. D. (1997). Factors related to risk tolerance. *SSRN Electronic Journal*, 7, 11–19. <https://doi.org/10.2139/ssrn.2234>
- Sun, H., Ni, W., Teh, P.-L., & Lo, C. (2020). The systematic impact of personal characteristics on entrepreneurial intentions of engineering students. *Frontiers in Psychology*, 11, 1–15. <https://doi.org/10.3389/fpsyg.2020.01072>
- Sutter, M., Weyland, M., Untertrifaller, A., & Froitzheim, M. (2020). Financial literacy, risk and time preferences - results from a randomized educational intervention. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3676095>
- Taylor, D. W. (2008). The entrepreneur in youth: An untapped resource for economic growth, social entrepreneurship, and education. *International Journal of Entrepreneurial Behavior & Research*, 14(5), 367–369. <https://doi.org/10.1108/13552550810897713>
- Tezel, Z. (2015). In *Financial education for children and youth. Handbook of research on behavioral finance and investment strategies: Decision making in the financial industry* (pp. 69–92). IGI Global. <https://doi.org/10.4018/978-1-4666-7484-4.ch005>.
- U.S. Financial Literacy Commission. (2006). Taking ownership of the future: The national strategy for financial literacy. In *The national strategy for financial literacy*.
- Vargas Halabí, T., & Mora-Esquivel, R. (2017). Tamaño de la muestra en modelos de ecuaciones estructurales con constructos latentes: Un método práctico. *Actualidades Investigativas En Educación*, 17(1). <https://doi.org/10.15517/aie.v17i1.27294>
- Vieira, K. M., Potrich, A. C. G., & Mendes-Da-Silva, W. (2019). A financial literacy model for university students. In *Individual behaviors and technologies for financial innovations* (pp. 69–95). Springer International Publishing. https://doi.org/10.1007/978-3-319-91911-9_4
- Widdowson, D., & Hailwood, K. (2017). Financial literacy and its role in promoting a sound financial system. *Reserve Bank of New Zealand*, 70(2), 37–47.
- Worthington, R. L., & Whittaker, T. A. (2006). Scale development research. *The Counseling Psychologist*, 34(6), 806–838. <https://doi.org/10.1177/0011000006288127>
- Xu, Z. X., Wang, Y., Zhu, M., & Ma, H. K. (2019). Is risk-taking propensity associated with unethical behaviors? An experimental study. *Ethics & Behavior*, 29(7), 557–571. <https://doi.org/10.1080/10508422.2019.1585854>
- Yamori, N., & Ueyama, H. (2022). Financial literacy and low stock market participation of Japanese households. *Finance Research Letters*, 44(January 2022), Article 102074. <https://doi.org/10.1016/j.frl.2021.102074>
- Yanto, H., Ismail, N., Kiswanto, K., Rahim, N. M., & Baroroh, N. (2021). The roles of peers and social media in building financial literacy among the millennial generation: A case of Indonesian economics and business students. *Cogent Social Sciences*, 7(1). <https://doi.org/10.1080/23311886.2021.1947579>
- Yao, R., Sharpe, D. L., & Wang, F. (2011). Decomposing the age effect on risk tolerance. *The Journal of Socio-Economics*, 40(6), 879–887. <https://doi.org/10.1016/j.socec.2011.08.023>
- Yap, R. J. C., Komalasari, F., & Hadiansah, I. (2016). The effect of financial literacy and attitude on financial management behavior and satisfaction. *International Journal of Administrative Science & Organization*, 23(3), 140–146.
- Yong, A. G., & Pearce, S. (2013). A beginner's guide to factor analysis: Focusing on exploratory factor analysis. *Tutorials in Quantitative Methods for Psychology*, 9(2), 79–94. <https://doi.org/10.20982/tqmp.09.2.p079>
- Yong, C. C., Yew, S. Y., & Wee, C. K. (2018). Financial knowledge, attitude and behaviour of young working adults in Malaysia. *Institutions and Economics*, 10(4), 21–48.
- Yoong, J. (2011). Financial illiteracy and stock market participation: Evidence from the RAND American life panel. In A. Lusardi, & O. S. Mitchell (Eds.), *Financial literacy: Implications for retirement security and the financial marketplace*. Oxford University Press.
- Zhang, M. F., Dawson, J. F., & Kline, R. B. (2021). Evaluating the use of covariance-based structural equation modelling with reflective measurement in organizational and management research: A review and recommendations for best practice. *British Journal of Management*, 32(2), 257–272. <https://doi.org/10.1111/1467-8551.12415>
- Zhang, S.-N., Li, Y.-Q., Liu, C.-H., & Ruan, W.-Q. (2020). Critical factors identification and prediction of tourism and hospitality students' entrepreneurial intention. *Journal of Hospitality, Leisure, Sport & Tourism Education*, 26(June 2020), Article 100234. <https://doi.org/10.1016/j.jhlste.2019.100234>
- Zhao, X., Lynch, J. G., & Chen, Q. (2010). Reconsidering Baron and Kenny: Myths and truths about mediation analysis. *Journal of Consumer Research*, 37(2), 197–206. <https://doi.org/10.1086/651257>
- Zhu, T., & Xiao, J. J. (2022). Consumer financial education and risky financial asset holding in China. *International Journal of Consumer Studies*, 46(1), 56–74. <https://doi.org/10.1111/ijcs.12643>
- Atkinson, A., & Messy, F.-A. (2012). Measuring financial literacy: Results of the OECD infep pilot study. In OECD working papers on finance. Insurance And Private Pensions. (Issue 15) doi:10.1787/5k9c9s90fr4-en.