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Measuring financial literacy: a literature review

Sonia Ouachani
Department of Economics, Management, Law, Languages, and Humanities, Higher School of Communication of Tunis (SUP'COM), Carthage University, Ariana, Tunisia and
Faculty of Economics and Management of Sfax (FSEGS), Sfax University, Sfax, Tunisia
Olfa Belhassine
Department of Finance and Accounting, Univ. Manouba, ESCT, Campus Universitaire Manouba, Manouba, Tunisia, and
Aïda Kammoun
Department of Management, High Institute of Business Administration of Sfax (ISAAS), Sfax University, Sfax, Tunisia

Abstract

Purpose – The purpose of this paper is to review the main methods used in the literature to measure financial literacy (FL) of individuals.

Design/methodology/approach – The paper begins by describing how the different items used to measure the FL level of individuals are constructed. Then, it focuses on how do researchers select the items. Finally, it reviews the different calculation methods used in the literature to assess the FL level.

Findings – FL as a concept is tough to define and measure. Several studies focus on the definition and the measure of this concept. Different items are used in the literature and are mostly related to the study topics. The used calculation methods differ across the different studies.

Originality/value – This paper sheds light on the principal methodologies used in the literature to measure FL. It highlights the relationship between the items' content areas and the studies' subjects. Thus, this paper suggests guidance for future studies on measuring methods of FL.

Keywords Financial literacy, Objective measures, Items, Content areas, Study topics, Literature review

Paper type Literature review

1. Introduction

In recent years, there is a growing interest in financial literacy (FL). Several studies in various countries show that individuals' FL affects financial decision-making and behavior (Bernheim, 1998; Cole *et al.*, 2011). Moreover, FL impacts individuals' retirement planning and saving (Bernheim, 1998; Lusardi and Mitchell, 2007a, 2008, 2011) and their financial planning behavior (Agarwal *et al.*, 2015; Arrondel *et al.*, 2013). Besides, FL is an essential determinant of stock market participation and investment decision-making (van Rooij *et al.*, 2011a; Amari and Jarboui, 2017; Al-Tamimi and Bin Kalli, 2009). Moore (2003) finds that the FL level affects indebtedness level and loan terms of Washington DC households. Finally, Okello *et al.* (2017) show that financial attitude, as a component of FL, has a significant and positive effect on the financial inclusion of poor households in rural Uganda. Indeed, financially literate consumers can make better-informed financial decisions, build a secure financial future and reach their own life goals, enhancing economic stability (Consumer Financial Protection Bureau (CFPB), 2016).

FL is a complex construct, which is why it is difficult to be accurately measured (van Rooij *et al.*, 2007; Bernheim, 1998). Two main problems arise when measuring FL. The first is the number of questions to be asked. van Rooij *et al.* (2011a) and Schuhen and Schürkmann (2014)

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note that it is very restrictive to limit the number of questions to one as in Stango and Zinman (2009) or to three as in Lusardi and Mitchell (2007b, 2008). Indeed, they recommend enlarging the set of questions to be asked to assess the level of individuals' FL.

The second problem is the errors in FL measurements (Lusardi and Mitchell, 2014). For instance, van Rooij *et al.* (2011a) note that the wording of the questions can significantly affect the responses of the interviewed individuals. Moreover, FL measures lack accuracy because they rely on subjective judgments related to the set of things that a well-informed individual should know (Bernheim, 1998). Bernheim (1998) notes that when coding the respondents' responses, he has to choose if the response is right or wrong. However, how close to the right answer should the response be to be considered right (or otherwise wrong) is subjective. It depends on the judgment of the person doing the coding.

Marcolin and Abraham (2006) sustain that there is a general agreement among studies about FL definition. However, there is not a standardized measurement of this construct (Marcolin and Abraham, 2006; Remund, 2010; Huston, 2010). Huston (2010) and Lusardi and Mitchell (2014) note that the divergence in FL measures may influence empirical studies' results, limiting the comparability of empirical findings. Marcolin and Abraham (2006) highlight the need to make a benchmarking between the different measures of FL. Huston (2010), Organization for Economic Cooperation and Development (OECD) (2013) and Lusardi *et al.* (2017b), among others, try to propose a standardized measure for this construct. Despite the efforts and given the complexity of the construct, there are still many differences in FL measurements adopted by researchers. Schuhen and Schürkmann (2014) argue that FL is not a global concept that can be evaluated by the same questions in all countries. Questions should be adapted to the country's specificities.

The purpose of this paper is to review the essential methods used to assess individuals' FL with respect to the various topics addressed in the literature. To the best of our knowledge, Kimiyaghalam and Safari (2015) is the only study that reviews the literature about FL measures. They show that the diversity of measures comes from the diversity of definitions. However, they do not investigate the approaches used in the literature to build FL indices. This paper aims to fill this gap by focusing on how researchers choose items in the literature. We focus on the determinants of items' choice and items' content areas used in FL measurements. To the best of our knowledge, it is the first paper emphasizing the link between items' content areas and study topics. Then, we tackle the main methods used in the literature to calculate the FL index. Findings show that FL is a tough concept to define and measure. Several studies focus on the definition and the measure of this concept. They use different items that are mostly related to the study topics. The used calculation methods differ across the different studies. Our results are important for researchers and economists aiming to assess individuals' FL. It discusses and synthesizes the measures presented in the literature.

The remainder of this paper is as follows. Section 2 defines the FL construct. Section 3 discusses how FL items are chosen. In Section 4, we relate content areas to the study topics. The calculation methods of the FL index are presented in Section 5. The last section concludes.

2. Financial literacy definition

Noctor *et al.* (1992) are among the first to define the FL concept. According to them, FL is the financial knowledge that leads to informed decision-making. We can observe that there are two dimensions in this definition. The first is the financial knowledge that is a consequence of financial education programs. The second is the ability to use the acquired financial knowledge appropriately to make informed decisions. Hilgert *et al.* (2003) report that some

studies depart from this definition and do not dissociate between the two dimensions. They assume that more financial knowledge will automatically be reflected in changes in financial management practices and behaviors.

Other studies restrict the FL concept to financial knowledge emanating from financial education programs. They dissociate FL and financial decision-making dimensions and study the interactions between these two concepts (Bernheim, 1998). For instance, Hilgert *et al.* (2003) investigate the connection between the FL of individuals and their financial behavior. They focus on four financial management activities, namely cash flow management, credit management, saving and investment. They show that those with higher financial knowledge scores make the best financial decisions. van Rooij *et al.* (2011a) confirm the same result and show that the level of FL is an essential determinant of stock market participation.

Huston (2010) dissociates financial knowledge and financial decision-making dimensions. She suggests that FL measures have to integrate both dimensions simultaneously. She adds that financial decision-making could be influenced by other elements other than financial knowledge, namely economic condition, culture and time preferences.

Lusardi and Mitchell's (2014) definition goes beyond the financial knowledge considered by previous definitions. They define FL as the ability of economic information analysis and informed financial decision-making. If individuals have financial knowledge but are unable to use it appropriately to make sound financial decisions, then they are considered by Lusardi and Mitchell (2014) financially illiterate.

The US President's Advisory Council on FL (PACFL) report (PACFL, 2008) adds skills as another dimension to FL definition. It focuses on financial decision-making as Lusardi and Mitchell (2014). However, Hung *et al.* (2009) note that this definition is restrictive because the FL level depends on the interactions between the different FL dimensions that influence financial behavior. Therefore, Hung *et al.* (2009) consider knowledge, skills, perceived knowledge and financial behavior interactions when defining FL.

Moore (2003) adds experience as a new dimension to the FL definition. She argues that FL is a complex concept that should reflect individuals' competency. According to her, more financially literate individuals will gain competence and be more effective in managing their financial affairs. Given the complexity of this concept, Moore (2003) proposes that FL cannot be measured directly, but proxies have to be used.

The OECD (2013) presents the most extensive definition of FL, combining literacy definition in the Program for International Student Assessment (PISA) domains and the specificities of the financial field. The OECD (2013) definition encompasses several dimensions of FL, namely financial knowledge, understanding of that knowledge, skills acquired and use of that knowledge, perceived knowledge (confidence to use) and effective decision-making. It also includes the highest number of terms of learning taxonomies. The OECD (2014) refers to this same definition. French and Mckillop (2016) refer to the OECD definition as being the more complete and covering all dimensions of FL.

To conclude, the FL concept interferes with the field of educational science. In FL definitions, there are terms borrowed from the learning taxonomies such as the taxonomy of Bloom (1956). Hung *et al.* (2009) use terms such as knowledge, abilities or skills and behavior to refer to FL. The diversity of these terms indicates the variety of FL definitions and could explain the variety of used measures (Allgood and Walstad, 2016; Hung *et al.*, 2009; Kimiyaghalam and Safari, 2015).

3. Financial literacy items

There is a myriad of studies that measure the FL of different categories of individuals facing different types of financial decisions. FL measures used in the literature can be classified into

two main groups, namely objective measures and subjective ones (Allgood and Walstad, 2016; French and Mckillop, 2016). However, before presenting these two categories of FL measures, we discuss how items are constructed.

3.1 Items construction

Some studies develop from scratch their questionnaire, proposing new questions in order to measure the FL level. Bernheim (1998) examines the effect of FL on saving and planning for retirement. In his measure of FL, he defines items assessing knowledge needed to make a saving plan for retirement. Moore (2003) investigates the relationship between FL of individuals in Washington and the categories of credits they obtained. She defines items related to the subject treated and uses items related to financial market investment, which are not directly related to borrowing. She notes that they are used to distinguish between the different groups of respondents. Lusardi and Mitchell design a module of FL integrated into the 2004 Health and Retirement Study (HRS) (Lusardi and Mitchell, 2006). This module consists of three items assessing: interest compounding, inflation and risk diversification. Recently, Lusardi and Tufano (2015) measure debt literacy and define new items not previously used in the literature. They investigate the relationship between the overindebtedness of American households and their FL level. Finke *et al.* (2016) began by testing 89 questions related to objective FL. After analyzing the responses, they end up with 16 items.

The majority of researchers use items taken from previous literature, not necessarily dealing with the same research topic. van Rooij *et al.* (2011a) use items selected from a set of previous studies carried out by several institutions around the world and focusing on different study topics. The authors choose only the items that are related to their specific research subject. Paiella (2016) uses the nine questions of the 2008 Italian Survey of Household Income and Wealth, which were adapted from a variety of studies. Sivaramakrishnan *et al.* (2017) construct their items referring to van Rooij *et al.* (2011a) and Agarwal *et al.* (2015). The former has the same topic, but not the latter. Baker *et al.* (2019) measure the FL of Indian stock investors referring to Lusardi and Mitchell (2007b), Al-Tamimi and Bin Kalli (2009), van Rooij *et al.* (2011a) and Ibrahim and Alqaydi (2013). Several studies use HRS items proposed by Lusardi and Mitchell (2006) (Lusardi and Mitchell, 2007b, 2008; Agarwal *et al.*, 2015; Idris *et al.*, 2016; Arrondel *et al.*, 2013).

Potrich *et al.* (2018) propose a new index to measure the FL level of Brazil citizens. They ask 38 questions, ten of which are adapted from OECD (2013) and van Rooij *et al.* (2011a). Arceo-Gómez and Villagómez (2017) use two approaches to measure FL among Mexican high school students. They follow the methodology proposed by the OECD in the PISA exam and use the three items developed by Lusardi and Mitchell (2006).

3.2 Objective measures of financial literacy

Objective measures are based on items assessing the actual financial knowledge and skills of the respondents. For these measures, there is little consensus regarding the used items. French and Mckillop (2016) refer to these questions as performance tests that are knowledge-based. They generally depend on the adopted definition of FL and the considered financial decision. We can classify the objective FL items used in the literature according to two criteria: the financial content and the sophistication of items.

3.2.1 Classification of items according to the financial content. According to the OECD (2013, p. 146), "*Content comprises the areas of knowledge and understanding that are essential in the area of literacy in question*". For instance, investment, saving, consumption and borrowing are financial contents or areas of knowledge that items are assessing. Each item

used in the objective FL measure assesses a particular financial content. We note that there is little consensus among researchers about the number of items and their content areas used in objective measures of FL. The item construction is performed in two ways. Some studies propose a conceptualization of the content areas they want to assess, and then they define the items. Other studies use items without automatically referring to their content area. For this reason, we classify the items of these latter studies according to Lusardi *et al.* (2017b) content areas.

(1) The conceptualization of content areas

To the best of our knowledge, four studies propose a conceptualization of the content areas (Huston, 2010; OECD, 2013; Council on Economic Education (CEE), 2013; Lusardi *et al.*, 2017b).

Lusardi and Mitchell (2006) investigate how levels of FL explain US elderly retirement planning behavior. They design a special module on FL and retirement planning implemented in the context of the HRS. The FL module contains three items belonging to two content areas: inflation and compound interest, which are the fundamental concepts of saving; investing and knowledge about risk diversification.

Based on the FL literature, Huston (2010) identifies four content areas and advocates considering three to five items in each area for a total of 12–20 items. These areas are money basics (referring to the basic concepts of personal finance management); borrowing (which is to bring future resources into the present through different types of loans); investing (transferring present resources into the future by using a range of saving and investment products); protecting resources (through risk management techniques or insurance products).

The OECD (2013) report proposes a complete approach to construct the FL measure. First, and after mapping the content areas it defines 75 FL items. Then, after the administration of the questionnaire in the field trial it retains 40 items for the main survey, covering four content areas, which are different from those identified by Huston (2010). These content areas are: money and transactions, planning and managing wealth and income, risk and reward (referring to the ability to manage, balance and hedge risks) and financial landscape (including the understanding of the regulatory framework, rights and obligations in financial markets, the relevant sources of information and the financial environment in general).

The CEE (2013) defines the national standards for FL. They propose to consider six content areas to measure FL. These content areas are: earning, consuming, saving, investment, borrowing, debt management and insuring. Recently, Lusardi *et al.* (2017b) propose the P-Fin Index, which is a new index of personal FL. It takes into account the six content areas proposed by the CEE (2013) and adds two more contents, precisely, comprehending risks and go-to information sources. Lusardi *et al.* (2017b) propose a questionnaire of 28 questions with three to four items for each content area. The P-fin index is the only FL measure that integrates all the cited content areas. Their objective was to build a general index. Moreover, they investigate the link between FL and several financial behaviors.

(2) Classification of items into the P-Fin content areas

The bulk of studies measuring FL use items without automatically referring to their content areas. In what follows, we classify the items used in the literature into the content categories identified by Lusardi *et al.* (2017b). We refer to the P-Fin content areas because they are the most detailed and can be used to classify the majority of items. Moreover, this classification allows for identifying the importance of the different areas of knowledge in the literature.

Table 1 displays a classification of the items used in the literature into the P-Fin content areas. It shows that the most assessed contents are investment and saving. The second most evaluated content is borrowing. Then we find consumption, insuring and earning areas in the

third, fourth and fifth places, respectively. Few studies integrate items related to the area of go-to information sources in FL measure. Indeed, several studies consider this content as a variable that could influence individuals' financial decision-making, but they do not incorporate it in FL measure (Bernheim, 1998; Hilgert *et al.*, 2003; Calcagno and Monticone, 2015; Hsiao and Tsai, 2018). Finally, only one study includes the comprehending risk area in its FL measure.

The number of items in each content area differs among studies. It varies between 1 and 17, depending on the domain and the study. Some studies use items not related to any of the P-Fin content areas. For instance, some papers integrate numeracy [1] items, which are not applied to specific financial circumstances (French and Mckillop, 2016; Lusardi and Mitchell, 2007b; Lusardi, 2012).

3.2.2 Classification of items according to their sophistication level. van Rooij *et al.* (2007, 2011a, b) were the first to classify items according to their sophistication level. They perform a factor analysis on the item responses and identify two main factors. They interpret these two factors as basic and advanced FL items. Then, they propose two FL indexes, namely basic and advanced. According to van Rooij *et al.* (2011a, b), the basic financial knowledge covers workings of simple and compound interest rates, time value of money, inflation and money illusion. The advanced financial knowledge contains more advanced topics related to knowledge of financial securities and investment principles [2]. To measure FL, Von Gaudecker (2015) calculates a financial numeracy index based on four questions assessing the numeracy capacity to compute simple financial matters. The four questions are taken from van Rooij *et al.* (2011a) FL basic index.

Some studies sustain that basic FL items are related to daily financial decisions. However, advanced FL items are related to occasional investment decisions. Although van Rooij *et al.* (2011a, b) define items related only to saving (basic) and investment (advanced), we cannot say that either basic or advanced FL items should belong to a specific content area. It is worth

P-Fin content areas	Literature
Investment saving	Moore (2003), Lusardi and Mitchell (2006; 2011; 2017; 2007a; 2008; 2014), Arrondel *et al.* (2013), Agarwal *et al.* (2015), van Rooij *et al.* (2011a, b), Bernheim (1998), Paiella (2016), Anderson *et al.* (2017), Hilgert *et al.* (2003), Idris *et al.* (2016), Grohmann (2018), Al-Tamimi and Bin Kalli (2009), Amari and Jarboui (2015; 2017), Bianchi (2018), Sivaramakrishnan *et al.* (2017), Hsiao and Tsai (2018), Lusardi *et al.* (2010), Finke *et al.* (2016), Potrich *et al.* (2018; 2015), Driva *et al.* (2016), Arceo-Gómez and Villagómez (2017), Kiliyanni and Sivaraman (2016), Calcagno and Monticone (2015), Shen *et al.* (2016), Potrich and Vieira (2018)
Borrowing	Moore (2003), Lusardi and Tufano (2009a; 2015), Bernheim (1998), OECD (2013; 2014), Hilgert *et al.* (2003), Anderson *et al.* (2017), Paiella (2016), French and Mckillop (2016), Hsiao and Tsai (2018), van Ooijen and van Rooij (2016), Finke *et al.* (2016), Potrich *et al.* (2015), Kiliyanni and Sivaraman (2016), Shen *et al.* (2016), Potrich and Vieira (2018)
Consumption	Moore (2003), OECD (2013; 2014), Bernheim (1998), French and Mckillop (2016), Hsiao and Tsai (2018), Potrich *et al.* (2018; 2015), Driva *et al.* (2016), Potrich and Vieira (2018)
Insurance	Hilgert *et al.* (2003), OECD (2013), Lusardi and Mitchell (2007b), Hsiao and Tsai (2018), Finke *et al.* (2016), Shen *et al.* (2016)
Earning	OECD (2013), Lusardi and Mitchell (2007b), French and Mckillop (2016), Hsiao and Tsai (2018)
Go-to information sources	Moore (2003), OECD (2013), Hsiao and Tsai (2018)
Comprehending risk	Kiliyanni and Sivaraman (2016)

Table 1. Classification of the items used in the literature into the P-Fin of Lusardi *et al.* (2017b) content areas

noting that Shen *et al.* (2016) refer to both Huston (2010) and van Rooij *et al.* (2011a, b) in constructing their FL items. They define basic and advanced FL items in each one of the four content areas proposed by Huston (2010). Hsiao and Tsai (2018) identify basic and advanced FL items based on factor analysis. Both subsets of questions cover four content areas similar to those proposed by Huston (2010). Thus, both basic and advanced FL items are not necessarily related to a specific content area.

3.3 Subjective financial literacy measures

Subjective FL refers to individuals' financial confidence level and evaluates the individuals' self-assessed financial knowledge or perceived knowledge (French and Mckillop, 2016; Bellofatto *et al.*, 2018). For the subjective FL measures, there is a consensus among researchers about the items. Several studies evaluate individuals' own perceived FL by addressing a single question with a Likert scale assessing how respondents perceive their level of FL (Lusardi and Mitchell, 2007a; Moore, 2003; Bernheim, 1998; Bayrakdaroğlu and Şan, 2014; Lusardi and Tufano, 2009a; Allgood and Walstad, 2016).

Other studies evaluate both objective and subjective FL levels. The comparison between the two measures helps assess the individuals' confidence in their financial knowledge (Bayrakdaroğlu and Şan, 2014; Lusardi and Mitchell, 2007a). In each identified content area, Finke *et al.* (2016) and Kiliyanni and Sivaraman (2016) add one question about the perceived FL level. Finke *et al.* (2016) measure two FL scores, one for the knowledge and the ability to use it and the second for the confidence in that knowledge. They use four questions to assess the level of respondents' confidence. They find that confidence in financial decision-making abilities does not decrease with age among elderly Americans. Thus, old Americans are overconfident in their level of FL. Kiliyanni and Sivaraman (2016) find that young Indians overrate their FL level by 50%, indicating an overconfidence in their financial knowledge. Bianchi (2018) assesses the level of subjective FL of individuals by asking them to evaluate their performance relative to other respondents. He finds a positive correlation between the objective and subjective levels of FL.

After evaluating the objective FL level, and to assess the overconfidence of respondents, Anderson *et al.* (2017) ask the respondents to specify the probability of having zero to five right answers [3]. They find that financial decision-making is more related to the overconfidence of LinkedIn US members than to their actual knowledge. Allgood and Walstad (2016) propose a new measure of FL that combines both objective and subjective measures. They demonstrate that financial behavior is a function of both objective and subjective FL measures. Furthermore, the combined measure performs better in assessing financial behavior than the objective one.

4. Study topics and content areas

The variety of study topics and, in particular, the variety of financial decisions considered could be another factor explaining the diversity of FL measures used in the literature. Most empirical studies measure the level of FL of a particular population for a specific financial decision. The studied financial decisions are planning and saving for retirement, debt management, loan characteristics and overindebtedness of households, financial planning and stock market participation. Moreover, some studies measure the FL level of a specific population (young, retired, elderly and women). Given that the P-Fin index of Lusardi *et al.* (2017b) is the most general FL measure, we will hereafter match its content areas with the study topics. To the best of our knowledge, the previous literature reviews on FL measures did not establish this link.

4.1 Planning and saving for retirement

The liberalization of pension systems in several countries made individuals responsible for their retirement planning. This fact explains the growing number of studies focusing on this topic (Lusardi and Mitchell, 2007a, b, 2008, 2011; van Rooij *et al.*, 2011b; Anderson *et al.*, 2017; Hilgert *et al.*, 2003). Bernheim (1998) was among the first to discuss the effect of FL on the ability of US retired households to make financial decisions. He suggests that Americans do not save for their retirement, and even if they do, they do not save enough. He shows that the lack of knowledge to make informed financial decisions is one of the reasons that explain this behavior.

The majority of studies use Lusardi and Mitchell (2006) three items, which are related to the saving and investment content areas (Lusardi and Mitchell, 2008, 2011, 2017). In addition to these items, some other studies add items related to consumption (Bernheim, 1998), earning (Lusardi and Mitchell, 2007b) and borrowing (Bernheim, 1998; Anderson *et al.*, 2017).

Lusardi and Mitchell (2007b) investigate the accumulation of wealth among baby boomers in 2004 and individuals of the same age in 1992. They use the data collected by the HRS. van Rooij *et al.* (2011b) study the effect of financial knowledge in retirement planning in the Netherlands, and Boisclair *et al.* (2017) in Canada. Anderson *et al.* (2017) investigate the relationship between FL and planning for retirement among LinkedIn US members in 2014. Lusardi and Mitchell (2017) use data from the Rand American Life Panel (ALP). All these studies report a positive correlation between the FL level and the planning for retirement.

4.2 Debt management, loan terms and overindebtedness

Another strand of the literature investigates the relationship between the level of FL of households and their indebtedness. They examine the credit management (Hilgert *et al.*, 2003), the loan terms (Moore, 2003), the debt reimbursement behavior (Lusardi *et al.*, 2017a) and the overindebtedness of households (Lusardi and Tufano, 2009a, 2015; Lusardi *et al.*, 2017a; van Ooijen and van Rooij, 2016). van Ooijen and van Rooij (2016) note that debt literacy is more accurate than basic FL for measuring indebtedness and mortgage behavior. All these studies use items related to the borrowing area to measure debt literacy. Hilgert *et al.* (2003), Moore (2003), Lusardi *et al.* (2017a) and Idris *et al.* (2016) incorporate saving and investment areas. Moore (2003) and Lusardi *et al.* (2017a) add items related to consumption and go-to information sources areas. French and Mckillop (2016) assess money management skills by items related to consumption, borrowing and earning areas.

Most studies find that debt literacy is negatively correlated with debt burden and cost (Lusardi and Tufano, 2009a, b, 2015; Lusardi *et al.*, 2017a). French and Mckillop (2016) evaluate the relative importance of numeracy and money management skills in the determination of UK households' debt level and net worth. They show that money management skills reduce the debt-to-income ratio, the use of high-cost loans, the number of lenders and increase households' net worth. The only study finding the opposite results is van Ooijen and van Rooij (2016), who examine the relationship between debt literacy, financial advice and mortgage loan decisions in the Netherlands. They use the debt literacy questionnaire of Lusardi and Tufano (2015) and find that the riskiness of mortgages is positively related to the debt literacy of homeowners.

4.3 Financial planning

There is a growing body of literature investigating the effect of FL on household financial planning decisions. This growing interest could be explained by the importance of these decisions for the individuals and the whole society's well-being. It is worth noting that

financial planning decisions cover several types of financial decisions. Agarwal *et al.* (2015) define financial planning as decisions related to investment behavior, risk tolerance, insurance usage and liability choice. Hilgert *et al.* (2003) investigate the relationship between the financial knowledge of American households and decisions related to cash management, debt management, savings and investment. They use items related to investment, saving and borrowing. They find a positive correlation between financial knowledge and the studied financial decisions. Arrondel *et al.* (2013), Agarwal *et al.* (2015) and Grohmann (2018) conclude that people who are more financially literate are more likely to prepare a clear long-term financial plan and have better financial decision-making. These three studies follow Lusardi and Mitchell (2011) approach to construct the questionnaire. The questions cover saving and investment areas.

Campbell (2006) finds that poor and less educated American households are more likely to make serious investment mistakes such as noninvestment in risky assets, underdiversification of risky asset holdings and failure to exercise options on mortgages appropriately. Calvet *et al.* (2007) show that Swedish financially sophisticated households make more efficient investment decisions, but also take more risks. They use wealth, education and the ratio of private pension contribution to income as proxies for financial sophistication.

4.4 Stock market participation

The stock market development is an essential factor contributing to the economic development of nations. Several studies are concerned with the issue of identifying factors that enhance the stock market development. In this context, some studies investigate the effect of FL on stock market participation and portfolio diversification.

Al-Tamimi and Bin Kalli (2009), Amari and Jarboui (2017) and van Rooij *et al.* (2011a) investigate the effect of the FL level of individuals on stock market participation in UAE, Tunisia and the Netherlands, respectively. They use items related to saving and investment areas in their measures of FL. The items assessing investment area are mainly related to the stock market and financial products. All these studies show that the more people are financially literate, the more they will participate in the stock market. Sivaramakrishnan *et al.* (2017) study the impact of FL on stock market participation in India. They use basic and advanced FL items as specified by van Rooij *et al.* (2011a) and Agarwall *et al.* (2015). Items are related to saving and investment areas. They find that only advanced FL is a predictor of equity holding.

Hsiao and Tsai (2018) study the relationship between FL level and active participation of individuals in derivative markets in Taiwan. The questionnaire includes general FL questions and specific question related to derivative products and management. The general FL questions cover four content areas similar to those proposed by Huston (2010), but larger [4]. Their items cover all the P-Fin content areas. They find that FL has a positive effect on purchasing complex derivative products.

Another line of research focuses on the relationship between FL and portfolio diversification. In this context, the most used content area is saving (Von Gaudecker, 2015). In addition to this content area, Amari and Jarboui (2015) use items related to investment. Bianchi (2018) examines the relationship between FL and portfolio choice and returns among French households. He uses items related to saving, investment and insuring. All these studies show that FL is highly and positively correlated with portfolio diversification and investment outcome.

4.5 Studies measuring financial literacy of a particular population

Lusardi *et al.* (2010) assess the level of FL among 7417 US youth aged between 23 and 28. They use the three questions designed by Lusardi and Mitchell (2006) for the HRS, covering saving and investment areas. They find that the level of FL is low and is correlated to

sociodemographic characteristics and family background. Women have lower FL levels than men. Educational level is associated with a higher level of FL. Finke *et al.* (2016) measure the level of FL of 60-year-old and more households in the USA between 2009 and 2013. In their measure, they include 20 items, four of which assess subjective FL. The remaining items cover the areas of investment, saving, borrowing and insurance. They find a linear decline in both FL level and cognitive abilities after the age of 60. Using the P-Fin index (all content areas), Yakoboski *et al.* (2018) and Hasler *et al.* (2017) measure the FL level of US adults. They show that, on average, it is low.

Potrich *et al.* (2018) measure the FL of Brazil citizens. They ask 38 questions, 15 of which are related to financial attitude, especially financial planning, and 13 are related to financial behaviors, including consumption and saving. Finally, ten questions are related to financial knowledge. Items are mostly related to the investment area. Potrich *et al.* (2015) measure the level of FL among southern Brazil adults. They use 37 items covering consumption, saving, borrowing and investment areas. Both studies find that the FL level is low in Brazil, especially for women. Driva *et al.* (2016) confirm the same result for 418 German teenagers in 2013. They use 12 items to assess knowledge related to consumption, saving and investment areas.

The low level of FL was also documented by Kiliyanni and Sivaraman (2016) for 736 educated adults in Kerala, an Indian town, and Arceo-Gómez and Villagómez (2017) for Mexican high school students. Rakow (2019) measures the FL level of US college students specialized in accounting. He incorporates a FL textbook in Intermediate I and II courses. Then he evaluates the change that occurred in their FL level between the beginning and the end of the semesters. The results show a significant improvement in the students' FL level. Moreover, they became more confident in their financial decisions.

4.6 Other topics

Calcagno and Monticone (2015) investigate the effect of FL on Italian investors' demand for financial advice. They ask eight questions assessing saving and investment areas. They find that customers with higher levels of FL are more likely to consult an advisor. Shen *et al.* (2016) study the relationship between FL and financial disputes in Taiwan. They use items related to the four content areas proposed by Huston (2010). They find that persons with a high level of FL are less likely to experience financial disputes. Potrich and Vieira (2018) examine the relationship between FL and the materialism, compulsive buying and propensity to indebtedness among Brazilians. They ask 38 questions covering consumption, saving, borrowing and investment areas. They find that FL has a positive effect on compulsive buying by improving it. It affects, to a lower extent, the propensity to indebtedness and then the materialism.

Fernandes *et al.* (2014) ran a meta-analysis of the relationship between FL programs and financial behavior in 168 papers. They find that FL programs can explain only 0.1% of the variance in financial behavior. Plus, FL interventions do not change the low-income sample behavior significantly. Then, they conduct three studies replicating previous ones but adding some traits correlated with both financial literacy and financial behavior. Their purpose is to examine if the variability in the studies' results could be attributed to the omitted variables. They find that the effect of FL decreases as they incorporate the omitted variables.

5. Measuring financial literacy

After constructing the questionnaire and administrating it, comes the time to analyze answers and calculate the FL level. Two methods are used to evaluate the FL level. The first is the calculation of a score, while the second is a statistical treatment of data. It should be mentioned that some studies retain the three questions of the 2004 HRS survey and do not calculate a

global score of FL (Lusardi and Mitchell, 2008, 2011; Agarwal *et al.*, 2015). These papers analyze the rate of correct answers for each question in relation to the other studied variables.

The most used method in the literature to assess the FL of an individual is based on the calculation of a score of correct answers (Beal and Delpachitra, 2003; Kiliyanni and Sivaraman, 2016). Some studies calculate a simple score of correct answers (Bernheim, 1998; Moore, 2003; Hilgert *et al.*, 2003; Al-Tamimi and Bin Kalli, 2009; Rakow, 2019; Finke *et al.*, 2016; Kiliyanni and Sivaraman, 2016; Amari and Jarboui, 2017; Lusardi *et al.*, 2017b; Bianchi, 2018). This score represents the percentage of right answers and gives the same weight to all the used items. Moore (2003) calculates several subscores of FL, namely financial knowledge, experience, positive behavior and negative behavior. She subsequently insisted on the fact that the combination of the four scores computed indicates the level of the FL of individuals.

The limit of this method is that the weight given to each content area, which depends on the number of items related to each content area, will not be the same for all studies. This restricts the studies' comparability. Although we find a slight agreement between researchers regarding the content areas for each type of subject treated, the number of items in each area is variable. Therefore, the FL measures used in the literature are different and noncomparable. Besides, the number of items varies among studies. It ranges from 3 to 39 (Moore, 2003) or even 40 (OECD, 2013). To overcome this limitation, some studies give almost the same weight to each content area by asking the same number of questions in each area. For instance, Huston (2010) recommends using three to five items per content area. Lusardi *et al.* (2017b) retain three to four items per content area, giving the same weight to all areas in their P-Fin index.

An alternative index is a weighted score of correct answers (OECD, 2013). The OECD (2013) proposes to use three levels of weights related to the content area, the cognitive process of learning and the context of the study. According to the OECD (2013), the three-level weight choices should depend on the real-life situation and problems confronting the young people in their daily lives or at home.

Only some studies perform a factor analysis on the responses collected to measure the level of FL (Jonsson *et al.*, 2017; Yoong, 2011; Grohmann *et al.*, 2015; Shen *et al.*, 2016). van Rooij *et al.* (2011a, b) run a factor analysis on the responses to the 16 questions of the FL module. They identify two FL factors: basic and advanced. Then they apply another factor analysis on the two subsets to determine the factor loadings and calculate the scores. Hsiao and Tsai (2018) follow the same methodology as van Rooij *et al.* (2011a, b) for 37 FL items. Their results confirm the presence of two sets of FL indices: basic and advanced. Von Gaudecker (2015) refers to van Rooij *et al.* (2011a, b) methodology to measure the FL level. Lusardi and Mitchell (2007a) undertake the factor analysis on the 13 questions they asked, five of which are basic. They have been able to determine a single index measuring the level of FL that they have subsequently connected with the other variables to consider. Lusardi and Mitchell (2017) apply the same methodology on two sets of questions. The first is related to basic financial knowledge and follows the HRS approach. The second is the sophisticated financial knowledge set. It includes questions about investment and risk management.

6. Conclusion

In this paper, we reviewed the main approaches used in the literature to assess the individuals' FL. First, we showed that the FL concept interferes with the field of educational science. Other terms, such as knowledge, abilities, skills, behavior, decision and experience, are also used to refer to FL. The diversity of these terms indicates the variety of FL definitions and could explain the variety of used measures (Allgood and Walstad, 2016; Hung *et al.*, 2009; Kimiyaghalam and Safari, 2015).

A crucial step in constructing a FL measure is to identify the questions that should be asked. Some studies designed their questionnaire from scratch (Bernheim, 1998; Moore, 2003; Lusardi and Tufano, 2015). Others used items from previous studies that do not necessarily deal with the same research topic (Sivaramakrishnan *et al.*, 2017; Agarwal *et al.*, 2015; Idris *et al.*, 2016; Arrondel *et al.*, 2013). Moreover, before defining the set of questions we have to identify which type of FL we are willing to assess. The majority of studies focus on the objective FL, which is the actual financial knowledge and skills of the respondents. Others investigate the subjective FL, which assesses the individuals' self-confidence (French and Mckillop, 2016; Bellofatto *et al.*, 2018). Among others, Finke *et al.* (2016) and Kiliyanni and Sivaraman (2016) combine both objective and subjective FL items to measure the FL level. There is a myriad of items in the literature assessing the objective FL level, while it is not the case for the subjective FL.

In this paper, we focused on objective FL items used in the literature because of their diversity. We classified them according to two criteria, namely the content area and the sophistication level. Huston (2010), OECD (2013) and CEE (2013) suggest conceptualizations of the content areas. More recently, Lusardi *et al.* (2017b) propose the P-Fin index, which presents a broader and more general conceptualization of content areas. The majority of studies measuring FL use items without referring to their content areas. As a contribution of this paper, we classified the items used in the literature into the content categories identified by Lusardi *et al.* (2017b). We noted that the most used content areas are investment and saving. As far as the items' sophistication level is concerned, van Rooij *et al.* (2007, 2011a, b) were the first to use this criterion. They identify items related to basic financial knowledge and others related to advanced financial knowledge.

Moreover, we remarked that the different studies, measuring FL, deal with several topics. The variety of study topics, and in particular, the variety of financial decisions considered could explain the diversity of FL measures used in the literature. The used content areas vary across different studies. However, we find investment and saving areas in almost all studies. Finally, the index measuring FL is calculated in two ways. The first is a score representing the percentage of right answers. The second is performed via a factor analysis, which is a statistical treatment.

To conclude, we note that despite the great variety of FL measures, there is some homogeneity between the studies regarding the content areas of items for each subject of research. To the best of our knowledge, no previous research highlighted the relationship between the subjects treated and the content areas of items. Our results are important for researchers aiming to assess individuals' FL. It discusses and synthesizes the measures presented in the literature, which are not universal and mainly depend on the study topic. Therefore, it would be interesting in future researches to propose specific FL measures to each study topic. Moreover, FL is not only important for personal financial decisions, but it is also crucial for entrepreneurs. Future studies should analyze the definition and measures of entrepreneurs' FL, which is different from personal FL. They also should identify content areas related to entrepreneurial FL.

Notes

1. Calculation capacity, percentage calculation.
2. The difference between stocks and bonds, risk diversification, role of the stock market, the relationship between the interest rate and bond prices.
3. They were asked to respond to five objective FL questions. Then they were asked to specify for each number of right answers the probability that they got the right answer.
4. Money management and savings, credit and loan management, financial and investment planning and insurance and pension planning.

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Corresponding author
Olfa Belhassine can be contacted at: olfa.belhassine@esct.uma.tn

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