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Assessing adults financial complex products literacy

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Abstract

Financial education has become an important research topic, due to the growth of a wide range of investment products available in online banking. The individuals are exposed to highly complex financial products without understanding the risk and what product is suitable for them. This study investigates and measured the financial education of individuals in complex financial products. A quiz game was developed for a bank website to measure 1,597 bank clients in complex products literacy. The survey also enabled a comparison between the basic and advanced skills of financial literacy knowledge. The results highlight a satisfactory overall financial literacy level. While basic knowledge level between individuals has a higher degree, there are serious concerns in advanced skill level. This study contributes to an understanding of adults' knowledge about the prediction of the risk of investments in complex financial products, as well as providing value to ongoing financial literacy research.

Keywords: e-Banking, Financial Literacy, Games, Financial Complex Products, Self-directed Investors.

1.   Introduction

The current economic conditions have raised serious fears about individual investors' financial security, particularly for those who lack the skills and resources to withstand financial market downturns and take advantage of upswings. Using the advantage of e-banking schemes, individuals are demanding responsibility for a rising number of financial decisions (OECD, 2016). Arguably, the two most important of these are purchase and investment planning. As these options are becoming more complex, questions are raised about individual financial well-being.

The financial crisis has brought to light the issues of making far-reaching decisions without enough knowledge and tools. With the expansion of e-banking, the financial markets around the globe have become more accessible to individual investors as well as offering new financial bank products and services that are ever more complex. Nonetheless, the asset price movements and the financial market volatility, cause of the financial crisis, challenge individual investors to obtain more data and to be ready to pursue investment decisions.

Despite what individual investors might try to infer about the financial markets, and overseeing their finances, it is often beneficial to find help and more information about the complexity of products offered by banks (LaPlante & Paradi, 2015). Moreover, the shift from the traditional model of investment analysis and advisory assistance from a personal finance expert to self-analysis and investment requires better knowledge and information about the product and the underlying asset (Marsden et al., 2011). First, individuals need to understand something about the mind-bending financial terminology used in the marketplace. Second, they need to understand what the product is (e.g. in terms of product features and risks). Ultimately, they need to have access to financial market information to follow the investment's performance. Thus, the dramatic shift from the traditional personal financial advisor to a participant-directed investment has increased the decision-making responsibility of individual investors for their investment planning. With this change comes with growing evidence that individual investors are making poor choices about the right products for their risk profile, especially in selecting from among the vast range of investment options.

In recent years, there has been interesting and concern over the lack of financial literacy about banking products, mainly among individual investors. Banks and other financial organizations are concerned to identify strategies for improving individual investors' well-being (OECD, 2016). Over the past few decades, these objectives have turned attention toward the financial capability of individuals. Individual investors who make good financial decisions, and effectively interact with providers of financial services, are also more likely to achieve their financial goals, and thereby improve their financial condition. Similarly, improving individual

investor financial literacy will lead to financial sector confidence, which in turn is strongly tied to economic growth. Financial capability is the internal capacity to act on one's best financial interest given social economic conditions. The overall concern, therefore, encompasses the knowledge, attitudes, skills, and behaviors of individual investors as they strive to understand, select, and make use of financial services that fit their needs.

Financial literacy requires that an individual knows and understands the forms, functions, and risks involved in the operation they are contemplating. In this sense, determining individuals' knowledge about investment products is first necessary to measure the financial literacy skill level of adult investors (Hastings *et al.*, 2013). Assessing an adult's financial literacy amounts to measuring the degree to which she or he understands key financial concepts and possesses the ability and confidence to manage personal finances. Therefore, measures of financial literacy are essential to realizing the adult's educational impact as well as the barriers to making an effective financial decision (Huston, 2010).

The present paper presents a qualitative study that analyzes the financial literacy of investors in complex financial products like mutual funds, to understand, essentially: How individual investors' knowledge (financial literacy) may help them in their decisions regarding complex financial investments and portfolio management.

In this study, we evaluate the financial literacy of bank individual investors through a quiz game that uses a questionnaire with multiple-choice questions. To do this, we challenged individual investors to play a game developed to measure their financial knowledge. The questions in the game focus on complex financial product investments, whose terms, features, and risks are difficult to evaluate, and that are expected to be reasonably difficult to be understood by an individual investor, due to the complexity of the investment's structure. Quiz games are a simple and attractive means to provide workplace financial education (Lusardi & Mitchell, 2008; Mandell, 2009; van Raaij, 2016). Hence, with an easy process to interpret, and gain knowledge, individual investors should be more easily disposed to make their decisions on investments, having a good notion about the products and risks undertaken.

Though there is a substantial body of theoretical and empirical work on the economics of education, little research has been conducted on understanding adults' financial literacy level (Agnew & Harrison, 2015; Paluri & Mehra, 2016). Our contribution to the literature on financial education's effectiveness is threefold. First, our empirical evidence for adult individual investors using a bank's online platform throws new light on the level of adult financial literacy regarding complex products. Second, our detailed analysis of pre-and post-test responses in relation to quiz game content provide valuable insights into what works for individual investors. Finally, this study contributes to an understanding of adults' knowledge about investments in complex financial products, as well as providing a valuable contribution to ongoing financial literacy research.

These research contributions are actually and important because financial literacy affects investor behavior. Peoples ignorance about basic and complex financial concepts can be tied to lack of use of online banking systems and cumulative losses over time; all of these behaviors can affect individual well-being and have spill-over effects as well, in case governments or banks. While much of research has been done testing predictions models there are none that assess what are the individual investors actually knowledge of financial complex products.

2. Literature Review

2.1. Financial Literacy

Many researchers and organizations operating in different disciplines have financial literacy that is limited in a variety of ways (Huston, 2010; Hung *et al.,* 2009; Atkinson, *et al.,* 2007). In 2008, the President's Advisory Council on Financial Literacy (PACFL) defined financial literacy as one's attitude to make use of individual awareness, abilities to effectively, and efficiently deal with individual financial resources, for a long life for the purpose of financial well-being (Schwab *et al.,* 2008). Financial literacy may be viewed as a combination of awareness, knowledge, skill, attitude, and behavior necessary to make sound financial decisions and ultimately achieve individual financial well being (INFE, 2011). Financial literacy is the skill to make well-informed decisions regarding the application and management of financial investments and portfolio risk diversification (Lusardi & Mitchell, 2014). Consequently, financial literacy can also be considered as the understanding of underlying economic and monetary concepts along with the skills to use this understanding and information, and to handle financial resources effectively and efficiently.

Financial literacy helps one make better decisions regarding spending and saving since it assumes knowing and understanding the forms, functions, and use of money and financial services. This is also significant from the perspective of individual investors and banks (Johnson & Sherraden, 2007). As today individual investors are living in a more complex financial environment than in the past, the need for financial literacy has increased enormously. Globalization makes it even more difficult to reach a correct conclusion on topics such as financial planning and asset management decision. Financial literacy has attracted the involvement of several groups, including governments, bankers, and other organizations, namely in developed countries. The importance of improving financial literacy has increased because of various elements, including the maturation of new investment product types, the complexities of modern financial markets, political and demographic changes (Mian, 2014).

2.2. Why Financial Literacy is Important

The importance of financial literacy has been gaining interest around the world over the past few years (Lusardi & Mitchell, 2011). The primary cause for this is that today we live in a complex environment, confronting many issues such as political, economic instability and financial distress. Globalization and the complexities of modern financial markets and investment securities have intensified the demand for financial literacy. Globalization also makes it harder for people to make suitable decisions regarding buying or selling investment products.

As governments launch new enterprises and national strategies to improve the financial skills of the population, demand has grown for research to identify social subgroups with specific financial education needs, and to develop initiatives and instruments to improve their financial well-being (Atkinson & Messy, 2013). To address these demands, the OECD launched its financial education project in 2002, developing policy analysis and recommendations. Those recommendations were focused on the best practices and principles in financial education, and awareness, specifically in sectors such as credit, insurance, and individual investments in risk products, like as mutual funds, stocks, bonds, and others.

Financial literacy also helps individuals realize how to manage the income they have available, and the amount they can eventually invest or save. In financial behavior, it is likewise relevant to understand risk and fiscal issues (Pellinen et al., 2011). Financial literacy is also significant as it is joined with financial practices, such as cash-flow management, credit management, savings, and investment (Hilgert et al., 2003). Because of financial illiteracy, individual investors frequently face fiscal troubles in the United States and in Europe. Individual investors are not sufficiently enlightened on how to make investment decisions (Norvilitis et al., 2003). Van Rooij et al. (2011) also determine that someone who is not financially knowledgeable is making poor investment decisions. People who lack financial knowledge may face adverse consequences of their financial decisions, and may end up losing money (Lusardi & Mitchell, 2007). Besides the lack of experience with complex financial products, low degrees of education and low financial literacy may slow adoption of these products (Gaurav et al., 2011).

Though there is a significant theoretical and empirical work developed in the economics of education, however little attention has been given to how an individual acquires and deploys financial literacy (Glewwe, 2002; Hanushek & Woessmann, 2008). In recent years, few articles have examined the decision to acquire financial literacy or studied the links between financial knowledge, saving, and investment behavior (Jappelli & Padula, 2013; Lusardi et al., 2013; Hsu, 2016). Therefore, basic research from social science, marketing and business disciplines can enhance our knowledge of how adults actually are ready to take financial decisions (Lynch, 2011).

2.3. Financial Literacy Evaluation and Measures

Much of the financial literacy debate may be linked to the fact that a great deal of variation still exists in how researchers define and measure financial literacy itself (Hung *et al.,* 2009). In addition, considerable debate continues about the role of financial literacy, and only a few studies have sought to measure financial literacy, partly because researchers lack the appropriate data (Van Rooij *et al.,* 2011). To evaluate financial education worldwide, and identify opportunities for improvement, Visa conducted a survey with five questions between February and April of 2012, with 25,500 participants in 28 countries (Barometer, 2012). Brazil topped the field, scoring 50.4 out of 100. Mexico, Australia, United States of America, and Canada rounded out the top five (Figure 1).
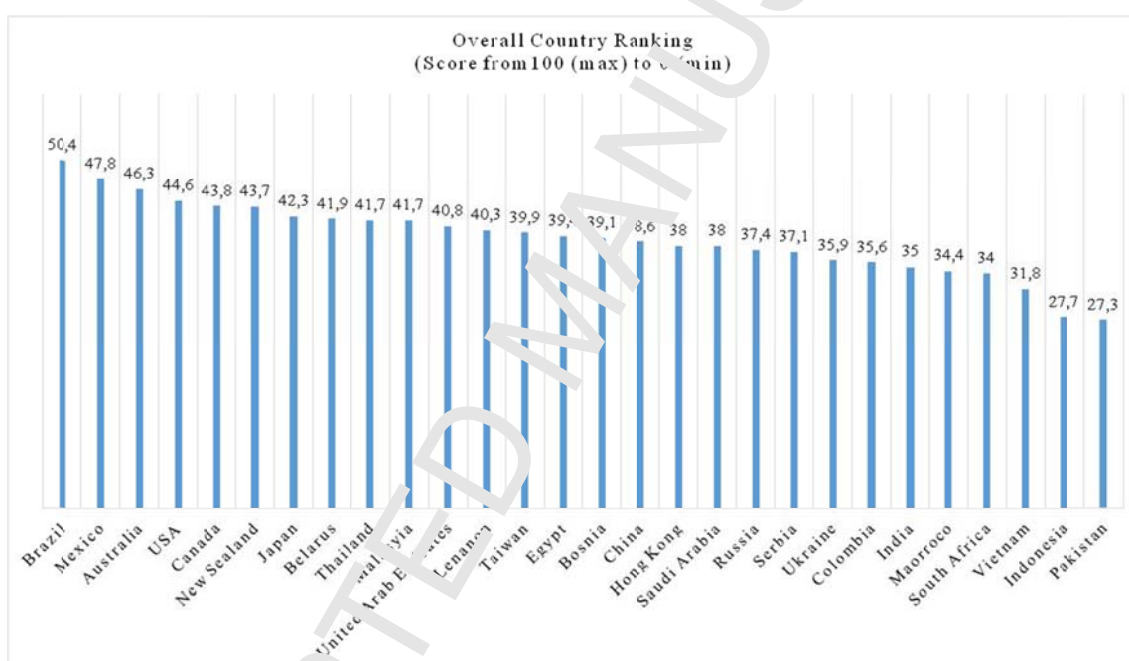
Figure 1. Overall Country Ranking (Most financially literate, left to right). (Source: Barometer, 2012).

Other financial literacy surveys, measured risk assessment, were performed by Standard & Poor's (Global FinLit Survey, 2015), and the conclusion is that just one-third of the world's population is financially literate. These survey rankings were calculated by interviewing more than 150,000 randomly selected adults in more than 140 countries over the course of 2014. Adults surveyed had to answer just five multiple-choice questions. On a country-by-country basis, Norway, Denmark, and Sweden tied for first place, with a score of 71 ranking as financially literate. At the bottom of the spectrum was Yemen — in which a score of just 13 was deemed as financially literate by the S&P survey (Figure 2).

Financial Literacy Score (0 to 100)

Country	Score
Norway	71
Denmark	71
Sweden	71
Israel	68
Canada	68
United Kingdom	67
Netherlands	66
Germany	66
Australia	64
Finland	63
United States	57
Sri Lanka	35
Dominican Republic	35
Costa Rica	35
Malawi	35
Gabon	35
Bulgaria	35
Côte d'Ivoire	35
Brazil	35
Cyprus	35
Uganda	34
Cambodia	18
Nepal	18
Armenia	18
Haiti	18
Tajikistan	17
Angola	15
Somalia	15
Afghanistan	14
Albania	14
Yemen, Rep.	13

Figure 2. Global Financial Literacy Ranking of the 148 countries targeted in 2014.
(Source: Global FinLit Survey, 2015).

Improving financial information and literacy is essential to support the individual decision-making procedure, depending on the resources available over time. Persons with a high level of financial literacy and capability to 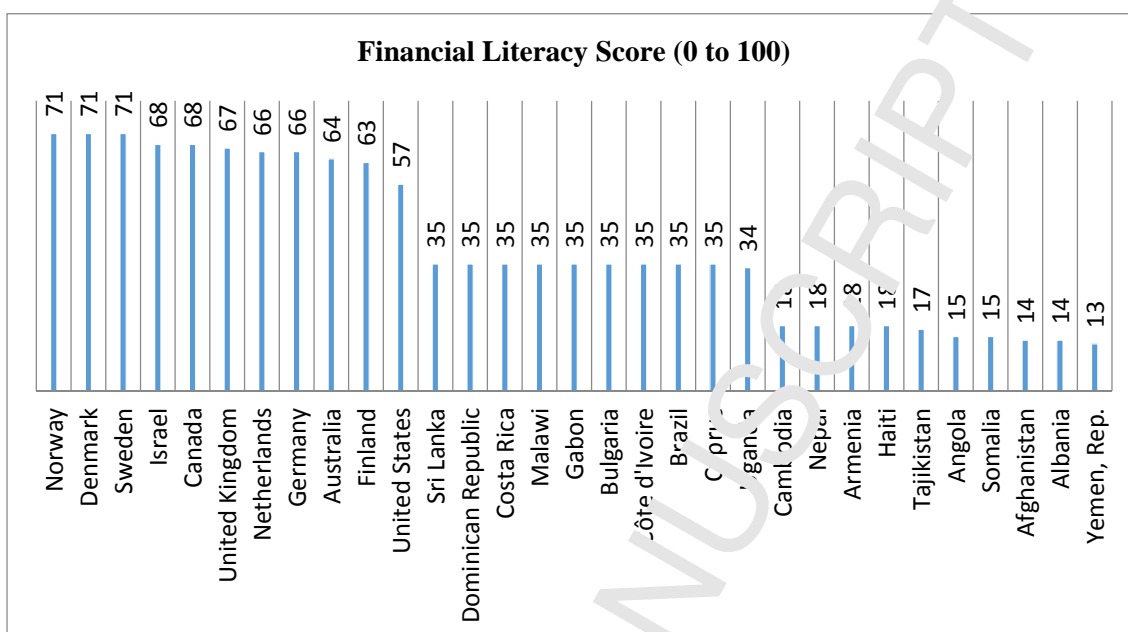help raise the standard of market efficiency and required regulation. Consequently, financial literacy is increasingly important, as innovation and international economic integration widen the scope and complexity of financial services.

2.4. Serious Games: a Powerful Teaching and Evaluation Tool

Serious games can be a powerful means to boost teaching, education, and knowledge evaluation tools (Guillén-Nieto & Aleson-Carbonell, 2012). The use of games in financial literacy education, as a tool, seeks to reduce the cognitive learning effort (Lee & Hammer, 2011). It is well known that a person often learns through gaming (e.g. Greitzer *et al.,* 2007), whether he is alone in executing a certain task, discovering how to play online games (or others), or teaching a range of subjects, including financial literacy (e.g. Kriz, 2003).

Computer games can be a persuasive teaching tool (Paraskeva *et al.,* 2010). Games are a very popular activity with a variety of audiences and can be used to motivate people and teach strategy (Vos *et al.,* 2011). The use of games to engage people in playing and learning is potentially a way to address the lack of financial literacy (Gee, 2003). In addition, computer games meeting pedagogical criteria should become an integral piece of learning (Divjak &

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Tomić, 2011). A web-based quiz game used as a formative assessment can enhance learning and motivation (Wang, 2008). Games in the form of a multiple-choice quiz software tool may enhance the social and emotional growth of personality (Hamari *et al.,* 2014). Through the game's characteristics (e.g. points, feedback, leaderboard, or a challenge) individuals are motivated to play due to the enjoyment of the learning process (Cheong *et al.,* 2013). Thus, organizations have been using games with the purpose informing, teaching, persuading, and influencing individuals, to improve their financial literacy (e.g. Figart, 2011).

By using appropriate game elements and mechanics, organizations can provide individual investor tools to play and learn in an easy way, helping individuals make more assertive and efficient financial decisions (Lusardi & Mitchell, 2008). Thus, the game elements and mechanics developed in financial literacy software, can educate the individuals about money and investments, and improve their financial knowledge (Kim, 2007).

3. Method

To answer our research question – how well adult individual investors understand financial literacy about complex financial products and portfolio management – and evaluate the financial literacy level of bank individual investors in complex financial products with high risk, we adopted a multiple-choice questionnaire developed in a quiz game context. The quiz game had seven scales assessing financial literacy pertaining to invest in complex financial products (cf. Appendix). There were two sets of questions, having different degrees of difficulty (basic skills: common sense financial knowledge; and advanced skills: advanced knowledge about investment in complex financial products and portfolio management). The game sought to measure individuals' knowledge regarding the topics covered, and at the same time, could actually help to improve their knowledge. In addition, our study explored investors' sociodemographic characteristics, according to gender, age, and education.

Traditional research performance tests, like most assessment literacy tests, are normally multiple-choice tests (Jovanovic *et al.,* 1994). The games-based learning in financial literacy was adopted since research behaviors are an intrinsic part of many games (Waelchli, 2010). Playing the quiz game, individual investors search for and gather information on financial products, decide which sources are relevant and useful, and use that information to accomplish their goal, for example to create a solid financial plan.

The basic questions within the quiz game cover knowledge, behaviors relating to various aspects of financial knowledge and were grouped with other questions that address similar topics (Atkinson & Messy, 2013). The questions were chosen to measure the financial literacy of adults (aged between 18 and 79) and they cover a range of fundamental concepts of finance, representing international good practice in financial literacy measurement (INFE, 2011). The

seven presented scales were adapted considering the topics: UBS funds, Amundi International SICAV, Fidelity, Eurovida entity, Threadneedle, FT (Foundation Trusts), and Nordea group (cf. Appendix). So, the 5 questions contained within each 7 questionnaires were chosen from different sources, to be precise, from Seven Assets Management companies that operate as investment management companies and offer asset management services following the guidance notes of OECD (Organization for Economic Co-operation and Development) for conducting an international comparable survey to measure the financial literacy (INFE, 2011).

Multiple-choice questionnaires/tests are standardized tools that allow assessing and evaluating skills (Dunn, 2002; Scharf *et al.*, 2007). From an extensive review centered on studies that measure information literacy, we found out that the most popular assessment tools are the multiple-choice questionnaires (Walsh, 2009). Answers may be graded as correct or incorrect, and total scores are obtained by the sum of correct answers. The number of correct responses can be converted to the percentage of correct responses, dividing the number of correct answers by the total number of questions answered in the quiz game, multiplied by 100. The individual investor's financial investment knowledge is assessed through the percentage of correct responses, with a score from 0 to 100 (e.g. 0% to 100%).

3.1. Quiz game

One of the challenges confronting the banking sector is helping to promote the knowledge of financial products, which are usually complex, and the training actions necessary for the elucidation of customers about these products. Financial products have terms, features, and risks that are difficult to value and to predict, and often are not likely to be correctly interpreted by a typical individual investor.

At the end of 2016, a Bank (specialist in the asset, investment management, and brokerage services) launched a quiz game, allowing individual clients (and others who were not clients) to increase their knowledge about investment products, available on the Bank website. To motivate the individuals, they were offered the chance to win an iPad by playing the game, while answering the quiz with questions about financial literacy (Figure 3).

Figure 3. Quiz Game – Home Page

With this quiz game, the Bank also sought to encourage the knowledge and financial education of common investors about relevant financial instruments to diversify the investment portfolio and risk management. In addition, the application was developed to help adults in their financial literacy and evaluated the clients knowledge about the investment funds, through multiple-choice questions (Quiz).

The Quiz Game could be launched from the Bank Website in its Home Page. As for the game settings, the Quiz Game displays a selection of 7 questionnaires with randomized questions for each group, and having no time restriction to answer those questions. In the Leaderboard clients could check their score and, if they desire, repeat the process, answering to the same questions, to improve their score. Upon answering correctly all 5 items of each questionnaire, the participants were automatically directed to the drawing for one of the seven available prizes - attractive iPads. Each participant could respond to the seven questionnaires, submitting each of them to each of the asset management institutions, obtaining in return seven numbers in the drawing for the prize. Participants could click on the multiple-choice button to select the proper answer in the quiz game and then after complete the 5 questions group conveniently return to the main menu, to pick out another asset management questionnaire (until complete successful all 7 questionnaires) .

When a participant finished the quiz game, results and her/his position on the score list appeared. After concluding the questionnaires, she/he received a ticket number and was directly admitted to the drawing to win one of the seven iPad prizes. Participants could play all seven questionnaires, one for each of the seven mutual fund managers) getting a drawing ticket for each game played.

3.2. Multiple Choice Survey

Financial literacy metrics are difficult to measure (Lusardi & Mitchell, 2008). Nevertheless, to design a standard set of questions around these ideas, four principles should be followed: 1) Simplicity: the questions should measure knowledge of the fundamental building blocks to decision making in an intertemporal setting; 2) Relevance: the questions should relate to concepts pertinent to persons' day-to-day financial decisions over the life cycle; moreover, they should capture general, rather than context-specific ideas; 3) Briefness: the number of questions must be kept short to secure widespread adoption; 4) Capacity: questions should differentiate among areas of financial knowledge to permit comparison across individuals. The design criteria (Lusardi & Mitchell, 2008) were applied to present multiple-choice questions (to be more precise each question had three options, to choose the best answer), for each of the five questions (Rodriguez, 2005), in each of the seven questionnaires (cf. example in Figure 4).

Figure 4. Quiz Game – Questions

Additionally, two sets of questionnaires were developed with different degrees of knowledge complexity to evaluate the individual perceptions on financial literacy in their two main skill categories: basic or common sense knowledge level (basic competencies), or advanced level (advanced skills) of financial literacy skills on complex investment products.

The survey was organized into two main sections. The first consisted of social-demographic questions (about gender and age). The second focused on testing people's knowledge and skills as they relate to the seven questionnaires (one by each asset manager). The seven asset managers that collaborated in this assessment defined the seven questions groups with 5 questions each, resulting in 35 multiple-choice questions (Appendix).

To understand the types of reasoning and financial knowledge required to answer the questions, we analyze the questions and answers in the two group set. Specifically, we explore

the diversity of answer types, the difficulty of questions in terms of the type of reasoning required to answer them, the complexity of financial product characteristic and the degree of syntactic divergence between the question and answer sentences. Since we have developed two sets we success rate equal. Thus, two levels of questions complexity were developed, to be randomly presented, to evaluate the basic and advanced skills: 1) a generic common sense or basic level, with lower difficulty, were developed in three groups of questions by asset managers, Amundi, Eurovida, and Threadneedle; 2) a higher level with complex questions was developed in four groups of questions by asset managers, Fidelity, F&I, Nordea, and UBS. Moreover, the basic skills group contains questions about individual knowledge of financial markets and investments, measuring common sense financial literacy. The advanced skills group contains questions about investment in complex financial products and portfolio management knowledge, measuring advanced financial literacy.

There is a diversity of financial literacy conceptual definitions, and different methods are used to measure the financial literacy (Hung *et al.*, 2009). In our study, we calculate the individual score by the number of correct answers from the three multiple answer quiz questions (Lusardi & Mitchell, 2008). The quiz game software and the questionnaire were hosted on the Bank website.

3.3. Survey Test

Before deploying the quiz game, the 7 questionnaires was previously validated, to test and measure the financial information literacy in three steps: 1) the questions were adapted from another similar test made by the Asset Managers institutions (to customers of other banks); 2) a small group of bank customers and employees performed the grammatical and structural test of the proposed questions, to ensure comprehensibility, and to give an indication of the difficulties of financial quiz questions; 3) the test scores were compared with similar previous tests already conducted by Asset Managers. All three steps revealed that the questionnaire had constructed validity.

3.4. Participants

The survey was available for approximately one month on the Bank website to clients (already clients of the bank) and other users/visitors (not clients of the bank), all designated as "participants". All questions and answers were coded and stored in the database that supported the game application. Each participant (as an individual investor) received a total score from 0 to 100 based on her/his answers, for each group of five questions.

We had a sample of 1,597 participants, 87% were clients, and 13% were visitors (cf. Table 1), 81% were men, all were adults, and the age group from 30 to 39 years old was the most representative (46%). Education was measured as falling into one of three categories: high school, Bachelor's Degree, and Master's degree or higher. The majority of participants in our sample have a Bachelor's degree (58%).

Table 1. Participants (Source: author).

Participants	N	%
Clients	1,382	87%
Visitors	215	13%
Total	1,597	100%
Gender	N	%
Men	1,290	81%
Women	307	19%
Total	1,597	100%
Age	N	%
18-29 years old	218	14%
30-39 years old	742	46%
40-59 years old	511	32%
60-79 years old	126	8%
Total	1,597	100%
Education	N	%
High school	399	25%
Bachelor's degree	926	58%
Masters or higher degree	271	17%
Total	1,597	100%

4.   Results

In order to understand the financial literacy among individual investors, we analyzed the questionnaire data obtained from Oct/10/2016 to Nov/11/2016. At the end of the game, the 1,597 participants had answered to 9,118 questions, in which Eurovida and Amundi had the highest number of responses. The answers to the Asset Managers questionnaire present a general equilibrium of responses from 13% to 16%, showing an overall interest in all questions.

To evaluate the individual investor's knowledge toward financial literacy, we analyzed the score of each group of questions by the degree of difficulty (three groups for basic skills and four groups in advanced skills). For each question groups defined by the seven Asset Managers questionnaires, the participants had three possible answers, and only one was correct (Table 2).

Table 2. Survey Results. (Source: author)

Questionnaire	Difficulty Degree	Score (0 to 100)
Amundi	Basic skills	86

Eurovida	Basic skills	84
Threadneedle	Basic skills	86
Basic competencies Average		**85**
UBS	Advanced skills	65
Fidelity	Advanced skills	62
FTI	Advanced skills	6
Nordea	Advanced skills	6.
Advanced skills Average		3
Global Average		81

Some questions required more technical, economic, and financial knowledge (e.g., Advanced Basic skills, average 63 out of 100), while others are more 'common sense' (e.g., Basic competencies, average 85 out of 100). The overall average score of correct answers was 81 out of 100, indicating a satisfactory level of individual investors' financial literacy knowledge.

Each of the seven multiple-choice quizzes consisted of five questions, each with three possible answers (having only one correct), and participants could continue the quiz only if they achieved three correct answers. Thus, the probability of a participant passing the quiz by randomly guessing the answer to each question is a binomial problem with n = 5, where p(correct) = 1/3 is 0.2099 (P(3<= x <=5) = 1 - binomcdf(5,1/3,2) = 1 - 0.7901 = 0.2099). Thus, participants not viewing and judging the questions had only a 20% chance of selecting the correct answer.

On average, all participants, independently of gender, age, or education, scored more than 80 out of 100 (cf. Table 3). Women, aged from 60 to 79 years old, and those with a Bachelor's degree scored higher than the other groups of participants.

Table 3. Participants group scores. (Source: author).

Participant groups	Score (0 to 100)
Gender	
Men	81
Women	83
Age	
18-29 years old	83
30-39 years old	81
40-59 years old	80
60-79 years old	84
Education	
High school	80

Bachelor's degree	82
Master or higher degree	81

The two groups of questionnaires, according to the degree of difficulty, divided participant's scores to measure the basic and advanced skills (cf. Table 4). We verified that participants scored higher in the questionnaires with lower difficulty degree (more than 80 in 100), and lower in the questionnaires with higher difficulty degree (less than 70 in 100), except in the group with age between 18 and 29 years old, which scored 78 out of 100. Women scored higher in the questionnaires with a higher difficulty degree (69 out of 100).

Participants with less education (high school), showed lower scores in both difficulty groups, enhancing a difference with the questionnaires group with a higher degree of difficulty (59 in 100). Table 4. Score by questionnaire difficulty level degree (Basic and advanced skills). (Source: author).

Table 4. Participants Basic and advanced skills (Source: author).

Difficulty degree	Score (0 to 100)	
Gender	Basic skills	Advanced skills
Men	86	63
Women	85	69
Global Average	86	64
Age	Basic skills	Advanced skills
18-29 years old	84	78
30-39 years old	85	63
40-59 years old	86	60
60-79 years old	88	60
Education	Basic skills	Advanced skills
High school	84	59
Bachelor's degree	86	65
Master or higher degree	86	66

5. Discussion

Earlier work on financial literacy tended to focus on young people and students, which is likely to be partly endogenous with regard to advanced financial investment experience.

This research looks at the determinants of banking complex financial products and the individual investor's self-assessment test score measures of financial literacy. We performed a literature review to identify and evaluate articles that measured both performance-based and self-reported or numeracy and examined their relationship to financial literacy outcomes. Most studies found no difference in the relationship between results of performance-based and self-

reported measures and outcomes (Gotch & French, 2014). Studies using multiple instruments and the completion of reading quizzes were related to both better exam and course performance (Johnson & Kiviniemi, 2009; Jovanovic *et al.*, 1994). The quiz test score measure performs better than the self-assessments when literacy is treated as an event variable (Bell *et al.*, 2015).

In the present study, the majority of participants are adults with 30 to 39 years old (46%). All participants (N=1,597) responded to the seven sets of questions (mutual funds managers' questionnaires), with: common sense questions (concerning basic skills), and more complex questions (concerning advanced skills) on financial knowledge.

Results indicate that participants have a very satisfactory financial literacy degree, achieving an overall score of 81 out of 100, which indicates a high level of financial literacy about complex products. This high score might be related to the fact that most participants were clients of the bank, which was specialized in asset management, an area in which the quiz game was centered. By contrast, the answers to the questionnaire with a higher (or advanced) difficulty degree in financial literacy revealed that the individual investors' scores are lower (around 60 out of 100) showing moderate skills in complex financial literacy, as was expected (Aribawa, 2017). This is especially important not only in terms of finance literature, but also for the financial institutions, regarding individual assessments about complex financial products and the extent to which individuals are well-informed and aware of the risks involved in investing in this type of financial product. According to the OECD (2016) survey results, adults in many countries around the world display, low levels of financial knowledge, fail to engage in financial behaviors that could improve their financial security. This recent results show that on average, just 56% of adults achieved a score at least 71%, considered the minimum target score indication room for improvement.

Findings by questionnaires' difficulty levels (low and high) show a gap (approximately 20 points) between the basic and advanced skills knowledge in literacy concerning investing in complex financial products. Financial literacy levels are influenced by gender, age, and education levels (OECD, 2016). Women's are better prepared in advanced skills, knowledge about investment in complex financial products, and portfolio management than men in general, individuals in the age group of 18 to 29 years old. We may accept that these participants, evaluated with a high score (more than 80 out of 100), have the power to formulate and execute investments and handle their financial portfolios, which calls for them to have the ability to manage complex financial products. Yet, as shown by the overall advanced skills, results, the individuals in general, seem to have a lower financial knowledge (around 60 out of 100), and so they may be considered as non-literate in complex financial products. Therefore, performing financial investments in complex and high-risk products, based on their own judgments, is likely to make them lose money, due to their lack of comprehension about those products.

Studies corroborate that women performed better in portfolio management, net returns, and tend to be less financially literate (e.g., Lusardi & Mitchell, 2008; Bauer *et al.,* 2009). In 2014 a study of Adult financial literacy in Australia (ANZ, 2015) has concluded also that women had higher scores on average than men normally on dealing with money in stressful situations like financial/investment matters.

However, some other studies find that women have less knowledge about finance topics (e.g., Chen & Volpe, 2002; Lusardi & Mitchell, 2011). Also, the individuals in the age group of 18-29 years old are better prepared with financial knowledge of complex products (score 78 out of 100), showing a gap of 18 points with the age group of 40-79 years old. However, age is intrinsically related to investor's experience and studies. For example, Bauer *et al.* (2009) and Korniotis & Kumar (2011) found a negative impact of age on investment performance, providing evidence that older people and investors that are more experienced have greater knowledge regarding investments.

Nevertheless, these results also suggest that the gender gap in critical domains of risk investment decision making can be reduced with appropriate control for financial literacy and information/education initiatives by financial organizations. Earlier works on financial literacy found that adult men and women differ on economic issues and about financial literacy (Almenberg & Dreber, 2015). Therefore, the improvement of our understanding of links between financial literacy and economic decision making is also important for interpreting the gender differences observed in financial investment issues, namely in complex financial products.

When it comes to lowering difficulty questionnaires, the scores are, on average uniform across all groups, moving from 84 (e.g., 18-29 years old and high school) to 88 (e.g., 60-79 years old) out of 100. Earlier studies on financial literacy have not focused on explaining the adult's gap in common sense and advanced knowledge in financial literacy of investment products.

The individual investor knowledge on more complex questions is significantly weakened in the participants with a lower education degree, and with ages from 40 to 79 years old. This situation has raised concerns that the cognitive decline that comes with age, and that is associated with a lower education degree, may compromise the investment decision-making ability and thereby the financial well-being (Finke *et al.,* 2016).

Results observed for individual investors are important because almost 90% of financial literacy studies do not provide an indicator of adult's financial literacy threshold and a grading system to interpret the measured results (Huston, 2010). For example, a respondent of a financial literacy test with a score of 70 or better (out of 100) is considered a literate person in the investment (Volpe *et al.,* 1996). Another example, a respondent of a financial literacy test with a score below 60 out of 100 is considered a non-literate person in the investment (i.e., the

person fails in the test) (Mandell, 1999). Moreover, individuals are financially literate if they score 75 or more (out of 100), however, for scores from 60 to 74 out of 100, it is unclear to define their actual knowledge (Mandell & Klein, 2009).

It is clear that levels of financial literacy vary within countries (Atkinson & Messy, 2013). Experiences measuring financial literacy indicate low financial literacy scores and suggests that more surveys of financial literacy are needed and that coherent tailored national strategies for financial education are essential for success (Yoshino et al., 2015; Anderson et al., 2017; Agarwalla et al., 2015; Lusardi & Tufano, 2015; Nguyen et al., 2017).

Therefore, according to our results, the participants can be considered as literate in investment (having an average score of 81 out of 100). However, analyzing our results in more detail, they probably have severe financial literacy difficulties, suggested by an average of 64 out of 100, scored in the advanced financial literacy tests, which were more difficult than the other tests. In fact, this poor result suggests that individual comprehension of complex financial products is minimal, and might not be sufficient to guarantee that individual investors are in a position to make good financial decisions regarding complex financial products, which is according to findings reported in other studies (e.g. Atkinson & Messy, 2013). Our findings also indicate an understanding of this financial literacy context as it is an individual investor's basic competency of the financial products' characteristics, risks, and benefits, compared with other types of investment.

Instrument scoring is an important means of rating, communicating and providing consistency in testing and interpreting results from an instrument. Therefore, we have followed the guidelines for creating financial literacy scores were the knowledge score was computed as the number of correct responses to the financial knowledge questions (Atkinson & Messy, 2013). Finally, regardless of the method of measurement a formative assessment can be made using any type of instrument that evaluates understanding and provides feedback about how individual investors are doing along the way (Timmers et al., 2015).

Academic research addressing individual investment of complex financial products literacy is new and is growing because the recent financial crisis and bank- ruptcy. Given the many differences in financial literacy across countries, demographic groups, and scholar education it may be important to study other regions and, for example, develop other programs and games targeted to those groups. With more personal data on people financial literacy, it is also possible to better study other financial illiteracy problems. With more information can help to enrich the financial literacy and could be used to reduce some limitations (e.g., the lack of financial literacy definition, the content of the measurement instrument, and results from interpretation) to a standard financial literacy measure (Huston, 2010). Studies exploring other types of games with a different sample profile and other types of questions should be addressed in future works

to compare results, namely to study the gap between general perceptions of men and women, and age groups.

6. Conclusions

Financial training is a form of action, which is helpful for people to acquire a fuller understanding of monetary products, services, and concepts. Financially educated individuals are better able to make investment selections and more ready to react to financial market volatility. By providing serious games for measuring the people financial literacy, organizations can ensure the understanding of the financial product that is making good use of their financial resources and can highlight needed improvements to such initiatives.

Playing the quiz game, investors will be better informed and ready to define their financial plan because searching and gather information on financial products they figure out what they need to do, and what financial products are suitable to accomplish their financial goals. In sum, according to the results, the individual investors are well-informed about basic financial literacy. However, they show insufficient knowledge, skills, and financial literacy about advanced complex products. Women's like the age group of 18 to 29 years old are better ready in advanced skills knowledge to investment in complex financial products, and portfolio management.

We highlight that it is actually advantageous for financial organizations to teach and help their clients to be financially literate. Financial literacy is critical to avoid wrong decision-making. A financially literate person will be better prepared to deal with financial market volatility, and understand their actions toward investment decisions, with or without a personal financial advisor's support. In sum, it is important to promote financial literacy using attractive and straightforward game tools to improve the individual investors' financial literacy and allow them with an effective financial education.

The findings described in this article also show that playing games like reinforce the communication between individual investors and banks, that is an important consideration when it comes to complex financial literacy. Although banks and governments are providing youth financial literacy programs is also essential in developing and delivering adult financial literacy programs namely in high levels of complex financial products.

This paper contributes to the growing literature linking financial literacy to investing in complex financial products on the prediction of risk on investments in complex financial products. We also make an important contribution to financial literacy research by using standard measures to evaluate complex product knowledge, by distinguishing between basic and

advanced skills and financial literacy, and by using a random sample that is broadly representative of the adult population with an investment bank account. This study may also be particularly useful for policymakers, regulators, and banks who prioritize financial inclusion and financial literacy, or who is introducing financial education strategies according to the high-level principles developed by financial organizations.

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Appendix: Questions are presented in the original language (Portuguese). The correct answers are in Bold.

UBS
1) O fundo UBS (Lux) Bond Fund – AUD investe em obrigações emitidas por:
A) Governo do Canadá
B) Empresas do Canadá
C) Governos e Empresas do Canadá

2) O fundo UBS (Lux) Bond Sicav – Currency Diversifier não investe em:
A) Dólares Canadianos
B) Pesos Argentinos
C) Francos Suíços

3) O fundo UBS (Lux) Equity Fund – Greater China investe em empresas cotadas na:
A) China, Hong Kong e Taiwan.
B) China
C) China e EUA

4) O fundo UBS (Lux) Equity USA – Growth tinha como maior posição a finais de Agosto de 2012 à:
A) Visa
B) Google
C) Apple

5) O fundo UBS (Lux) Bond Sicav – Currency Diversifier investe em obrigações dos:
A) Mercados emergentes
B) Mercados desenvolvidos
C) Mercados emergentes e desenvolvidos

Amundi
1 - Amundi International SICAV é um fundo.
a) Que investe de forma flexível em acções globais, com um enfoque baseado em valor
b) Com mais de 15 anos de história, líder em sua categoria e com diversos prémios e reconhecimento
c) Todas as anteriores

2 - O universo no qual Amundi International SICAV pode investir é:
a) Somente acções
b) 50% acções / 50% renda fixa
c) Pode diversificar sua carteira em diferentes classes de activos, incluindo acções, renda fixa e ouro

3 - O enfoque flexível de Amundi International SICAV permite-lhe:
a) Diversificar em ouro como forma de protecção frente a condições extremas de mercado
b) Manter liquidez em carteira à espera de oportunidades de investimento
c) Todas as anteriores

4 - Um dos objectivos de Amundi International SICAV é:
a) Superar o índice MSCI World
b) Obter rentabilidades superiores a 15%
c) Preservar e aumentar o capital com um horizonte de investimento a longo prazo, independente das condições de mercado

5 - O objectivo de preservação do capital a 5 anos de Amundi International SICAV significa:
a) Tentar que o investidor não perca dinheiro nesse horizonte de investimento
b) Manter a capacidade aquisitiva do investidor em termos reais

c) Todas as anteriores

Fidelity

1 - Qual o risco potencial incorrido pelo fundo FF Global High Grade Income Fund?
a) Cambial e Crédito
b) Taxa de Juro e downgrade do País
c) Ambos

2 - Qual das seguintes frases é falsa?
a) Os dividendos são uma fonte extra de rendimento
b) Os cupões das obrigações podem oferecer um fluxo previsível de rendimento
c) O Imobiliário não pode oferecer um fluxo previsível de rendimento

3 - O FF Global High Grade Income Fund é:
a) Um Produto que substitui investimentos em tesouraria
b) Um fundo Total Return em obrigações diversificado em várias moedas
c) Um fundo com apostas tácticas (de curto prazo) entre mercados

4 - O FF Global High Grade Income Fund não é aconselhado a:
a) Investidores adversos ao risco cambial
b) Investidores que procuram rendimentos regulares e dispostos a suportarem algum risco cambial
c) Investidores que procuram um produto que possa fazer parte e diversificar a sua carteira de investimentos

5 - Em quais dos seguintes países o FF Global High Grade Income Fund não pode investir?
a) Brasil
b) Canadá
c) Suécia

Eurovida

1 - Quem é a Eurovida?
a) Entidade bancária
b) Seguradora do Ramo Vida
c) Corretora de seguros

2 - Que tipo de produtos comercializa a Eurovida?
a) Seguros de vida
b) Seguros de capitalização & investimento e Planos Poupança Reforma
c) Todos os anteriores

3 - Que aplicação da Eurovida, atualmente em comercialização no Banco Best, combina garantia de capital no final do prazo, rendimento e liquidez?
a) Eurovida Renda 2017 1ª Série Não Normalizada
b) Eurovida Sorriso +
c) Nenhum dos anteriores

4 - Qual a rentabilidade anual (TIR - Taxa Interna de Rentabilidade), bruta para efeitos de IRS e líquida de comissões, garantida pelo Eurovida Renda 2017 1ª Série Não Normalizada?
a) 4,43%
b) 5,25%
c) nenhuma das anteriores

5 - O investimento no Eurovida Renda 2017 1ª Série Não Normalizada pode ser feito a partir de?
a) apenas 1.000€
b) 25.000€
c) 50.000€

Threadneedle
1 - Qual o país de origem da Threadneedle?
a) Reino Unido
b) China
c) Madagascar

2 - Que gestora ganhou o prémio Morningstar de melhor gestora de acções estrangeira em Portugal em 2012?
a) Threadneedle
b) Banca Mora
c) Dolphin Equities

3 - A Threadneedle tem uma boa reputação por…
a) Generating high returns with controlled volatility
b) Being managed by Swiss fund managers
c) Publishing daily institutional factsheets

4 - Qual o significado de "Select" nos fundos da Threadneedle, por exemplo no European Select Fund?
a) Um fundo mais concentrado, com um número mais reduzido de acções.
B) Um fundo que apenas investe em acções com um nome difícil de pronunciar.
c) Um fundo focado em acções do sector alimentar.

5 - Qual a fonte de retorno principal que pensamos ter no nosso fundo European Equity?
a) Selecção das acções
b) Ter sorte
c) Alta rotação da carteira

FT
1 - Qual vai ser o maior contribuidor para o crescimento mundial do PIB em 2012?
a) Medidas expansionistas do BCE
b) Lucros das empresas americanas
c) Contribuição dos Países Emergentes

2 - Na última década, a rendibilidade anualizada dos fundos Templeton Global Bond e Templeton Global Total Return foi:
a) Negativa

b) Entre 5% e 10%
c) Superior a 10%

3 - Quais dos seguintes países são Investment Grade pela S&P?
a) Coreia do Sul, Brasil, Rússia, México, Índia, Indonésia e Polónia
b) EUA, Alemanha, Austrália, Japão e Suécia
c) Todos os anteriores

4 - Qual das seguintes instituições não pode entrar em falência?
a) Empresa
b) Fundo de Investimento
c) Obrigação

5 - Quantos anos tem o fundo FTIF Templeton Global Bond?
a) Entre 5 e 10 anos
b) Entre 10 e 20 anos
c) Mais de 20 anos

<u>Nordea</u>
1 - Em que ano foi criado o grupo Nordea?
a) 1995
b) 2000
c) 2004

2 - A Nordea delega algumas estratégias a gestoras especializadas. Qual foi a primeira
boutique externa a colaborar com a Nordea?
a) Private Capital Management
b) Stanlib
c) Unibanco

3 - Que indicador dá uma visão "real" (de mercado) relativa à qualidade de crédito de
uma obrigação?
a) CDS
b) Rating
c) Revistas

4 - O que quer dizer CDS?
a) Credit Default Swap
b) Credit Default Spread
c) Collaterised Debt Securities

5 - Quantos países nordicos fazem actualmente parte da carteira do Nordea 1 –
European Low CDS Government Bond Fund?
a) 1
b) 3
c) 5

Assessing adults financial complex products literacy.

- This paper investigates adult's financial literacy in complex financial products

- An online quiz game has developed to assess knowledge across financial investments

- Overall games should be implemented to assess & learning financial literacy

- The results highlight that adults have a satisfactory overall financial literacy level

- We contribute to a better understanding of literacy in the game's context

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