

Tacneng, Ruth; Puzon, Klarizze Anne Martin; Barry, Thierno Amadou

## Working Paper

# Crowding out effects of financial knowledge and attitude on risk preferences: Evidence from a least developed African country

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WIDER Working Paper 2021/58

## **Crowding out effects of financial knowledge and attitude on risk preferences**

Evidence from a least developed African country

Ruth Cadaoas Tacneng,<sup>1</sup> Klarizze Anne Martin Puzon,<sup>2</sup> and Thierno Barry<sup>1</sup>

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**Abstract:** Using hand-collected survey and experimental data, we examine the determinants of financial literacy as well as the link between self-reported risk and elicited risk preferences in a least developed African country, Guinea. We measure financial literacy as the sum of three elements: financial knowledge, attitude, and behaviour. Our findings indicate that the lack of a significant relationship between our financial literacy measure and risk preferences is caused by the crowding out effects of financial attitude and knowledge. Individuals who display stronger financial knowledge are more willing to take on risk, but so are those with poor financial attitudes. Among individuals who have extensive financial knowledge, those with lower financial attitude scores or negative attitudes towards future planning and saving are more willing to take risks. These highlight the need to accentuate not only financial knowledge but also strong financial attitude and good financial behaviour to comprehensively and properly manage risks.

**Key words:** financial literacy, risk preferences, Africa

**JEL classification:** D14, D81, O1, O55

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<sup>1</sup> LAPE, Université de Limoges, Limoges, France; <sup>2</sup> UNU-WIDER, corresponding author: [klarizze@wider.unu.edu](mailto:klarizze@wider.unu.edu)

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Katajanokanlaituri 6 B, 00160 Helsinki, Finland

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## 1 Introduction

Risk attitude or an individual's willingness to take on risk is an essential factor in decision making. In recent years, financial education has received attention from policy makers because of its importance in improving the ability for individuals to make informed economic and financial choices (Klapper, Lusardi, and Oudheusden 2015; Lusardi and Mitchell 2014) and in properly managing risks (BIS 2018). As banking and financial products and services have become increasingly more complex, and at the same time more accessible because of technological innovation, the role played by financial education in achieving sustainable financial inclusion has never become more significant. Along with financial consumer protection regulation, the Responsible Finance Forum identifies financial capability as one of the pillars for responsible finance (World Bank 2012). Thus, policy makers in recent years have worked on developing programmes and creating policies that enhance financial education to achieve financial inclusion and sustainable economic growth. This is particularly important especially in less developed economies where financial literacy is low and 37 per cent of the adult population remains unbanked (Global Findex Data 2017). Inquiring into individuals' four financial decision-making concepts— inflation, numeracy, risk diversification, and compounding interest—the results of the Standard & Poor's Rating Services Global Financial Literacy Survey conducted in 140 economies in 2014 show that only one out of three adults worldwide understand at least three out of the four financial concepts (Klapper, Lusardi, and Oudheusden 2015). Moreover, their survey results show that richer countries tend to have higher financial literacy rates, on average, compared with poorer countries.

To the extent that financial literacy could enhance informed decision making and managing risks through knowledge accumulation and display of good financial practices, this paper analyses whether risk preferences vary systematically with financial education.<sup>1</sup> The objective of this paper is three-fold. First, we examine the factors correlated with financial literacy and its three components—financial knowledge, financial attitudes, and financial behaviour—through survey questions based on OECD's (2015) recommendations for measuring financial literacy. Second, we investigate the link between financial literacy and individual risk preferences. We, hence, answer the question: are more financially literate individuals willing to take on more risks than less financially literate ones? Moreover, our study provides a better understanding of the roles played by financial knowledge, financial behaviour, and financial attitude, particularly towards saving and future planning, on individual risk attitude. While financial knowledge pertains to understanding different financial concepts, financial behaviour encompasses the ability of individuals to display appropriate behaviour such as honouring commitments on time. Financial attitudes, on the other hand, comprise individuals' attitudes towards money and savings, thus measuring the importance individuals attribute to long-term security. To elicit individual risk preferences, we use the Gneezy and Potters (1997) method using an experimental game that asks respondents how much of their endowment would they be willing to invest in a risky project. Lastly, we examine the relationship between stated risk attitudes and revealed risk preferences. In order to carry out these empirical objectives, we combine experimental data and survey questions conducted on 279 respondents in Conakry, Guinea.

The link between financial literacy and risk preferences is not well studied in the literature. Closely related studies that look into the relationship between cognitive skills and risk attitudes are scarce in the literature. Notable exceptions include Frederick (2006), Burks et al. (2009), Dohmen et al.

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<sup>1</sup> Financial literacy and education are used interchangeably throughout the paper.

(2010), and Benjamin, Brown, and Shapiro (2013) who find cognitive skills to be associated with more willingness to take on risks. Dohmen et al. (2010) find that individuals who have low cognitive ability are more risk averse. Moreover, Burks et al. (2009), for a sample of trainee truckers, find that individuals with better cognitive skills are more willing to take calculated risks. Unlike cognitive skills that partly capture personality traits rather than intelligence (Segal 2012; Borghans, Meijers, and Ter Weel 2008), financial literacy measures particularly financial knowledge and describes individual competence and their ability to grasp financial concepts. Moreover, other authors relate students' math SAT scores with risk choices. For example, Benjamin, Brown, and Shapiro (2013) find students with lower math scores to be less risk neutral. In addition, Frederick (2006) finds cognitive ability to be positively associated with willingness to take on risk in lotteries but only when outcomes do not include losses.

Financial literacy has been relatively studied in the literature particularly in developed economies. Measuring financial literacy based on savings and portfolio choice models and OECD's (2005) definition of financial education, Lusardi and Mitchell (2006, 2011a) formulate questions in the US Health and Retirement Study. They identify three important concepts that are crucial in individual decision making: interest compounding, inflation, and risk diversification. They find financial literacy to be negatively related to educational attainment and that only around one-third are knowledgeable of the three concepts, suggesting that people lack financial literacy and are, on average, uninformed about financial instruments consistent with previous US studies (Moore 2003; Bernheim 1998). Moreover, the OECD (2005) mentions evidence of consumer overconfidence in terms of financial knowledge in Germany, the United States, Australia, and the UK, which may deter them from seeking financial advice or deepen their knowledge of financial concepts. In Africa, cross-country studies analysing and available statistics measuring financial literacy remain limited. Country-level statistics, for example, in Kenya from the 2006 FinAccess survey analysed by Atkinson and Kempson (2008) show evidence of poor financial behaviours and attitudes, as manifested by the difficulties they encountered in managing their money and the lack of planning behaviour. Moreover, while South African data show that South Africans tend to portray responsible behaviour with regard to financial management, they lack financial knowledge about risk diversification and interest rates and face problems linked with long-term planning (Roberts and Struwig 2011).

Most recent studies focusing on financial literacy relate it with financial inclusion and economic decisions such as retirement planning and wealth accumulation (notable examples include Lusardi and Mitchell 2006, 2007, 2008, 2009, 2011b; and Grohmann, Klühs, and Menkhoff 2018) and entrepreneurship. Lusardi and Mitchell (2007) find a positive relationship between financial knowledge and retirement planning abilities, which is related to saving capabilities (Lusardi 1999). Moreover, Hogarth, Anguelov, and Lee (2005) show an overwhelming proportion of low educated consumers among the 'unbanked', or those who are financially excluded. Grohmann, Klühs, and Menkhoff (2018) document cross-country evidence of a link between higher financial literacy and financial inclusion. Moreover, they find that the marginal impact of financial literacy on access to financial services is higher in countries with lower financial depth. However, in terms of the use of financial services, they find that countries with higher financial depth benefit more from increased financial literacy. Micro-based studies such as Cole, Sampson, and Zia (2011), Doi, McKenzie, and Zia (2014), and Jamison, Karlan, and Zinman (2014) give credence to the existence of a positive relationship between financial literacy and inclusion. Moreover, a recent study by Riepe, Rudeloff, and Veer (2020) find that financial literacy attenuates differences in risk taking between wage earners and entrepreneurs.

To our knowledge, there are few studies that look into the link between financial literacy—more precisely, financial knowledge, financial behaviour and financial attitude, and individual risk preferences. Studying the context of sub-Saharan Africa, which is marked by low financial

inclusion such as lack of access to formal financial products and low financial literacy, is important because of the large potential of inclusion and financial literacy to improve household decision making and increase firm growth opportunities. Messy and Monticone (2012) argue that insufficient financial education or low financial literacy is a huge demand-side barrier to achieving financial inclusion and, thus, inclusive growth. In addition, many African countries often face resource constraints as they live in risky environments and are often insufficiently prepared to face different shocks—natural, health, agricultural, and economic—leaving them financially vulnerable and easily stuck in a poverty trap. Aside from helping in managing household resources, anticipating income shocks, and inculcating planning and saving to smooth income fluctuations, financial education may help drive entrepreneurship, provide individuals a better understanding of the terms and conditions of obtaining informal credit from money lenders, and the financial products offered by micro-finance institutions and, in general, banks. Alongside financial consumer protection, financial literacy equips especially vulnerable households and individuals with the knowledge to avoid falling prey to abusive financial providers, scams, and fraud. The OECD (2013) asserts that financial education is important in restoring confidence in financial markets. Because of the importance of financial education, the G20 leaders endorsed the 2012 OECD/International Network on Financial Education (INFE) High-Level Principles on National Strategies of Financial Education that aims to guide policy makers to develop evidence-based and customized approaches to financial education across all economies.

It is, thus, not surprising that several initiatives have been launched with the aim of improving financial education in Africa, either for the general population or targeted to specific subgroups using various delivery channels. For example, Ghana developed a national strategy in 2009 for financial consumer protection and financial literacy in the micro-finance sector. In 2012, Namibia's Ministry of Finance launched its financial literacy initiative. Different stakeholders are also active in implementing financial education programmes. Across Africa, Messy and Monticone (2012) document that while most initiatives are implemented in eastern Africa and almost in all southern African countries, only few have been developed in west and in central Africa.

Some studies indicate a lack of financial education initiatives in Guinea. A study by the ACET (2019) shows that unlike Zambia and Sierra Leone who have taken steps to increase financial literacy and capability of women and youth to make responsible financial decisions, Guinea is yet to adopt similar initiatives. Moreover, the result of a dialogue of several panellists organized by the Central Bank of Guinea (BCRG) in collaboration with AFI (l'Alliance pour l'Inclusion Financière) in November 2019 indicates that the lack of financial education is one of the principal reasons for financial exclusion in Guinea. The findings of a study conducted by the World Bank Group, the BCRG, and First Initiative (World Bank 2018) give credence to these, showing that the level of education is a significant contributing factor to differences in access to formal financial accounts between educated and uneducated adults. Further, their study also shows that 56.9 per cent of the adult population consider not being able to make ends meet (possess an equivalent of US\$33) in case of an emergency or a financial shock. This, hence, suggests that national programmes and initiatives must be developed to educate the Guinean population about the use, especially, of saving services and electronic wallets. Consequently, the World Bank introduced, under the programme 'Supporting National Payment Systems in Ebola Affected Countries' (SNPS), a financial capability component aimed at increasing knowledge and trust of the population on e-money. Based on their interviews with focus groups, who are beneficiaries of social transfers and unbanked individuals, they find that respondents tend to exhibit poor savings behaviour, preferring to save cash at home rather than use savings mechanisms of formal financial institutions and to rely on family and friends for financial emergencies.

Our main findings show that the aggregate measure of financial literacy is not significantly associated with individual risk preferences. This is, however, because of contrasting links of two

of its components and risk attitudes. Individuals with higher financial knowledge scores are found to be more risk neutral, on average, while those who exhibit positive financial attitudes towards savings and future planning are more risk averse. These results have some profound implications on individuals' propensity to save up and prepare for the future, especially in the context of least developed economies where shocks may easily lead to financial vulnerability. Moreover, depending on the country, the bulk of the retirement money may be left for individuals to manage. In contrast to more developed economies, such as in Europe where older people have better access to social pension plans and, hence, count public transfers as a primary source of income, the ageing population in poor countries such as in sub-Saharan Africa is more economically vulnerable (Kakwani and Subbarao 2005). At later stages in life, they either depend on private transfers from their children or remain active in the labour force throughout their lives. Nevertheless, globally, the ILO (2018) estimates an increasing trend in labour force participation rates of seniors and near seniors (persons aged 55–64). However, while the labour force participation rate of seniors in Europe and Central Asia was around 7 per cent in 2015, the corresponding percentage of economically active seniors in Africa was 39 per cent (ILOSTAT 2017; UN 2017). In addition, myopic financial views with regard to retirement planning is tantamount to misunderstanding poverty later in life, especially in less developed economies. Old-age poverty is an important issue in poor countries (Barrientos, Gorman, and Heslop 2003). Statistical estimates presented by Deaton and Paxson (1997) show that the percentage of old who are poor in Ghana is 64.1 per cent. Moreover, Moore (2001) finds an intergenerational negative impact of poverty. Our findings also show that those who are relatively more financially knowledgeable, but possess myopic financial attitude, tend to be the most risk neutral. Hence, this may tend to indicate behavioural preference in favour of short-term gains and impatience. This finding has policy implications on how financial literacy has to be enhanced. Particularly in the context of less developed economies, developing financial knowledge may not be sufficient because in order for individuals to make informed financial decisions and be better able to manage risks, they must also have the right mindset with regard to savings and future planning. Our main results on the link between financial knowledge and risk attitudes are consistent with existing studies that interrogate the relationship between risk preferences and cognitive ability and skills (Frederick 2006; Burks et al. 2009; Dohmen et al. 2010; and Benjamin, Brown, and Shapiro 2013). Inquiring into the correlations between financial literacy and socio-demographic characteristics, we find that men and those who have better material well-being are relatively more financially literate. Our results are robust to the use of an alternative estimation technique and variable definitions.

The paper is organized as follows. Section 2 provides a description of the risk game experiment conducted in Guinea, Africa, definitions of variables used in our empirical estimations, and descriptive statistics. The next section describes the empirical methodology used to estimate our equations, followed by the presentation and discussion of results in Section 4. Section 5 discusses robustness checks and further issues. We conclude in the final section.

## **2 Stylized facts and methods**

### **2.1 Recruitment**

We recruited respondents from the Université Général Lansana Conté de Sonfonia-Conakry and Université de Simbaya, two universities located in the capital of Guinea—Conakry. This is to ensure literacy and numeracy of the respondents. We trained local assistants to manage the sessions. Our local assistants are of mixed gender and ethnicity. A few weeks before planned sessions, respondent recruitment was conducted by word-of-mouth advertisements and flyers. In the registration sheets, they were asked for their phone number and name. For each session, we

randomly mixed participants from different departments in the two universities. Participants were informed that they would engage in a study on decision making. Precisely, they will engage in a game where they may be able to earn additional money. This money is in addition to their participation fee of GNF10,000 (EUR1), a payment that is equivalent to the minimum wage. During each session, local assistants from Conakry distributed questionnaires, read the instructions out loud, and provided numerical examples to ensure comprehension by participants. Respondents were told to give their best and honest response in the questionnaires. All answers and final earnings were kept confidential. Participants were assigned specific seats by local assistants, and their identities remained anonymous. They were merely identified with their identification (ID) numbers and were not allowed to talk with others during the session. Clarifications or questions were to be asked privately to local assistants only. After carrying out the risk experiment, a financial literacy, beliefs, and socio-demographic survey was conducted, which consisted of questions that ask about respondents' socio-demographic characteristics, beliefs, and comprehension of financial concepts in order to measure financial literacy. All questionnaires were written in French, the official language of Guinea.

## 2.2 Definition of variables

### 2.2.1 Risk preferences

In experimental literature, there exist different ways to elicit individual risk preferences [refer to Charness, Gneezy, and Imas (2013) for an excellent review of empirical methodologies to elicit risk preferences/attitudes], such as the Balloon Analogue Risk Task (BART) (Lejuez et al. 2002), the Gneezy and Potters (1997) method, and the Eckel and Grossman (2002) method. More complex methods such as the multiple price list method are also used to elicit risk preferences through participants' choices between gambles (Holt and Laury 2002).

We adopt the Gneezy and Potters (1997) method to elicit individual risk preferences because we are analysing a developing country context where literacy is one of the lowest in the world. Moreover, Charness and Villevall (2009) argue that simpler risk measures, such as the amount of resource one is willing to expose to risk, tend to yield more accurate real-world risk-taking behaviours compared with a complicated list of choices among lotteries. Besides, several scholars remain sceptical about the use of survey questions in measuring risk attitudes (Camerer and Hogarth 1999; Dohmen et al. 2011).

We measure risk preferences in a context where respondents can obtain real monetary payoffs based on their financial/investment decision. In this game, the participant receives an endowment equivalent to GNF10,000 (approximately equal to EUR1), which is different from their participation fee. The participant is asked to decide how much of this endowment they would like to invest in a risky project. This is the only choice the participant is asked to make in the experiment. The participant's total payoff at the end of the game is equal to the amount they did not invest plus the gain from the investment, if the investment was a success. In the game, there is 50 per cent probability of success, where total gain is three times the invested amount.

Given that the investment yield is 3X with a probability 0.50, where X is the amount invested in the risky project, and that the money not invested is 10,000-X, the expected payoffs are the following:

Expected payoff if X=0: GNF10,000

Expected payoff if X≠0:  $0.5 (3X + (10,000 - X)) + 0.5 (10,000 - X) = \text{GNF}(10,000 + 0.5X)$



The payoff is maximized at  $X=10,000$ , where the expected value is GNF15,000. Moreover, the expected value is higher for any investment amount compared with not investing. A risk-averse individual should, hence, invest less, while a risk-seeking one should invest GNF10,000. The invested amount, thus, corresponds to the individual's risk preference or to the extent by which the individual is willing to take on risk (Charness, Gneezy, and Imas 2013). We, hence, define *risk* as the amount invested by the respondent in the risky project.

The experimental instructions of the risk game are detailed in Appendix A.

Moreover, we also enquire into the individuals' self-perceived or self-reported risk preferences by asking them to rate themselves on a scale of 1 to 10, through a hypothetical risk attitude question: Do you see yourself as a person who lives your life very prudently (1) or are you a person who is prepared to take risk (10)? The question posed in the survey in relation to the individual's self-reported/perceived riskiness is detailed in Appendix B.

#### *Descriptive statistics of risk preferences*

We present in Table 1 the distribution of *risk*, or the amount invested in the risky project. Statistics indicate that the majority of the respondents choose to invest in the risky project, with only 4.30 per cent opting to receive a payoff equal to the initial GNF10,000 endowment. A little over one-third choose to invest 50 per cent of their endowment, for an expected payoff of GNF12,500. Moreover, 37 respondents (13 per cent) invest their entire endowment for an expected payoff of GNF15,000. According to sex, among those who invest at least a portion of their endowment on the risky project, 27.69 per cent of men invest less than 50 per cent of their endowment on risky projects compared with 51.51 per cent of women respondents. Though the distribution is not strikingly different in terms of the proportion of male or female respondents investing more than 50 per cent of their endowment in the risky project (22.75 per cent for women vs. 28.17 per cent for men), we note that only 4.55 per cent of women respondents are willing to invest all of their endowment in the risky project, compared with 16 per cent of the male respondents. These statistics indicate that men are more risk neutral than women. Globally, we find variation in terms of the respondents' risk preferences, with the majority opting to invest half their endowment and more than 20 per cent investing at least 70 per cent of their endowment in the risky project.

Table 1: Distribution of *risk*, the amount invested in the risky project, of 279 respondents using the Gneezy and Potters (1997) method to elicit risk preferences

<i>Risk</i> : amount invested	Number of respondents	Percentage (%) of respondents	Percentage (%) of male respondents	Percentage (%) of female respondents
0	12	4.30	3.76	6.06
1,000	25	8.96	7.98	12.12
2,000	23	8.24	6.10	15.15
3,000	28	10.04	7.51	18.18
4,000	17	6.09	6.10	6.06
5,000	99	35.48	40.38	19.70
6,000	13	4.66	4.69	4.55
7,000	8	2.87	2.35	4.55
8,000	8	2.87	2.35	4.55
9,000	9	3.23	2.82	4.55
10,000	37	13.26	15.96	4.55

Note: *risk* is the amount invested by an individual in a risky project in the risk/investment game. The total number of respondents is 279.

Source: authors' calculations.

We show in Table 2 the descriptive statistics of *risk* as well as statistical differences in the willingness to take on risk, between men and women. On average, the respondents invest GNF4,899.64 to the risky project, representing 49 per cent of their endowment. Consistent with observations in Table 1, men are found to be more risk neutral than women, with investment in the risky project amounting to GNF5,173.71, on average, compared with GNF4,015.15 for women respondents. We observe similar trend results when looking into the median, the 25<sup>th</sup> and the 75<sup>th</sup> percentile values. While 50 per cent of the male respondents invest less than GNF5,000 (50 per cent) on the risky project, a similar proportion of female respondents invest less than 30 per cent of their endowment in the risky project.

Table 2: Descriptive statistics of *risk*, the amount invested in the risky project, of 279 respondents using the Gneezy and Potters (1997) method to elicit risk preferences, according to sex

	<i>Risk</i> (average)	<i>Risk</i> (median)	<i>Risk</i> (25 <sup>th</sup> percentile)	<i>Risk</i> (75 <sup>th</sup> percentile)
Total	4,899.64	5,000	3,000	6,000
<b>Sex</b>				
Female	4,015.15	3,000	2,000	5,000
Male	5,173.71	5,000	3,000	6,000

Note: *risk* is the amount invested by an individual in a risky project in the risk/investment game. The total number of respondents is 279.

Source: authors' calculations.

*Risk preferences: Gneezy and Potters (1997) versus self-reported riskiness*

Table 3 provides descriptive statistics of the risk attitude/preference measure (*risk*) using the Gneezy and Potters (1997) experimental method to elicit risk preferences and individual's self-reported/perceived riskiness from survey responses (refer to Appendix B for the survey question). Self-reported risk measures indicate that almost half of the respondents view themselves to be risk-averse (individual living his/her life very prudently, or rating of one on a scale of 1 to 10). Less than 10 per cent of the respondents consider themselves as 'pure' risk-takers (or living their lives dangerously). In general, we do not find compelling evidence of a positive correlation between the risk preference measure (*risk*) and self-perceived riskiness. We note, however, that the amount invested in the risky project is relatively higher, on average, for those who rated themselves seven to nine in terms of self-reported riskiness.

Table 3: Descriptive statistics of risk measures using i) survey questionnaire responses (*self-perceived/reported riskiness*)—(1) prudent, (10) very risky, and ii) risk preferences (*risk*) à la Gneezy and Potters (1997)

Self-perceived riskiness (degree) from survey responses	<i>Risk</i> : amount invested Mean	<i>Risk</i> : amount invested Median	<i>Risk</i> : amount invested Std Dev	Frequency (%)
1	4,757.35	5,000	2,731.16	50.37
2	5,117.65	5,000	3,444.49	12.59
3	5,333.33	5,000	2,850.05	14.44
4	4,583.33	5,000	2,678.48	4.44
5	4,538.46	5,000	2,436.90	9.63
6	4,285.71	4,000	1,704.34	2.59
7	5,500.00	5,000	2,738.61	2.22
8	7,500.00	7,500	3,535.53	0.74
9	6,500.00	6,500	4,949.75	0.74
10	2,833.33	3,500	2,483.28	2.22
Total	4,882.58	5,000	2,794.18	

Note: *risk* is the amount invested by an individual in a risky project in the risk/investment game. The total number of respondents with answers on self-perceived riskiness question: 270 out of 279.

Source: authors' calculations.

### 2.2.2 Financial literacy

Financial literacy as defined by the OECD/INFE is a combination of awareness, knowledge, skill, attitude, and behaviour necessary to make sound financial decisions and ultimately achieve individual financial well-being. Most studies in the literature, particularly cross-country comparisons (notable works are Lusardi and Mitchell 2011b, 2014; Xu and Zia 2012; Klapper, Lusardi, and Oudheusden 2015; Grohmann, Klühs, and Menkhoff 2018), focus on core questions capturing financial knowledge of the following economic concepts that are vital in making financial decisions: 1) interest compounding; 2) inflation; 3) risk diversification; and 4) knowledge of interest rates. Hence, in the majority of studies in the literature, financial literacy is what we conceptually define as financial knowledge in the paper. Notable examples of studies that distinguish between the three components include Fessler, Silgoner, and Weber (2019) and Kadoya and Khan (2020).

In this study, we use a more comprehensive measure of financial literacy following the OECD/INFE definition and benchmark, which incorporates two other aspects of financial literacy: financial behaviour and financial attitude. The financial literacy score (financial literacy) is, thus, the sum of financial knowledge, financial attitude, and financial behaviour scores, where the maximum rating is 18. Moreover, we note the importance of reporting both the aggregated and disaggregated scores because, as suggested by Fessler, Silgoner, and Weber (2019), it might be misleading to use the former because of correlations among the three components. Appendix C provides details about the questions related to the financial literacy survey, and Appendix D gives more detailed information about how our financial literacy measures are calculated.

### 2.2.3 Components of financial literacy

#### *Financial knowledge*

We construct a financial knowledge score based on recommendations/suggestions reported in *Measuring Financial Literacy: Results of the OECD/International Network on Financial Education (INFE) Pilot Study* (Atkinson and Messy 2012) and in subsequent versions of the OECD/INFE toolkit to measure financial literacy. The financial knowledge score, *financial knowledge*, is based on participants' responses to eight questions capturing different financial knowledge aspects: i) basic

numeracy (division); ii) time-value of money; iii) identification of interest paid on loan; iv) simple calculation of interest plus principal; v) understanding the implication of compounding; vi) understanding the relationship between risk and return; vii) definition of inflation; and viii) risk diversification.

One point is attributed to every correct answer to the eight questions. The maximum financial knowledge score is, hence, eight.

### *Financial attitude*

Atkinson and Messy (2012) indicate that financial attitudes and preferences are essential elements of financial literacy. They argue that attitudinal responses are self-fulfilling, meaning that individuals who have a negative attitude towards saving are less likely to save. Aside from attitude towards money and saving, this financial literacy component also encompasses future planning.

The financial attitude score, *financial attitude*, is calculated based on participant responses to attitudinal statements, as suggested in the 2013, 2015, and 2018 OECD/INFE toolkits to measure financial literacy and financial inclusion. The questions are scaled from one—completely agree—to five—completely disagree. The financial attitude score is equal to the average of the participants' responses to the three questions. Higher values of the financial attitude score indicate preference and/or giving importance to long-term security, while low financial attitude scores are associated with short-term gratification. Appendix D provides further details about the calculation of the financial attitude score.

### *Financial behaviour*

Atkinson and Messy (2012) stress financial behaviour as a crucial, if not the most important, component of financial literacy. They argue that exhibiting appropriate behaviour, for example, towards expenditure planning, or those that improve financial well-being, bring out the positive results/outcomes of being financially literate. Good financial behaviour considers the capacity of individuals to honour their financial commitments on time and awareness of their finances, as well as setting and working to achieve long-term goals.

We base our financial behaviour score, *financial behaviour*, on convictions to four behavioural statements and the presence of an active saving mechanism. We slightly deviate from the suggestion of the OECD/INFE to include questions on personal responsibility in terms of household budget, financial product choice, and borrowing to make ends meet. This is because our respondents are mainly students, and in Africa, financial depth is relatively low and a large proportion of the population are unbanked.

To create the financial behaviour score, we assign one point every time an individual agrees (completely agree or somewhat agree) to a behavioural statement. In addition, one point is assigned if the respondent has an active saving mechanism. The score, hence, ranges from zero to five.

#### *2.2.4 Descriptive statistics of financial literacy indicators*

We present in Table 4 the distribution of respondents' financial literacy scores. One-third of respondents have financial literacy scores ranging from 3 to 10, which is almost the same proportion of individuals with financial literacy scores greater than 12.

Table 4: Distribution of the financial literacy components: *financial knowledge*, *financial behaviour*, and *financial attitude*

Financial literacy	Frequency (no. & %)	Financial knowledge	Frequency (no. & %)	Financial behaviour	Frequency (no. & %)	Financial attitude	Frequency (no. & %)
[3,4]	2 (0.72)	0	7 (2.51)	0	2 (0.72)	1	19 (6.81)
(4,6]	6 (2.15)	1	11 (3.94)	1	6 (2.15)	(1,2]	28 (10.04)
(6,8]	32 (11.47)	2	28 (10.04)	2	17 (6.09)	(2,3]	96 (34.41)
(8,10]	61 (21.86)	3	55 (19.71)	3	39 (13.98)	(3,4]	98 (35.13)
(10,12]	83 (29.75)	4	92 (32.97)	4	106 (37.99)	(4,5]	38 (13.62)
(12,14]	79 (28.32)	5	59 (21.15)	5	109 (39.07)		
(14,16]	16 (5.73)	6	23 (8.24)				
		7	3 (1.08)				
		8	1 (0.36)				

Source: authors' calculations.

Moreover, we note that only around 9.68 per cent of respondents scored at least six of the eight financial-knowledge-related questions. A little more than one-third (35 per cent) answered only at most three questions correctly. These indicators show that the level of financial knowledge is low in Guinea. In the cross-country study of Klapper, Lusardi, and Oudheusden (2015), they found that 30 per cent of their Guinean household respondents understood correctly at least three of four questions measuring the following financial concepts: numeracy, interest compounding, inflation, and risk diversification.

In terms of financial behaviour, the distribution indicates that most of the respondents have high financial behaviour scores, with around 76 per cent scoring at least four out of a maximum score of five. In terms of financial attitude, around 16 per cent do not consider saving and future planning to be particularly important. Moreover, around 35 per cent and 14 per cent show a moderate or strong preference for future planning, respectively. Table 5 provides information on the statistical correlation between the financial literacy components. More precisely, we calculate the average financial behaviour and financial attitude scores at varying degrees of knowledge of financial concepts.

Table 5: Average financial behaviour and financial attitude scores according to level of financial knowledge

Financial knowledge	Average financial behaviour	Average financial attitude
0	2.71	2.90
1	3.55	2.64
2	3.96	2.73
3	4.09	2.73
4	3.92	3.07
5	4.34	3.32
6	4.39	3.59
7	4	3.77
8	2	3.67

Source: authors' calculations.

#### *Financial literacy indicators and socio-demographic characteristics*

While statistics do not show a clear correlation between financial behaviour and financial knowledge scores, we observe that a preference for future planning, on average, is stronger for those who have higher financial knowledge scores, albeit only less than one index point difference between those with zero and seven points. Respondents who are relatively less knowledgeable of

financial concepts also have low financial attitude scores. Moreover, it is worth noting that there is only one respondent who correctly answered all financial-knowledge-related questions. Consequently, it is misleading to interpret its corresponding financial behaviour and financial attitude scores.

Table 6 shows the descriptive statistics of the financial literacy measures, also distinguished by socio-demographic profile and individual convictions/beliefs. Statistics show that the financial literacy scores (*financial literacy*) of the respondents, on average, is 10.89 (out of 18). While they scored high in terms of financial behaviour and average in terms of financial attitude, respondents have a very low financial knowledge rating, scoring only less than half of the maximum (3.81 out of a maximum of eight), on average. Moreover, we find some differences across socio-demographic characteristics. Men have higher financial literacy scores than women across all its components, primarily driven by their variation in terms of financial knowledge. Older respondents tend to be more financially literate, with respondents 30 years and older having the highest financial literacy scores, driven primarily by their financial knowledge scores. We also observe that those with better material well-being or living standards, such as possession of television and electricity, which can also be viewed as indicators of higher income and better access to information, are more financially literate across all dimensions. We also observe from the statistics that those who speak more than two national languages are slightly more financially literate. We do not see sizeable differences in the financial literacy scores of bigger families vis-à-vis smaller ones and individuals participating in the labour force vis-à-vis the unemployed or full-time students.

Table 6: Average values of financial literacy indicators of Guinean respondents by socio-demographic profiles

Characteristics	<i>Financial literacy</i>	<i>Financial behaviour</i>	<i>Financial attitude</i>	<i>Financial knowledge</i>
	10.89	4.04	3.05	3.81
<b>Sex</b>				
Female	9.91	3.80	3.03	3.08
Male	11.20	4.11	3.06	4.03
<b>Age category</b>				
Less than 20 y/o	10.20	3.83	2.81	3.56
20–24 y/o	10.85	4.04	3.13	3.67
25–29 y/o	11.14	4.16	2.97	4.02
30 or more	11.98	4.05	3.13	4.81
<b>Possesses TV</b>				
No	9.12	3.57	2.47	3.08
Yes	11.24	4.12	3.16	3.96
<b>Has electricity</b>				
No	9.60	3.82	2.73	3.04
Yes	11.11	4.07	3.10	3.93
<b>Has paid work in the past 12 months</b>				
No	10.58	3.97	3.02	3.58
Yes	11.31	4.12	3.09	4.10
<b>Has more than 3 siblings</b>				
No	10.88	3.98	3.16	3.74
Yes	10.90	4.05	3.02	3.83
<b>Language/s spoken</b>				
Less than or equal to 2	10.19	3.93	2.90	3.36
More than 2	11.23	4.08	3.13	4.02

Source: authors' calculations.

### 3 Empirical strategy

To examine the link between financial literacy and its components and risk preferences, we estimate the following equations (Eqs. 1a and 1b) using ordinary least squares (OLS) regression.

$$Risk_i = \alpha_1 + \alpha_2 financialliteracy_i + \gamma_1 male_i + \gamma_2 largefamily_i + \gamma_3 paidwork_i + \gamma_4 trust_i + \gamma_5 age_i + \varepsilon_i \quad (1a)$$

$$Risk_i = a_1 + a_2 financialknowledge_i + a_3 financialattitude_i + a_3 financialbehaviour_i + g_1 male_i + g_2 largefamily_i + g_3 paidwork_i + g_4 trust_i + g_5 age_i + e_i \quad (1b)$$

Alternatively, we estimate Eqs. 2a and 2b that use alternative indicators of financial literacy to measure financial literacy. We define four dummy variables that identify individuals with low levels of financial literacy and their components: *low financial literacy*, *low financial knowledge*, *low financial attitude*, and *low financial behaviour*. We argue that the level of financial literacy is relatively low in Guinea, with an average financial literacy score of 10.89 (out of a maximum of 18). In some studies, such as Klapper, Lusardi, and Oudheusden (2015), they define a financially literate person as one who answers at least three out of four questions (75 per cent) measuring numeracy, interest compounding, inflation, and risk diversification. The number of respondents who have at least 13.5 in their financial score is around 38 subjects (14 per cent). We assert that using low levels of financial literacy is more appropriate to reflect actual financial literacy levels. We, hence, define individuals with low financial literacy (*low financial literacy*) as those who score at most a total of 10 in the financial knowledge, financial behaviour, and financial attitude measures. They account for a little more than one-third of the respondents. Moreover, individuals who have poor financial attitude (*low financial attitude*), poor financial behaviour (*low financial behaviour*), and less financial knowledge (*low financial knowledge*) are those with financial attitude scores, financial behaviour scores, and financial knowledge scores of at most equal to two. We argue that because most Guinean respondents scored low, in general, in terms of financial knowledge, the absolute values as thresholds may be more indicative of poor financial attitude, behaviour, and knowledge. Nevertheless, to check the robustness of our findings, we define alternative dummy measures of low levels of financial literacy based on relative values—median and percentile values—and estimate the equations using these alternative measures in the robustness check section.

$$Risk_i = \beta_1 + \beta_2 lowfinancialliteracy_i + \theta_1 male_i + \theta_2 largefamily_i + \theta_3 paidwork_i + \theta_4 trust_i + \gamma_5 age_i + \eta_i \quad (2a)$$

$$Risk_i = b_1 + b_2 lowfinancialattitude_i + b_3 lowfinancialknowledge_i + b_4 lowfinancialbehaviour_i + \tau_1 male_i + \tau_2 largefamily_i + \tau_3 paidwork_i + \tau_4 trust_i + \tau_5 age_i + \xi_i \quad (2b)$$

We also consider other variables that may be associated with individual risk preferences as mentioned in the literature, such as sex (Apicella et al. 2008; Eckel and Grossman 2008; Charness and Viceisza 2011; Dohmen et al. 2011), household characteristics such as composition and participation in the labour force (Dohmen et al. 2011), age (Dohmen et al. 2011), and individual's confidence or trust in others (Eckel and Wilson 2004). We, hence, define the following control variables: *male*, which is a dummy variable equal to one if the respondent is a male and zero if female; *largefamily* is a dummy variable that is equal to one if the respondent has more than three siblings and zero if he/she has at most three siblings; *paidwork* is a dummy variable equal to one if the respondent has a paid work in the past 12 months and zero otherwise; *trust* is a dummy variable equal to one if the respondent answered 'Most people can be trusted' to the question: 'Generally

speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?' and zero if otherwise; *age* is the natural logarithm of the respondent's age.

We show the summary statistics of the variables used in our estimations in Table 7. Around 40 per cent have income-generating jobs, while around three-fourths of participants belong to large families or have more than three siblings. Only 13 per cent of the respondents display trust. Meanwhile, at least one-third of the respondents are multilingual or are speaking more than two national languages. Moreover, the average age of the respondents is 22.87.

Table 7: Descriptive statistics of variables used in estimations

Variable	Obs	Mean	Std Dev	Min	Max
<i>Risk</i>	279	4,899.64	2,825.37	0	10,000
<i>Financial literacy</i>	279	10.89	2.40	3	16
<i>Financial behaviour</i>	279	4.04	1.04	0	5
<i>Financial attitude</i>	279	3.05	1.03	1	5
<i>Financial knowledge</i>	279	3.81	1.42	0	8
<i>Male</i>	279	0.76	0.43	0	1
<i>largefamily</i>	279	0.77	0.42	0	1
<i>paidwork</i>	279	0.43	0.50	0	1
<i>Trust</i>	279	0.13	0.33	0	1
<i>Vocational</i>	251	0.16	0.37	0	1
<i>Arts</i>	251	0.08	0.27	0	1
<i>History</i>	251	0.34	0.47	0	1
<i>Business</i>	251	0.23	0.42	0	1
<i>Sciences</i>	251	0.19	0.39	0	1
<i>Fulani</i>	251	0.45	0.50	0	1
<i>Has TV</i>	251	0.89	0.31	0	1
<i>Age</i>	279	3.13	0.16	2.9	3.8
<i>Polyglot</i>	278	0.69	0.46	0	1

Source: authors' calculations.

## 4 Empirical results

### 4.1 What factors relate to financial literacy?

We estimate Eq. 3 to investigate the determinants of financial literacy.

$$\mathbf{finlit}_i = \pi_1 + \pi_2 \mathbf{male}_i + \pi_3 \mathbf{age}_i + \pi_4 \mathbf{languagespoken}_i + \pi_5 \mathbf{has tv}_i + \pi_6 \mathbf{fulani}_i + \sum_{z=7}^{10} \pi_z \mathbf{discipline}_i + \varepsilon_i \quad (3)$$

where  $\mathbf{finlit}_i$  is a vector of the financial literacy indicators: *financial literacy*, *financial knowledge*, *financial behaviour*, and *financial attitude*; *male* is a dummy indicator of the respondent's gender, equal to one if the respondent is male and zero if female; *age* is the natural logarithm of the respondent's age; *polyglot* is a dummy indicator equal to one if the respondent can speak more than two national languages and zero if less; *has TV* is a dummy variable indicating quality of material being and easy access to media and information—it is equal to one if the respondent possesses a television in his/her home and zero otherwise; *Fulani* is a dummy variable indicating the respondent's ethnic affiliation—it is equal to one if he/she is a Fulani and zero if he/she identifies with another ethnic group; *discipline* is a set of dummy variables corresponding to the respondent's field of study—arts, history, science, or vocational/technical. The reference academic discipline is business/economics.



We report in Table 8 the characteristics linked with higher financial literacy scores. We find male respondents to be more financially literate on average by 1.2 points than females. Television ownership, which is a measure of material well-being, and access to media and information increases the financial literacy score by 1.7 points. Those specializing in a vocational course compared with pursuing a business/economics degree have lower financial literacy scores. Disaggregating financial literacy into its three components, column (ii) for *financial behaviour*, (iii) for *financial attitude*, and (iv) for *financial knowledge*, we find a positive link between television ownership and all three financial literacy components. Moreover, in terms of gender differences, the results imply financial knowledge mainly drives financial literacy differences between men and women. More specifically, males were found to be more knowledgeable of financial concepts than females, but do not display superior financial behaviour nor financial attitude. This result is consistent with previous studies in the literature, such as Kadoya and Khan (2020) in Japan; Lusardi, Mitchell, and Curto (2010, 2014) and Lusardi and Tufano (2009) in the United States; and Van Rooij, Lusardi, and Alessie (2011) in the Netherlands. On average, we find those who are taking vocational courses to be less financially literate than business/economics majors; however, science majors are more financially knowledgeable than the latter, albeit by only half a point or by 6.25 per cent. On average, business and economics majors are also found to display positive attitudes towards saving and future planning more than history majors and those taking up vocational courses. We do not find age to be linearly related to financial literacy, which may reflect a possible nonlinear relationship between age and financial literacy (Lusardi and Mitchell 2014) or the lack of old-age respondents. On the whole, these results indicate that gender and material well-being determines financial literacy. The superiority of financial knowledge of male respondents than females reflects gender disparities in Guinea, for example, in terms of access to education because of gender bias and traditional views of women and employer preferences for men (Glick and Sahn 1997) in the Guinean society.

Table 8: Estimation of financial literacy using OLS regressions

	Financial literacy	Financial behaviour	Financial attitude	Financial knowledge
Male	1.163*** (3.11)	0.251 (1.47)	-0.015 (-0.09)	0.928*** (4.36)
Age	0.720 (0.78)	-0.011 (-0.03)	-0.054 (-0.12)	0.785 (1.50)
Polyglot	0.336 (0.98)	0.124 (0.79)	-0.011 (-0.07)	0.223 (1.14)
Has TV	1.710*** (3.75)	0.431** (2.08)	0.644*** (2.99)	0.635** (2.45)
Fulani	0.171 (0.59)	0.227* (1.73)	-0.176 (-1.28)	0.120 (0.73)
Arts	-0.674 (-1.14)	-0.282 (-1.04)	-0.393 (-1.40)	0.000 (0.00)
History	-0.160 (-0.43)	-0.086 (-0.51)	-0.359** (-2.04)	0.284 (1.35)
Sciences	0.341 (0.79)	0.091 (0.46)	-0.304 (-1.49)	0.554** (2.25)
Vocational	-0.854* (-1.89)	0.083 (0.41)	-0.584*** (-2.73)	-0.353 (-1.37)
Constant	5.947** (2.12)	3.206** (2.51)	3.085** (2.32)	-0.344 (-0.22)
R-squared	0.151	0.056	0.077	0.198
Adj R-squared	0.119	0.020	0.043	0.168
Obs	251	251	251	251
F-stat	4.754***	1.574	2.236**	6.598***

Note: \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . *t*-statistics in the parentheses. *Risk* is the amount invested by an individual in a risky project in the risk/investment game. *Financial literacy* and its components: *Financial knowledge*, *financial attitude*, and *financial behaviour* are our financial literacy measures. The control variables are *male*, which is a dummy variable equal to one if the respondent is a male and zero if female; *age* is the natural logarithm of the respondent's age; *polyglot* is a dummy variable that is equal to one if the respondent speaks more than two national languages and zero if he/she speaks at most two; *has TV* is a dummy variable equal to one if the respondent possesses a TV at home and zero if not; *Fulani* is a dummy variable equal to one if the respondent's ethnic affiliation is Fulani and zero if otherwise; *arts*, *history*, *sciences*, and *vocational* are dummy variables indicating the discipline of study of the respondent.

Source: authors' calculations.

Findings in Table 8 are supported by probit regressions in Table 9 where we use alternative measures of financial literacy using dummy variables to indicate having low financial literacy scores, as defined in Section 3. Those with low financial literacy scores are those who got an aggregate score of at most 10 in all three components. We found women to be more likely to be less financially literate than men. Moreover, low financial knowledge scores are found to be positively correlated with being female and having low multilingual competence. Science and history majors were also found to be less likely to obtain low financial knowledge scores than business and economics majors. Moreover, those pursuing a science degree are less likely to have low financial behaviour scores than business and economics majors. Finally, having access to a television is linked to lower incidence of having low financial literacy scores, particularly in terms of financial behaviour.

Table 9: What determines low financial literacy? Estimation results using probit regressions

	Low financial literacy	Low financial behaviour	Low financial attitude	Low financial knowledge
male	-0.634** (-2.28)	-0.294 (-0.97)	0.138 (0.51)	-0.976*** (-3.66)
age	-0.087 (-0.11)	0.674 (0.86)	-0.244 (-0.37)	-0.408 (-0.48)
polyglot	-0.412 (-1.60)	-0.343 (-1.20)	0.146 (0.59)	-0.446* (-1.69)
has TV	-0.866*** (-2.83)	-0.801** (-2.50)	-0.741*** (-2.69)	-0.436 (-1.30)
Fulani	-0.172 (-0.71)	-0.318 (-1.24)	0.183 (0.90)	-0.278 (-1.11)
arts	-0.265 (-0.53)	-0.366 (-0.75)	0.186 (0.46)	-0.283 (-0.61)
history	-0.354 (-1.15)	-0.241 (-0.81)	0.089 (0.33)	-0.555* (-1.91)
sciences	-0.176 (-0.48)	-1.019** (-1.96)	0.131 (0.41)	-1.191** (-2.24)
vocational	0.088 (0.25)	-0.398 (-1.03)	0.331 (1.06)	-0.047 (-0.14)
constant	1.104 (0.45)	-1.611 (-0.67)	-0.137 (-0.07)	2.357 (0.91)
Pseudo R-squared	0.1323	0.1073	0.0436	0.2108
Obs	251	251	251	251
Chi-squared	22.11***	15.50*	9.88	38.73***

Note: \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . t-statistics are in the parentheses. Risk is the amount invested by an individual in a risky project in the risk/investment game. Low financial literacy, low financial knowledge, low financial attitude, and low financial behaviour are binary variables indicating low financial literacy, financial knowledge, and financial behaviour scores. The control variables are *male*, which is a dummy variable equal to one if the respondent is a male and zero if female; *age* is the natural logarithm of the respondent's age; *polyglot* is a dummy variable that is equal to one if the respondent speaks more than two national languages and zero if he/she speaks at most two; *has TV* is a dummy variable equal to one if the respondent possesses TV at home and zero if otherwise; *Fulani* is a dummy variable equal to one if the respondent's ethnic affiliation is Fulani and zero if otherwise; *arts*, *history*, *sciences*, and *vocational* are dummy variables indicating the discipline of study of the respondent.

Source: authors' calculations.

## 4.2 Financial literacy and risk preferences

We analyse the relationship between financial literacy and individual risk preferences elicited in the risk game by Gneezy and Potters (1997). Table 10 shows no significant link between financial literacy and risk attitude. Decomposing into its three components, we find that this is because of the significant yet opposite correlations between risk and financial attitude and of risk and financial knowledge. Financial knowledge crowds out the negative link between financial attitude and risk preferences. Better financial knowledge seems to encourage risk taking, but a more positive attitude towards savings and future planning is associated with risk aversion. Consistent with several studies in the literature (e.g., Apicella et al. 2008; Eckel and Grossman 2008; Dohmen et al. 2011), we find men to be more risk neutral than women, investing 8–10.75 per cent more of their initial endowment into the risky project.

Table 10: Link between financial literacy and individual risk preferences

	Risk: amount of investment	
financial literacy	-4.989 (-0.07)	
financial attitude		-366.922** (-2.18)
financial knowledge		316.109** (2.44)
financial behaviour		-152.588 (-0.93)
male	1,075.878** (2.47)	868.494** (1.99)
largefamily	-37.324 (-0.09)	-90.145 (-0.23)
paidwork	115.523 (0.31)	88.841 (0.24)
age	366.318 (0.32)	70.501 (0.06)
trust	643.007 (1.25)	665.381 (1.31)
constant	2,882.726 (0.83)	4,495.466 (1.29)
R-squared	0.038	0.070
Adjusted R-squared	0.016	0.042
Obs	279	279
Breusch-Pagan Chi-squared	0.07	0.01
F-stat	1.76	2.52**

Note: \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . t-statistics are in the parentheses. Risk is the amount invested by an individual in a risky project in the risk/investment game. *financial literacy* and its components, *financial knowledge*, *financial attitude*, and *financial behaviour*, are our financial literacy measures. The control variables are *male*, which is a dummy variable equal to one if the respondent is a male and zero if female; *largefamily* is a dummy variable that is equal to one if the respondent has more than three siblings and zero if he/she has at most three siblings; *paidwork* is a dummy variable equal to one if the respondent has a paid work in the past 12 months and zero otherwise; *trust* is a dummy variable equal to one if the respondent, in general, finds that most people can be trusted and zero otherwise; *age* is the natural logarithm of the respondent's age.

Source: authors' calculations.

We obtain similar findings when using the alternative dummy financial literacy measures, as presented in Table 11. We investigate whether individuals with lower levels of financial literacy are more risk averse or are more risk neutral. We find, on average, no significant differences in terms of the risk preferences among those with low financial literacy scores and those with higher financial literacy ratings. We conjecture that the channel driving this result is the inconsistency in the effects of financial knowledge and attitude. Once measures of financial literacy are disaggregated, we find that low financial attitude is associated with more risk taking. Albeit not significant, the results show opposite signs with regard to the coefficient of financial knowledge. The tendency of those with a more positive attitude towards savings and future planning to invest less in risky projects may be indicative of their efforts to anticipate income shocks or smooth consumption after a windfall.

Table 11: Do individuals with lower levels of financial literacy take lower risk or have weaker risk preferences?

	Risk: amount invested in risky project	
low financial literacy	-307.736 (-0.63)	
low financial attitude		979.038** (2.18)
low financial knowledge		-708.325 (-1.46)
low financial behaviour		223.763 (0.38)
male	1,033.550** (2.39)	890.826** (2.01)
largefamily	-37.882 (-0.09)	-92.898 (-0.23)
paidwork	109.350 (0.29)	37.430 (0.10)
age	350.607 (0.31)	414.035 (0.37)
trust	678.122 (1.32)	774.358 (1.52)
constant	2,952.732 (0.86)	2,811.962 (0.82)
R-squared	0.039	0.061
Adjusted R-squared	0.018	0.033
Obs	279	279
Breusch-Pagan Chi-squared	0.06	1.05
F-stat	1.83*	2.19**

Note: \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . t-statistics are in the parentheses. Risk is the amount invested by an individual in a risky project in the risk/investment game. *low financial literacy*, *low financial knowledge*, *low financial attitude*, and *low financial behaviour* are dummy variables indicating low levels of financial literacy, financial knowledge, financial attitude, and financial behaviour, respectively. The control variables are *male*, which is a dummy variable equal to one if the respondent is a male and zero if female; *largefamily* is a dummy variable that is equal to one if the respondent has more than three siblings and zero if he/she has at most three siblings; *paidwork* is a dummy variable equal to one if the respondent has a paid work in the past 12 months and zero otherwise; *trust* is a dummy variable equal to one if the respondent, in general, finds that most people can be trusted and zero otherwise; *age* is the natural logarithm of the respondent's age.

Source: authors' calculations.

### 4.3 Interaction between financial knowledge and financial attitude on individual risk preferences

We further investigate possible interaction effects of financial knowledge and financial attitude and inquire whether the risk preferences of more financially knowledgeable individuals depend on if they have a relatively poor or positive attitude towards saving and future planning. This allows us to determine whether short-term gratification plays a role in the risk-neutrality of individuals. If long-term planning or consideration about the future is embedded in one's comprehension of financial concepts, then we should not expect significant explanatory power of the interaction between financial knowledge and financial attitude on individual risk preferences. If, however, we find significant interaction effects, we conjecture the importance of identifying distinctive influences of the two on individual decision making—in this case in terms of risk preferences.

We, hence, estimate the following equation:

$$Risk_i = \lambda_1 + \lambda_2 lowfinancialknowledge_i + \lambda_3 lowfinancialattitude_i + \lambda_4 (lowfinancialattitude * lowfinancialknowledge)_i + \Gamma X + \eta_i \quad (4)$$

where *low financial knowledge* and *low financial attitude* indicate low levels of the financial knowledge and financial attitude components of financial literacy, respectively, as defined in Section 3.  $\lambda_2$  provides information about the average investment of individuals with low financial knowledge scores and relatively more positive financial attitude, while  $\lambda_3$  represents the amount invested by individuals with poor financial attitudes but relatively good financial knowledge scores on the risky project, on average. Among those with low financial knowledge scores,  $\lambda_4$  represents the difference between the average investment on the risky project of those who have poor vis-à-vis positive attitude towards savings and financial planning.  $X$  is a vector of control variables, including a dummy variable indicating low financial behaviour scores (*low financial behaviour*).

Though most studies from the literature stress that greater cognitive skills (in our case, comparable to having relatively higher financial knowledge scores) are associated with less risk aversion, not much is known about how non-cognitive characteristics such as financial attitudes may alter risk preferences, especially amongst those with fewer or more cognitive skills.

We present our estimation results in Table 12. Our findings indicate that those who are relatively more financially knowledgeable but with poor (or low) financial attitude invest GNF981 (almost 10 per cent of the endowment) more in the risky project (linear prediction of *risk* equivalent to GNF5,832, on average) compared to the reference group or individuals who are more financially knowledgeable and have greater positive attitude towards saving and future planning (linear prediction of *risk* equivalent to GNF4,851, on average). This supports our previous result that financial knowledge increases investment in the risky project, while financial attitude has an opposite, negative relationship with risk preferences. Further, this may imply tendencies for short-term gratification and may be dangerous even for more financially knowledgeable individuals in the context where future planning and saving are important because of the threats of economic, natural, and health shocks and where poverty may be prevalent. Besides, as shown in the descriptive statistics in Section 2.2.4 and in Table 4, less than 10 per cent of respondents have knowledge of at least six of the eight financial concepts measured and the average and median financial knowledge score is around three.

Table 12: Interaction between financial attitude and financial knowledge: impact on individual risk preferences

	<i>Risk</i>
<i>low financial knowledge</i>	-706.280 (-1.33)
<i>low financial attitude</i>	981.10** (1.96)
<i>low financial attitude* low financial knowledge</i>	264.070 (0.27)
<i>low financial behaviour</i>	223.204 (0.37)
<i>male</i>	890.746** (2.00)
<i>largefamily</i>	-93.19 (-0.23)
<i>paidwork</i>	37.26 (0.10)
<i>age</i>	414.40 (0.37)
<i>trust</i>	774.458 (1.51)
Constant	2,810.865 (0.82)
R-squared	0.061
Adj R-squared	0.030
Obs	279
F-stat	1.94**
Linear prediction of <i>risk</i>	
Low financial attitude, low financial knowledge	5,115.23
Low financial attitude, good financial knowledge	5,832.26
Good financial attitude, low financial knowledge	4,144.88
Good financial attitude, good financial knowledge	4,851.16

Note: *t*-statistics are in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . *Risk* is the amount invested by an individual in a risky project in the investment game.

Source: authors' calculations.

Overall, our results imply the need for policy makers to improve financial literacy and develop financial literacy initiatives across all its dimensions (i.e. knowledge, behaviour, and attitude) in order for individuals to be better informed when making decisions and more equipped in managing risks.

## 5 Robustness checks

In the final part of our analysis, we provide robustness checks by using alternative measures and the censored regression method to estimate our equations.

### 5.1 Disaggregated financial literacy components

First, we investigate which specific attributes or financial concepts are related to individual risk preferences. We, hence, estimate the equations using question/concept-based financial literacy measures, composed of 16 variables representing the eight financial-knowledge-related (*finke\_1* to *finke\_8*), five financial-behaviour-related (*finb\_1* to *finb\_5*), and three financial-attitude-related

questions (*finatt\_1* to *finatt\_3*). These 16 variables are dummy variables that are equal to one if the respondents correctly answered the corresponding questions about financial concepts for financial knowledge and zero otherwise. For financial behaviour, they are equal to one if the respondent completely or somewhat agrees to the corresponding behavioural statements (*finb\_1* to *finb\_4*) and if they have an active saving mechanism (*finb\_5*) and zero otherwise. For financial attitude, the three variables, *finatt\_1* to *finatt\_3*, are dummy variables that are equal to one if the respondents somewhat or completely disagree with the corresponding financial attitude statements that tend to favour consumption over saving and prefer short-term gratification. Please refer to Appendices C and D for more information about the calculation of the measures.

Table 13 shows the relationship between each element of the financial literacy components and risk preferences. We found two questions having a significant link to risk-taking behaviour. We summarize them as follows. A correct response on the fifth question on financial knowledge, i.e. the one pertaining to interest rate compounding, is associated with an increase of GNF973 (almost 10 per cent of the initial endowment) on investment in the risky project. Moreover, we find a negative link between those who have an active saving mechanism and risk preference. More specifically, those who have an active saving mechanism invest GNF600 (6 per cent of the initial endowment) less, on average, in the risky project compared with those who do not have an active saving mechanism. We obtain similar results with regard to the financial knowledge and financial attitude indicators where they served as control variables.

Table 13: Impact of financial literacy using individual elements included in the calculation of the financial literacy components (*financial knowledge*, *financial behaviour*, and *financial attitude*) on risk preferences (*risk*)

	Risk: amount invested in risky project	
<i>fink_1</i>	287.262	
	(0.67)	
<i>fink_2</i>	88.491	
	(0.20)	
<i>fink_3</i>	160.516	
	(0.29)	
<i>fink_4</i>	638.586	
	(1.07)	
<i>fink_5</i>	973.568**	
	(2.25)	
<i>fink_6</i>	65.702	
	(0.16)	
<i>fink_7</i>	449.980	
	(1.25)	
<i>fink_8</i>	250.424	
	(0.68)	
<i>finb_1</i>	-460.036	
	(-0.57)	
<i>finb_2</i>	-157.479	
	(-0.42)	
<i>finb_3</i>	-76.994	
	(-0.14)	
<i>finb_4</i>	508.084	
	(0.93)	
<i>finb_5</i>	-618.692*	
	(-1.72)	
<i>finatt_1</i>		-513.003
		(-1.42)



<i>finatt_2</i>			-398.261 (-1.09)
<i>finatt_3</i>			306.754 (0.60)
<i>financial attitude</i>	-336.834* (-1.94)	-374.143** (-2.20)	
<i>financial behaviour</i>	-166.009 (-1.01)		-135.599 (-0.81)
<i>financial knowledge</i>		274.889** (2.06)	319.710** (2.42)
Control variables	Yes	Yes	Yes
Constant	4,846.364 (1.36)	4,470.759 (1.26)	3,960.749 (1.14)
R-squared	0.081	0.080	0.069
Adj R-squared	0.029	0.039	0.034
Obs	279	279	279
Breusch-Pagan chi-squared	0.15	0.40	0.02
F-stat	1.552*	1.939**	1.982**

Note: \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . t-statistics are in the parentheses. Risk is the amount invested by an individual in a risky project in the risk/investment game. *finnk\_1* to *finnk\_8* represent each of the eight elements used in calculating the financial knowledge indicator. *finb\_1* to *finb\_5* are dummy variables corresponding to respondents' accordance to corresponding behavioural statements. *finatt\_1* to *finatt\_3* are dummy variables that are equal to one if the respondent does not agree with the three attitudinal questions that reflect lack of saving and future planning attitudes. *financial literacy* and its components, *financial knowledge*, *financial attitude*, and *financial behaviour*, are our financial literacy measures. The control variables are *male*, *largefamily*, *paidwork*, *trust*, and *age*.

Source: authors' calculations.

## 5.2 Censored regression method: Tobit estimation

We implement a Tobit specification test to take into account the bounded nature (upper = 10,000 and lower = 0) of the dependent variable, *risk*. We note, however, that the appropriateness of using the Tobit specification depends on the normality and homoscedasticity of the disturbances. We note that the error terms are homoscedastic as confirmed by the Breusch-Pagan and White tests, as displayed in Tables 10 and 11. In addition, we implement the conditional moment test of normality of the disturbances in the Tobit specification, derived by Skeels and Vella (1999), but it is only applicable when imposing a zero lower limit on the dependent variable. Nevertheless, we also report this test to justify the use of the Tobit estimation method.

We report the results of our estimations in Tables 14 and 15. We note the appropriateness of using the Tobit specification in estimating the two equations (albeit tested only on a zero lower bound) at 1 per cent and 5 per cent significance levels. Consistent with the results obtained in Table 10, we find a contrasting link between financial attitude and risk and between financial knowledge and risk preference. Moreover, we find poor financial attitudes using dummy variables to be associated with higher risk taking. We also obtain the expected signs of the coefficients of our control variables and consistent with the main results, particularly *male*, implying that male respondents, on average, take on more risk than female respondents.

Table 14: Financial literacy and risk preferences using the Tobit estimation method, lower limit = 0 and upper limit = 10,000

	Risk: amount invested in risky project	
financial literacy	-3.415 (-0.04)	
financial attitude		-407.363** (-2.04)
financial knowledge		363.774** (2.37)
financial behaviour		-180.516 (-0.93)
male	1,293.887** (2.50)	1,057.222** (2.05)
largefamily	-50.698 (-0.11)	-109.910 (-0.24)
paidwork	70.870 (0.16)	38.054 (0.09)
age	587.273 (0.44)	271.153 (0.20)
trust	866.492 (1.41)	903.138 (1.49)
Constant	2,141.651 (0.52)	3,918.128 (0.95)
LR Chi-squared	10.94*	19.42**
Obs	279	279
Left-censored	12	12
Right-censored	37	37
Tobcm – conditional moment test	4.36	3.34

Note: \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . t-statistics are in the parentheses. Risk is the amount invested by an individual in a risky project in the risk/investment game. *financial literacy* and its components, *financial knowledge*, *financial attitude*, and *financial behaviour*, are our financial literacy measures. The control variables are *male*, *largefamily*, *paidwork*, *trust*, and *age*.

Source: authors' calculations.

Table 15: Tobit estimation method: Do individuals with lower levels of financial literacy take lower risk or have weaker risk preferences?

	Risk: Amount of investment	
low financial literacy	-372.868 (-0.65)	
low financial attitude		1,134.089** (2.13)
low financial knowledge		-767.388 (-1.35)
low financial behaviour		281.826 (0.40)
male	1,242.715** (2.42)	1,100.923** (2.10)
largefamily	-53.787 (-0.11)	-112.131 (-0.24)
paidwork	62.945 (0.14)	-14.712 (-0.03)
age	589.782 (0.44)	622.979 (0.47)
trust	912.182 (1.49)	1,016.626* (1.67)
Constant	2,190.069 (0.54)	2,117.041 (0.53)
LR Chi-squared	11.36*	17.1**
Obs	279	279
Left-censored	12	12
Right-censored	37	37
Tobcm – conditional moment test	5.06*	1.65

Note: \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . t-statistics are in the parentheses. In order to correct for the presence of heteroscedastic error terms, we use robust standard errors. *Risk* is the amount invested by an individual in a risky project in the risk/investment game. *low financial literacy*, *low financial knowledge*, *low financial attitude*, and *low financial behaviour* are dummy variables indicating low levels of financial literacy, financial knowledge, financial attitude, and financial behaviour, respectively. The control variables are *male*, which is a dummy variable equal to one if the respondent is a male and zero if female; *largefamily* is a dummy variable that is equal to one if the respondent has more than three siblings and zero if he/she has at most three siblings; *paidwork* is a dummy variable equal to one if the respondent has a paid work in the past 12 months and zero otherwise; *age* is the natural logarithm of the respondent's age.

Source: authors' calculations.

We present in Table 16 the results of the estimation of the equation analysing possible interaction effects of financial attitude and financial knowledge on risk preferences using the Tobit estimation method. Consistent with the findings reported in Table 12, we find that more financially knowledgeable respondents with poor financial attitudes tend to invest more in the risky project (with linear prediction of investment on the risky project equivalent to GNF6,106, on average) and, hence, are more risk neutral (by GNF1,137 or 11.37 per cent more than the initial endowment) compared with those who are more financially knowledgeable and show positive attitude towards savings and future planning.

Table 16: Tobit estimation method: interaction between financial attitude and financial knowledge and the impact on individual risk preferences

	Risk
low financial knowledge	-764.942 (-1.22)
low financial attitude	1,137.761* (1.91)
low financial attitude*low financial knowledge	353.787 (0.31)
low financial behaviour	282.451 (0.40)
male	1,102.297** (2.10)
largefamily	-111.602 (-0.24)
paidwork	-13.646 (-0.03)
age	617.853 (0.46)
trust	1,014.215* (1.67)
Constant	2,130.143 (0.52)
LR Chi-squared	17.14**
Obs	279
Left-censored	12
Right-censored	37
Tobcm – conditional moment test	1.67
Linear prediction of risk:	
Low financial attitude, low financial knowledge	5,322.37
Low financial attitude, good financial knowledge	6,106.35
Good financial attitude, low financial knowledge	4,203.64
Good financial attitude, good financial knowledge	4,968.59

Note: t-statistics are in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Risk is the amount invested by an individual in a risky project in the investment game.

Source: authors' calculations.

### 5.3 Alternative financial literacy dummy measures

We define alternative measures of financial literacy and its components, particularly to indicate low levels of financial knowledge, financial attitude, and financial behaviour, as defined in Section 3. We use two thresholds to identify the respondents with relatively low levels of financial literacy scores: the median and the 25<sup>th</sup> percentile values. We therefore identify those respondents with financial attitude, financial knowledge, and financial behaviour scores less than the two thresholds and consider them as those with relatively low levels of financial literacy. We present the results of the estimations regarding the link between low levels of financial literacy and risk preferences as well as the interaction effects of relatively low financial attitude and low financial knowledge scores on preferences to take on risk in Tables 17 and 18.

On the whole, the results indicate that individuals who display relatively poor financial attitude or those who do not attribute importance on savings and future planning take on more risk or invest between GNF600 to GNF1,000 more, on average, compared to others. Moreover, we find those with relatively lower financial knowledge to take on less risk than others, albeit significant only at

the 10 per cent level of significance using median values as a relative threshold. We also find consistent results with regard to the interaction effect of financial knowledge and financial attitude. Among respondents with relatively higher financial knowledge scores, we find that those with poor financial attitudes tend to invest around GNF800 to GNF1,000 (8–10 per cent of the initial endowment) more in the risky project compared with those with a relatively stronger financial attitude or those who give relatively more importance to intertemporal money management or future planning.

Table 17: The link between low levels of financial literacy and risk preferences using alternative definitions of financial literacy indicators

	Risk: amount invested in risky project	
	Alternative 1: median values	Alternative 2: 25th percentile values
low financial attitude	649.736* (1.81)	991.695** (2.22)
low financial knowledge	-705.818* (-1.91)	-668.690 (-1.38)
low financial behaviour	-57.481 (-0.14)	-72.299 (-0.18)
male	935.654** (2.16)	883.586** (1.99)
largefamily	-14.261 (-0.04)	-102.659 (-0.26)
paidwork	97.564 (0.26)	36.080 (0.10)
age	243.647 (0.22)	437.485 (0.39)
trust	626.633 (1.23)	779.859 (1.53)
Constant	3,338.437 (0.97)	2,779.366 (0.81)
R-squared	0.057	0.061
Adj R-squared	0.029	0.033
Obs	279	279
F-stat	2.049**	2.178**

Source: authors' calculations.

Table 18: The interaction between low levels of financial knowledge and financial attitude and risk preferences using alternative definitions of financial literacy indicators

	Risk: amount invested in risky project	
	Alternative 1: median values	Alternative 2: 25th percentile values
low financial attitude	858.197*	1,006.203**
	(1.82)	(2.01)
low financial knowledge	-493.132	-654.101
	(-1.02)	(-1.22)
low financial attitude*low financial knowledge	-502.476	-76.267
	(-0.68)	(-0.07)
low financial behaviour	-87.601	-75.045
	(-0.22)	(-0.19)
male	897.502**	883.226**
	(2.05)	(1.99)
largefamily	-8.355	-104.561
	(-0.02)	(-0.26)
paidwork	106.408	34.805
	(0.28)	(0.09)
age	227.143	439.886
	(0.20)	(0.39)
trust	607.817	780.632
	(1.19)	(1.52)
Constant	3,362.733	2,772.275
	(0.98)	(0.81)
R-squared	0.059	0.061
Adj R-squared	0.027	0.029
Obs	279	279
F-statistics	1.869*	1.930**
Linear prediction of risk		
Low financial attitude, low financial knowledge	4,718.1	5,116.3
Low financial attitude, good financial knowledge	5,713.7	5,846.6
Good financial attitude, low financial knowledge	4,362.4	4,186.3
Good financial attitude, good financial knowledge	4,855.5	4,840.4

Source: authors' calculations.

We confirm these findings even when using alternative measures that indicate relatively higher levels of financial literacy and their components. Individuals whose financial attitude, financial behaviour, and financial knowledge scores are at least equal to their respective 75<sup>th</sup> percentile values are considered relatively more financially literate than others. This is the criteria we use to define the following dummy indicators: *high financial attitude*, *high financial knowledge*, and *high financial behaviour*. We present the estimation results in Table 19. The empirical findings show consistent results with using binary variables to indicate low financial literacy scores. Among individuals with high financial knowledge scores, those with a poor financial attitude towards savings and future planning tend to take on more risk, investing almost GNF1,000 or 10 per cent of the initial endowment more in the risky project, compared with individuals who are more financially literate both in understanding financial concepts and in terms of financial attitude.

Table 19: The link between high levels of financial literacy and interaction between high financial knowledge scores and high financial attitude on risk preferences

	Risk	
high financial attitude	-517.455 (-1.51)	-326.429 (-0.79)
high financial knowledge	661.206* (1.73)	999.270* (1.81)
high financial attitude*high financial knowledge		-628.713 (-0.85)
high financial behaviour	-545.617 (-1.56)	-556.158 (-1.58)
male	1,082.903** (2.53)	1,061.547** (2.47)
largefamily	-89.825 (-0.23)	-104.315 (-0.26)
paidwork	128.202 (0.34)	145.324 (0.39)
age	211.253 (0.19)	255.701 (0.23)
trust	712.867 (1.39)	676.506 (1.31)
Constant	3,583.474 (1.04)	3,397.531 (0.98)
R-squared	0.061	0.063
Adj R-squared	0.033	0.032
Obs	279	279
F-statistics	2.193**	2.027**
Linear prediction of risk		
High financial attitude, high financial knowledge		4,903.4
High financial attitude, poor financial knowledge		4,533.3
Poor financial attitude, high financial knowledge		5,859.0
Poor financial attitude, poor financial knowledge		4,859.7

Source: authors' calculations.

## 6 Conclusion

The principal aim of the paper was to investigate financial literacy in Africa, more particularly in Guinea where data on financial education or literacy is scarce and initiatives to develop financial literacy are crucial but scant. We hand-collected data from a financial literacy survey and a risk game experiment. With 279 randomly chosen respondents from Guinea, West Africa, we analysed the socio-demographic characteristics that determine financial literacy and examined the link between financial literacy and individual risk preferences. We disentangled the benchmark OECD/INFE-recommended financial literacy measure into its three components: financial attitude, financial behaviour, and financial knowledge.

Our findings indicate that men and those with easy access to media and information have better material well-being and are more financially literate than their counterparts. Moreover, our results show that financial literacy has no significant link with individual risk preferences. This is because of the opposite effects of financial knowledge and attitude on risk-taking behaviour. We show that both better comprehension of financial concepts and negative financial attitude towards future planning and saving are linked with stronger preferences to take on risk. We also find that among

those who have a better grasp of financial concepts, those who attribute more importance to saving and intertemporal money management tend to take on less risk than those who have myopic financial attitude. These results indicate that those with greater comprehension of financial concepts tend to take on more risk, which aligns with studies that find those with greater cognitive skills to be more risk neutral. Nonetheless, distinguishing those with negative and positive attitudes towards future planning and intertemporal money management provides a more comprehensive description of individual characteristics and convictions linked with stronger risk preferences. We argue that financial literacy ensures informed decision making and reduces overconfidence in one's financial capability, as may be the case of taking on risk without attributing sufficient importance on saving and future planning. Indeed, overconfidence may lead to rash decisions, dismissing in this case intertemporal considerations that may be crucial in case of shocks. Financial attitude and behaviour are integral especially in the context of Africa, where natural, health, and income shocks may easily lead to financial vulnerability. As statistics indicate, almost 60 per cent of Guinea's adult population are not able to make ends meet in case of a financial shock.

This study has important policy implications, especially in Africa where financial inclusion remains low, albeit there are increasing efforts to fill the financial access gap and where old-age poverty is prevalent, and participation of seniors in the labour market has been increasing in recent years.

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## Appendix A: Experimental instruction: risk game

Nous vous offrons 10000 FG. Ces 10000 FG vous appartiennent désormais et vous seront remis personnellement à la fin de la session. Cependant, vous pouvez décider d'investir une partie de cet argent si vous le voulez. L'argent non investi vous reviendra directement.

Le jeu sera effectué de la façon suivante : on va jeter un dé. Si après le jet, le nombre sur un dé est un nombre impair (1,3,5), l'argent investi vous rapportera 3 fois le montant investi ou 0 si le nombre sur un dé est un nombre pair (2,4,6).

Votre gain pour cette tâche sera égal au gain de votre investissement + l'argent que vous n'avez pas investi.

Vous n'aurez aucun calcul à faire. Le tableau suivant vous montre toutes les possibilités d'investissement et les gains correspondants.

Votre investissement	Votre gain si un nombre « impair »	Votre gain si un nombre « pair »
0	10000	10000
1000	12000	9000
2000	14000	8000
3000	16000	7000
4000	18000	6000
5000	20000	5000
6000	22000	4000
7000	24000	3000
8000	26000	2000
9000	28000	1000
10000	30000	0

Votre investissement est : \_\_\_\_\_

## Appendix B: Survey question on self-reported/perceived riskiness

En matière d'attitude à l'égard du risque, où placez-vous sur une échelle de 1 (très prudemment) à 10 (très dangereuse) ?

**Je vis très prudemment**

1

2

3

4

5

6

**Je vis de manière très dangereuse**

7

8

9

10

## Appendix C: Financial literacy questionnaire

1. Vous trouverez, ci-après, une série d'affirmations portant sur des attitudes ou des comportements. Pour chacune de ces affirmations, pouvez-vous me dire si vous êtes pas du tout d'accord, plutôt pas d'accord, ni d'accord ni pas d'accord, plutôt d'accord, tout à fait d'accord. (**Cochez votre réponse**). Il n'y a pas de bonnes ou de mauvaises réponses.

	Tout à fait d'accord	Ni d'accord ni pas d'accord	Pas du tout d'accord
A. Avant d'acheter quelque chose, je me demande si j'en ai bien les moyens.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. J'ai tendance à vivre au jour le jour et je ne me fais pas de souci pour le lendemain.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Je tire plus de satisfaction à dépenser l'argent qu'à épargner pour l'avenir.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. Je règle mes factures en temps et en heure.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E. Lorsque j'achète un produit d'épargne ou de placement, je suis prêt(e) à risquer une partie de mon argent.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F. En matière financière, je surveille personnellement et étroitement mes affaires.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G. Je me fixe des objectifs financiers à long terme et je m'efforce de les atteindre.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H. L'argent, c'est fait pour être dépensé.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. Au cours des 12 derniers mois, avez-vous [personnellement] épargné de l'argent de l'une des façons suivantes, que cet argent soit ou non toujours en votre possession ? (**Cochez toute réponse pertinente**)

- Conserver de l'argent liquide chez vous ou dans votre portefeuille
- Augmenter le solde créditeur de votre compte bancaire/votre compte IMF
- Verser de l'argent sur un compte d'épargne
- Confier de l'argent à des membres de votre famille pour qu'ils épargnent en votre nom
- Acheter des produits de placement financier
- Ou d'une autre manière (achat de biens immobiliers ou de produits d'investissement atypiques tels que vignes, forêts, chevaux de course)
- Ne s'est pas constitué d'épargne (y compris je n'épargne pas/je n'ai pas d'argent à épargner)

Ne sait pas

3. Imaginez que cinq frères reçoivent un don de 1.000.000FG.

3.1 S'ils partagent équitablement cette somme, combien chaque frère recevra-t-il ?  
\_\_\_\_\_FG

3.2 Maintenant, imaginez que ces frères doivent attendre un an pour toucher leur part des 1.000.000 FG et que le taux d'inflation se situe à 7%. Dans un an, seront-ils en mesure d'acheter :

Davantage avec leur part qu'ils ne le pourraient aujourd'hui

Autant

Moins qu'ils ne le pourraient aujourd'hui

Cela dépend de ce qu'ils veulent acheter

Ne sait pas

3.3 Vous prêtez 25.000 FG à un ami un soir et il vous rend 25.000 FG le lendemain. Quel intérêt a-t-il payé pour ce prêt ? \_\_\_\_\_%

3.4 Supposons que vous déposiez 100.000 FG sur un compte d'épargne « sans frais » offrant un taux d'intérêt garanti de 2% par an. Vous n'effectuez aucun versement ni aucun retrait sur ce compte. Combien y aura-t-il dessus à la fin de la première année, une fois les intérêts crédités ?  
\_\_\_\_\_

3.5 Quelle somme y aurait-il sur le compte au bout de cinq ans sachant qu'il n'y a pas de frais ?

Plus de 110.000 FG

110.000 FG exactement

Moins de 110.000 FG

Il est impossible de répondre à partir des informations fournies

Ne sait pas

4. J'aimerais savoir si vous pensez que les déclarations suivantes sont vraies ou fausses (**VRAI ou FAUX**) :

\_\_\_\_\_4.1 La possibilité de gagner beaucoup d'argent s'accompagne aussi de l'éventualité de perdre beaucoup d'argent.

\_\_\_\_\_4.2 Une inflation élevée signifie que le coût de la vie augmente rapidement.

\_\_\_\_\_4.3 On risque moins de perdre tout son argent quand on diversifie ses placements



## Appendix D: Calculation of financial literacy indicators

### Financial literacy

Financial literacy, as defined by the OECD INFE, is a combination of awareness, knowledge, skill, attitude, and behaviour necessary to make sound financial decisions and ultimately achieve individual financial well-being.

We, hence, calculate financial literacy as the sum of financial knowledge, financial attitudes, and financial behaviour. The maximum financial literacy score is 18.

$$\text{financial literacy} = \text{financial knowledge} + \text{financial attitudes} + \text{financial behaviour} \quad (\text{A1})$$

#### A. Financial knowledge

We construct a financial knowledge score based on recommendations/suggestions reported in the *Measuring Financial Literacy: Results of the OECD/International Network on Financial Education (INFE) Pilot Study* (Atkinson and Messy 2012) and in subsequent versions of the OECD/INFE toolkit to measure financial literacy (OECD 2018), with very slight deviations regarding the inclusion or non-inclusion of certain concepts in constructing financial knowledge scores (i.e. division as a test of basic numeracy, which is deemed to not add value in a knowledge score). We create the financial knowledge score based on individual responses to eight questions capturing different financial knowledge aspects, assigning a value of one if the individual responded to each question correctly.

The eight questions measure knowledge on: i) basic numeracy (division); ii) time-value of money; iii) identification of interest paid on loan; iv) simple calculation of interest plus principal; v) understanding the implication of compounding; vi) understanding the relationship between risk and return; vii) definition of inflation; and viii) risk diversification. These eight questions correspond to survey questions 3.1 (*fink\_1*), 3.2 (*fink\_2*), 3.3 (*fink\_3*), 3.4 (*fink\_4*), 3.5 (*fink\_5*), 4.1 (*fink\_6*), 4.2 (*fink\_7*), and 4.3 (*fink\_8*). *fink\_1* to *fink\_8* are dummy variables indicating correct responses to the corresponding questions and zero otherwise.

One point is attributed to every correct answer to the eight questions. The maximum financial knowledge score is, hence, eight.

#### B. Financial attitudes

The financial attitude score is based on individual responses to three scaled statements, as suggested in the 2013, 2015, and 2018 OECD/INFE toolkits to measure financial literacy and financial inclusion. The values of the scale are: 1 – Completely agree with the statement, 2 – Somewhat agree, 3 – Neither agree nor disagree, 4 – Somewhat disagree, and 5 – Completely disagree. We calculated the average of the three scores so that it ranges from 1 to 5.

The three statements are:

- i) I find it more satisfying to spend money than to save it for the long term (*finatt\_1*).
- ii) I tend to live for today and let tomorrow take care of itself (*finatt\_2*).
- iii) Money is there to be spent (*finatt\_3*).

### C. *Financial behaviour*

The financial behaviour score is based on convictions to four behavioural statements and the presence of an active saving mechanism. We slightly deviate from the suggestion of the OECD/INFE to include a question on personal responsibility in terms of household budget, financial product choice, and borrowing to make ends meet. This is because our respondents are mainly students, and in Africa, financial depth is relatively low, and a large proportion of the population is unbanked.

To create the financial score, we assigned one point every time an individual agrees (completely agree or somewhat agree) to a behavioural statement. In addition, one point is assigned if the respondent has an active saving mechanism (*finb\_5* in the analyses). The score, hence, ranges from 0 to 5.

The four behavioural statements are:

- i) Before I buy something, I carefully consider whether I can afford it (*finb\_1*).
- ii) I pay my bills on time (*finb\_2*).
- iii) I keep a close personal watch on my financial affairs (*finb\_3*).
- iv) I set long-term financial goals and strive to achieve them (*finb\_4*).