Financial literacy in Brazil – do knowledge and self-confidence relate with behavior?

Thiago Borges Ramalho[a] and Denis Forte[a,*]
[a]Universidade Presbiteriana Mackenzie, Sao Paulo, Brazil

Abstract

Purpose – People are increasingly responsible for making sound financial decisions to foster their financial satisfaction and well-being, which magnifies the importance of financial literacy, and this concept and measurement is still not yet crystallized in the literature, specifically capturing different behavior perceptions. Moreover, there is not a distinction based on different classifications of behavior, such as over or underconfidence, to understand the relation between literacy and decision process. To fill this gap, this paper aims to investigate whether the financial literacy conceptual model proposed applies similarly to every group independently of their previous self-confidence perception. For this purpose and quality control, OECD (2016) data were used with a final sample of 1,487 Brazilian citizens. Quantitative analysis technique using partial least squares structural equations path modeling and differences between groups using multi-group analysis was applied. In line with general studies, when analyzing the financial literacy usual model for the group as a whole, financial knowledge construct positively influences self-confidence, and both together positively affect financial behavior. However, for individuals with low financial knowledge and low self-confidence, as well as for those with too much or too little confidence, the model did not hold. Therefore, self-confidence perception influences the way financial knowledge is used for financial decisions and should be addressed in financial education and training to be more effective.

Design/methodology/approach – To operationalize the variables and test the paper's hypotheses, the authors used the methodology developed in OECD (2016), based on the research instrument's Brazilian application adapted from the questionnaire developed in OECD (2015), with data initially used and made available by Garber and Koyama (2016). Based on the recommendations of Hair Jr *et al.* (2017a, 2017b), the authors used partial least squares modeling PLS-PM (SmartPLS 3.2.6) to estimate the structural models.

Findings – Concerning structural relationships, the final model showed knowledge with a positive influence on self-confidence, self-confidence with a positive effect on behavior and knowledge with a positive influence on behavior, both directly and, through its relationship with self-confidence, indirectly. This underscores that, for the total sample, the greater people's knowledge and self-confidence, the better their behavior. The unexpected absence of attitude in the final model, even allowing for potential measurement problems, brings up an important reflection on the mediating effect that the self-control variable may exert between attitude and behavior. A person may believe that saving for the future is important (attitude) but whether they actually save (behavior) may depend on self-control, which is needed to prevent immediate gains from being prioritized in practice.

Research limitations/implications – The findings reported so far concern the study's total sample. However, as expected from the literature review that provides the basis for the sixth and the most important hypothesis, respondents were found to be heterogeneous in terms of knowledge and self-confidence levels. These differences were evaluated by means of multi-group analyses that indicated that the model does not apply to respondents with low knowledge and low self-confidence and to those who are over- and

underconfident. This implies inferring that financial education programs may be of little use if they only address technical knowledge development and fail to consider behavioral aspects such as those related to self-confidence, as this paper points out, and others. This signals the importance of diagnosing people's profiles to enable developing solutions capable of minimizing the presence of behavioral biases. This need to be studied further.

Practical implications – The results imply inferring that financial education programs may be of little use if they only address technical knowledge development and fail to consider behavioral aspects such as those related to self-confidence, as this paper points out, and others. Models must be reviewed in light of natural diferences of cognition and lead to customized financial education.

Social implications – This signals the importance of diagnosing people's profiles to enable developing solutions capable of minimizing the presence of behavioral biases. Therefore, not only training topics in personal finance but also a deeper education program since the kindergarden must be considered.

Originality/value – Its practical contribution is to suggest the development of financial education programs that also take account of the potential presence of behavioral biases, which may prevent the misallocation of (scarce) public- and private-sector funds stemming from a limited focus on developing the population's actual financial knowledge.

Keywords Financial literacy, Overconfidence, Financial behaviour, Underconfidence

Paper type Research paper

1. Introduction

Financial literacy has been gaining room in the agendas of public managers, government agencies and other organizations (Lusardi and Mitchell, 2014; OECD, 2016). Notwithstanding, the literature still lacks consensus on how to work with it (Huston, 2010; Fernandes *et al.* 2014). Several studies have conceptualized and operationalized financial literacy as synonymous with actual financial knowledge, while others embrace a multi-dimensional view that usually involves financial knowledge, attitude and behavior.

Studies that operationalize financial literacy as actual financial knowledge provide more restrictive definitions that emphasize the understanding of basic financial concepts without addressing whether and how this understanding is put to use. However, financial literacy should reflect people's ability to understand financial information and use it skillfully and confidently (Huston, 2010) and must be understood as a complex phenomenon made up of a combination of knowledge, attitude and behavior (OECD, 2016), which lends sense to the use of a multi-dimensional view to conceptualize and operationalize the construct.

The problem is that even studies that embrace a multi-dimensional view fail to converge, even if they adopt the same dimensions. In this sense, Potrich *et al.* (2016) made a great contribution by empirically testing and comparing models to find that the best fit was the one that adopted financial knowledge and financial attitude in mutual correlation as predictors of financial behavior.

Therefore, the model proposed by Potrich *et al.* (2016) approaches the conceptual financial literacy model of Hung *et al.* (2009a, 2009b), where financial behavior is influenced by skills, actual financial knowledge and perceived financial knowledge (relates with self-confidence). This brings into the debate the relevant role that behavioral biases may play in people's decision-making process.

Based on the above, and to contribute to the still controversial academic debate, financial literacy has not been conceptualized in this study as a stand-alone variable, but rather as a set of relationships that allow explaining financial behavior, even if only partially. Therefore, as suggested by Potrich *et al.* (2016), and together with what Hung *et al.* (2009a, 2009b) propose, the antecedents of financial behavior for this paper's purposes were actual financial knowledge, financial attitude and perceived financial knowledge, resulting in an

unprecedented financial literacy conceptual model, which is an important contribution from this study.

To empirically test the study's hypotheses, we used data from the OECD (2016) study that have also been used and made available in Garber and Koyama (2016). The data concern a final sample of 1,487 Brazilian citizens that are heterogeneous in terms of their actual financial knowledge and perceived financial knowledge.

To investigate whether the heterogeneity across these four groups implies in different behaviors in the light of the financial literacy conceptual model at hand, we ran multi-group analyses whose conclusions, involving the identification of relevant inter-group differences, are this study's main contributions.

Starting from the scenario above and the proposed hypotheses, the study's driving question was: Does the proposed financial literacy conceptual model apply similarly to groups of people with different combinations of actual financial knowledge and perceived financial knowledge? The study aimed therefore to check and empirically evaluate whether statistically significant differences exist in the structural coefficients found in the financial literacy model's structural relationships, considering the various groups of individuals with different combinations of actual financial knowledge and perceived financial knowledge.

In addition, some specific objectives were set: to revise the concept, mensuration types and models of financial literacy; to present a conceptual model of financial literacy; to measure the variables in the proposed financial literacy model; to evaluate the structural relations of the proposed financial literacy model including control variables; and to propose a final model of financial literacy.

2. Literature review

Financial literacy is a key element for any successful national strategy that is one capable of identifying solutions to improve the lives of the respective populations (OECD, 2016). Given its current relevance, a growing number of studies address the subject, as seen in Figure 1, which charts the annual evolution of publications on "financial literacy" according to the Web of Science base.

Despite the growing number of financial literacy publications and the huge convergence in terms of its current relevance (Potrich *et al.*, 2015a, 2015b), consensus is paradoxically lacking in Academia on how to conceptualize and operationalize it (Huston, 2010).

In studies that operationalize financial literacy as actual financial knowledge, more restrictive definitions have been provided, adding emphasis to the understanding of basic
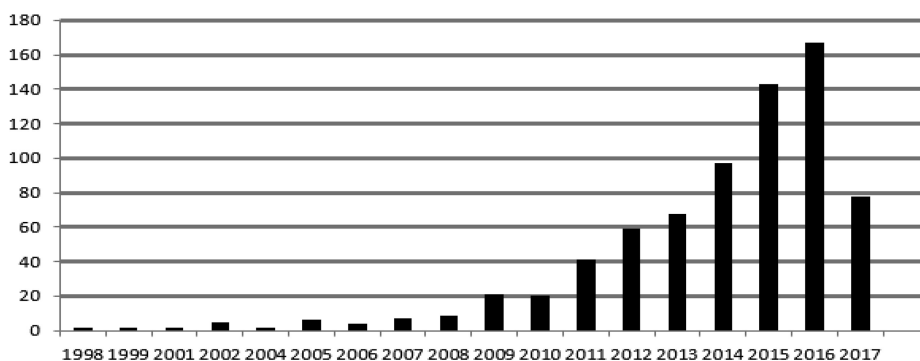
Source: Authors (2017)

Figure 1.
Evolution of the
annual number of
papers on financial
literacy

financial concepts and not addressing whether and how this understanding is put to use. On the other hand, OECD (2013) defines financial literacy as knowledge and understanding of financial concepts and risks that can be applied with motivation, confidence and skill to their financial decisions as means to improve individuals' financial well-being. Thus, for a more comprehensive definition of financial literacy, studies also exist that do so multi-dimensionally (Table I).

Based on the different approaches, Potrich et al. (2016) developed and compared three models and concluded that mutually correlated financial knowledge and financial attitude predict financial behavior. In a certain way, this conclusion approaches the model submitted in Huston (2010), where financial behavior is explained by factors associated with human capital. It is also somewhat similar to the financial literacy conceptual model of Hung et al. (2009a, 2009b), where financial behavior is influenced by actual and perceived financial knowledge and skills.

Based on the papers of Potrich et al. (2016) and Garber and Koyama (2016), and in the light of the importance of perceived knowledge as argued in Hung et al. (2009a, 2009b), financial literacy is represented as a model in which actual financial knowledge is a predictor of perceived financial knowledge and financial attitude, and all three explain financial behavior, the main variable of interest for this study.

Behaviors are observable actions that represent how individuals act under certain conditions (Schader and Lawless, 2004). Therefore, in a study of financial literacy, it is essential to evaluate people's decision-making process to enable investigating whether they

One-dimensional view	Multi-dimensional views
Chen and Volpe (1998)	Hung et al. (2009a, 2009b)
Chen and Volpe (2002)	Norvilitis and Maclean (2010)
Hogarth and Hilgert (2002)	OECD (2013)
Fox et al. (2005)	Potrich et al. (2013)
Lusardi and Mitchell (2006)	Agarwalla et al. (2013)
Lusardi and Mitchell (2007a)	Potrich et al. (2015a)
Lusardi and Mitchell (2007b)	Potrich et al. (2015b)
Lusardi and Mitchell (2008)	Potrich et al. (2016)
Mandell and Klein (2009)	OECD (2016)
Choi et al. (2010a)	Garber and Koyama (2016)
Lusardi et al. (2010)	
Lusardi and Mitchell (2011a)	
Lusardi and Mitchell (2011b)	
Cole et al. (2011)	
Van Rooij et al. (2011a)	
Van Rooij et al. (2011b)	
Van Rooij et al. (2012)	
Gathergood (2012)	
Fonseca et al. (2012)	
Jappelli and Padula (2013)	
Klapper et al. (2013)	
Gibson et al. (2013)	
Schicks (2014)	
Armantier et al. (2015)	
Allgood and Walstad (2016)	

Table I.
Studies on financial literacy

Source: Authors (2017)

display financially positive behaviors, which may result in improved resilience in times of crisis (OECD, 2016), in fostering financial well-being (Huston, 2010; OECD, 2013, 2016), and in greater financial satisfaction (Daniel; Martin; Maines, 2004; Joo and Grable, 2004).

Concerning personal finances, the OECD (2016) states that the following kinds of behavior can be measured and analyzed: budgeting, saving, shopping, payments, financial products selection and choice, goals and control.

Concerning knowledge, its concept is represented by all the information that people possess. In this line, several authors have been taking actual financial knowledge synonymously with financial literacy but remains an important component even in studies that adopt a multi-dimensional approach, as it enables people to make appropriate and well-informed financial decisions (OECD, 2016).

The literature indicates a relationship between financial knowledge and several economic behaviors (Lusardi and Mitchell, 2007a, 2007b, 2014; Mandell and Klein, 2009; Remund, 2010; Choi *et al.*, 2010a, 2010b; Gathergood, 2011; Van Rooij *et al.*, 2011a; Van Rooij *et al.*, 2011b; OECD, 2016; Garber and Koyama, 2016). Thus, emphasizing the significant and growing literature that demonstrates an association between actual financial knowledge and financial behavior, we developed this study's first hypothesis:

H1. Actual financial knowledge is positively associated with financial behavior.

Additionally, attitude covers three components: cognitive (belief or ideas), affective (feelings) and conative (behavioral) (Schader and Lawless, 2004). Therefore, attitudes relate with preferences that may influence behaviors. Even in the case of people with sufficient knowledge and skill to behave in a certain way, their attitude will influence the decision on whether to act (OECD, 2016). Thus, financial attitude is deemed as an important element of financial literacy, given that individual preferences are determinants of financial behavior (OECD, 2013, 2016).

In this context, Potrich *et al.* (2015a, 2015b) stress that financial learning is determinant in the formation of responsible financial attitudes and behaviors. Norvilitis and Maclean (2010) state that knowledge affects attitude, which in its turn influences financial behavior, whereas Potrich *et al.* (2016) argue that financial knowledge and financial attitude, in mutual correlation, influence financial behavior. Garber and Koyama (2016) supplement this by indicating that financial knowledge and financial attitude help explain financial behaviors.

These studies support the following hypotheses:

H2. Actual financial knowledge is associated with financial attitude.

H3. Financial attitude is positively associated with financial behavior.

It is worth emphasizing that this study used the data made available in Garber and Koyama (2016) for OECD (2016), where financial attitude was linked with intertemporal choice and where desirable attitudes were deemed to be those reflecting a preference for long-term benefits.

In addition, financial literacy includes more than just knowledge and, as such, it is equally important to understand self-confidence-related aspects (Asaad, 2015). Therefore, if actual financial knowledge concerns the knowledge that one indeed possesses, perceived financial knowledge subjectively represents people's self-confidence in their financial knowledge (Hung *et al.*, 2009a, 2009b; Asaad, 2015; Robb *et al.*, 2015; Allgood and Walstad, 2016; Zahirovic-Herbert *et al.*, 2016).

Based on this, Asaad (2015), Robb *et al*. (2015), Allgood and Walstad (2016) and Zahirovic-Herbert *et al*. (2016) categorize the relationship between actual and perceived knowledge into four groups: high actual and perceived knowledge; high actual knowledge and low perceived knowledge; low actual knowledge and high perceived knowledge, and low actual and perceived knowledge. Woodyard *et al*. (2017) define that low actual knowledge and high perceived knowledge denote overconfidence, as high actual knowledge and low perceived knowledge represent under-confidence.

Overconfident people believe themselves capable of making decisions unassisted and become more vulnerable to fraud (Drew and Cross, 2013; OECD, 2016). The reverse of overconfidence – under-confidence – has also been the subject of recent studies. Pikulina *et al*. (2017) find that overconfidence, as well as under-confidence, negatively affect investment-related behavior. Xia *et al*. (2014) claim that people who underestimate their knowledge are less likely to trade in the stock market, which may imply lower returns on their investments. The literature likewise includes studies that investigate relationships involving other levels of self-confidence and actual financial knowledge. Allgood and Walstad (2016) find that self-confidence is a good predictor of financial behavior, which finds confirmation in Woodyard *et al*. (2017), who conclude that both actual and perceived knowledge are positively associated with desirable behaviors. These studies therefore support the final hypotheses to be investigated here:

H4. Actual financial knowledge is positively associated with perceived financial knowledge.

H5. Perceived financial knowledge is positively associated with their financial behavior.

H6. Statistically significant differences exist in the structural coefficients for at least one among *H1*, *H2*, *H3*, *H4* and *H5*, considering the different groups in terms of actual and perceived financial knowledge combinations.

H6a. Among the people with high actual and perceived financial knowledge and the others.

H6b. Among the people with low actual financial knowledge and high perceived financial knowledge (overconfident people) and the others.

H6c. Among the people with high actual financial knowledge and low perceived financial knowledge (under-confident people) and the others.

H6d. Among the people with low actual and perceived financial knowledge and the others.

Consequently, the financial literacy conceptual model shown in Figure 2 displays the hypotheses regarding relationships among the variables actual financial knowledge, perceived financial knowledge, financial attitude and financial behavior, including control variables gender, age and education.

3. Methodological procedures
The purpose of OECD (2016) was to measure financial literacy by combining financial knowledge, attitude and behavior scores to check the impact of financial knowledge on
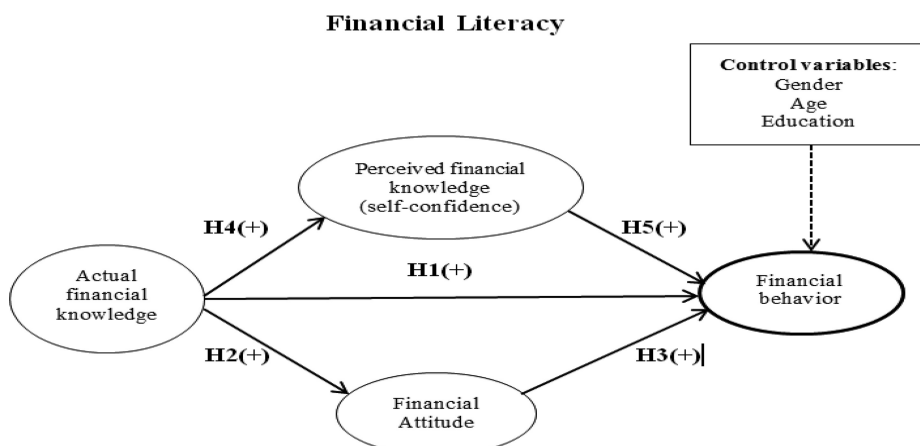
Financial Literacy

Source: Authors (2017)

certain behaviors, among other analyses. In Brazil, the OECD (2016) study occurred as a partnership involving the Central Bank of Brazil, information bureau Serasa Experian and a polling company IBOPE Inteligência, and interviewed 2002 representative respondents 16 years old or older (Garber and Koyama, 2016).

This paper operationalizes the variables and test the paper's hypotheses, by using the methodology developed in OECD (2016), based on the research instrument's Brazilian application adapted from the questionnaire developed in OECD (2015), with data initially used and made available by Garber and Koyama (2016).

Particularly, on respondents' perceived financial knowledge – their self-assessment of actual financial knowledge possessed – the following question was used: "Now, on a slightly different topic, how would you rate your financial knowledge level." For this question, a scale was used where 1 stands for "very good," 2 "good," 3 "average," 4 "poor" and 5 "very poor," the scale inversion justified by statistical calculations and analyses requirements. Respondents were then separated into groups with different profiles in terms of actual and perceived financial knowledge (self-confidence levels). Respondents with low and high actual financial knowledge scored below (1-4) and above (5-7) the average (4.38), respectively. Respondents with high and low perceived knowledge were those that respectively assessed their financial knowledge as poor (2 on the reverse scale) or very poor (1 on the reverse scale), that is, below average (3) and good (4 on the reverse scale) or very good (5 on the reverse scale, that is, above average (3).

Concerning actual financial knowledge, right answers to questions summed 1 point and wrong answers nothing (7 points for the seven possible correct answers).

In addition, financial attitude was calculated using the average of a Likert scale from 1 to 5, and for financial behavior all positive answers summed 1 point and the question for financial product choice 2, adding up to 9 points for the eight questions.

After obtaining the data, we checked for missing values and outliers. Out of the total 2,002 respondents, we identified 515 that failed to answer the savings-related question (excluded), reducing the sample size to 1,487. Out of these 1,487, 25 failed to answer the perceived financial knowledge question. Because they represented just 1.68 per cent of the sample, and following one of the data-substitution options given in Hair Jr *et al.* (2005),

the data were replaced with the respondents' average to prevent reducing sample size. No outliers were identified.

Based on Hair Jr *et al.*'s (2017a, 2017b) recommendations, we used partial least squares modeling PLS-PM (SmartPLS 3.2.6) to estimate the structural models. Because the models' variables are observable, representing indicators themselves, or measured as averages or scores (non-latent), we were unable to evaluate the measurement model, but only the structural models, through path analysis (Hair *et al.*, 2009), following the steps prescribed in Hair Jr *et al.* (2017a, 2017b). Effect size was classified as small (0.02), medium (0.15) and large (0.25), as recommended in Cohen (1988). To test for statistical significance, we resorted to bootstrapping with 5,000 re-samplings (also used to check every statistical significance in this study). Because there may be heterogeneity in structural models that is, statistically significant differences in the structural coefficients of two or more groups (Hair *et al.*, 2017b), such heterogeneity was investigated in this study by means of multi-group analysis, again using SmartPLS 3.2.6.

4. Results

As described in the upcoming sections, after evaluating of the complete model, with all variables – including controls – and corresponding to the model with the most predictors, the test's predictive power was evaluated using G*Power 3.1.9.2 and post hoc: Compute achieved power – given α, sample size and effect size analysis. Given the model's R-squared of 12.1 per cent, we arrived at an f-squared effect size = 0.138, which, together with a significance level of $\alpha = 0.05$, $n = 1,487$ and number of predictors = 6, results in statistical power of 1.00, confirming that sample size was appropriate. We emphasize that, even for the models evaluated in the section dedicated to multi-groups analysis, with smaller sample sizes, statistical power was again analyzed and always produced values in excess of 0.80, the ideal parameter according to Cohen (1988) for models with statistically significant adjusted R-squared at 5 per cent.

Table II shows the descriptive statistics of the conceptual model's variables.

Concerning perceived financial knowledge, which reflects respondents' self-confidence level, the average actual financial knowledge of respondent who self-evaluated themselves as good or very good was 4.56, as compared to 4.64 of those who self-evaluated as average, which, according to OECD (2016), suggests that at least some of those who believe they have above-average financial knowledge are in fact overconfident. The 3.86 average of those who

Variable	Quantity of respondents	Minimum	Maximum	Average	SD
Actual financial knowledge (0-7)	1487	0	7	4.38	1.58
Financial attitude (1-5)	1487	1	5	3.11	0.87
Perceived financial knowledge (1-5)	1487	1	5	2.95	0.98
Financial behavior (0-9)	1487	0	9	4.80	1.91
Low actual and perceived financial knowledge (0 and 1)	297	0	1	0.20	0.40
Overconfidence (0 and 1)	198	0	1	0.13	0.34
Underconfidence (0 and 1)	157	0	1	0.11	0.31
High actual and perceived financial knowledge (0 and 1)	253	0	1	0.17	0.38

Source: Authors (2017)

Table II.
Descriptive statistics of the variables

self-evaluated as poor or very poor reflects the fact that a significant share of respondents are clear on their actual financial knowledge levels, but this study also found under-confident respondents, that is, respondents who believe their actual financial knowledge level to be lower than it is in fact.

As concerns respondents' self-confidence, 297 showed low actual and perceived knowledge (20 per cent), 253 showed high actual and perceived knowledge (17 per cent), 198 were overconfident (13 per cent) because they showed low actual knowledge and high perceived knowledge and 157 (11 per cent) showed above-average actual knowledge and low perceived knowledge, indicating under-confidence. In total, 582 respondents (39 per cent) rated their knowledge as average. Out of these, 345 and 237, respectively, had actual knowledge above and below average, which to a certain extend reflects low and high self-confidence, but not to an excessive degree.

First, variable normality was checked by means of the Shapiro–Wilk test (Shapiro and Wilk, 1965), which rejected the null hypothesis of normality, indicating the need to use a nonparametric test for correlation analysis, such as the Spearman test (Choi *et al.*, 2010b), to ensure greater security surrounding the findings. Then we analyze association between variables, initially in bivariate fashion, the first step was to check the correlation coefficients (Table III).

Actual financial knowledge was positively correlated with perceived financial knowledge, but not with financial attitude (unexpected). As for financial behavior, the results indicate the absence of a correlation with financial attitude (also unexpected), and positive correlation with both actual financial knowledge and perceived financial knowledge, which enables an early identification of the importance of knowledge and self-confidence in explaining financial behavior.

4.1 Evaluation of the structural model

Adopting the recommendation in Atinc *et al.* (2012), the first model was estimated exclusively for the financial behavior endogenous variable, and control variables age, gender (male) and education (higher). As Table IV shows, the structural coefficients for gender and education were positive and statistically significant. However, the effect sizes of the structural coefficient for gender and age were not statistically significant, effectively meaning that this control variable had no effect on financial behavior. On the other hand, education's effect size was statistically significant (f-squared of 0.033, p-value 0.001).

Keeping just the control variable education, whose structural coefficient and effect size are statistically significant, the R-squared changed slightly to 3.0 per cent.

To evaluate the structural relationships without considering the effect of control variables, the second model was estimated with the exogenous variable actual financial knowledge and endogenous variables financial attitude, perceived financial knowledge and

Variable	KNLDG	AT	PERC KNLDG	BHVR
KNLDG	1			
AT	0.0444 (0.0873)	1		
PERC KNLDG	0.1821 (<0.0001)	−0.0823 (0.0015)	1	
BHVR	0.2187 (<0.0001)	−0.029 (0.2642)	0.2818 (<0.0001)	1

Note: Values in parentheses represent the p-value
Sources: Authors (2007), using the R software; KNLDG – Actual financial knowledge; AT – Financial attitude; PERC KNLDG – Perceived financial knowledge; BHVR – Financial behavior

Table III.
Correlation
(Spearman) test
results

financial behavior. As Table V shows, the structural relationships between actual financial knowledge and perceived financial knowledge, actual financial knowledge and financial behavior, and perceived financial knowledge and financial behavior were statistically significant with adjusted R-squared of 10.8 per cent. No structural relationship involving financial attitude was statistically significant. For the remained, the effect sizes of structural coefficients were also statistically significant. Furthermore, actual financial knowledge had positive and statistically significant (0.049, p-value 0.000) indirect effect on financial behavior, resulting in a total effect of 0.217 (p-value 0.000), slightly below the total effect exerted by perceived financial knowledge: 0.254 (p-value 0.000).

To evaluate the effect of the control variable and the statistically significant structural relationships in Model 2, the third model was estimated with the exogenous variable actual financial knowledge and endogenous variables perceived financial knowledge and financial behavior, in addition to control variable education. Figure 3 shows the structural coefficients, the adjusted R-squared value and the structural coefficients and the respective p-values.

As Figure 3 shows (additional detail provided in Table VI), consistently with the results from the two previous models, with R-squared (12,5 per cent) and adjusted R-squared (12,1 per cent) statistically significant (p-value 0.000), structural relationships between actual financial knowledge and perceived financial knowledge, actual financial knowledge and

Structural relationship	Structural coefficient	Standard error	t-value	p-value	R-squared	Adjusted R-squared
Age → Financial behavior	0.007	0.025	0.270	0.787	3.4%	3.2%
Male → Financial behavior	0.062	0.025	2.449	0.014		
Education → Financial behavior	0.180	0.027	6.605	0.000		

Note: VIF values of 1.008 for male and higher and 1.001 for age indicating the absence of multicollinearity problems (Hair Jr *et al.*, 2017a, 2017b)
Source: Authors (2017)

Table IV.
Structural Model 1 – results

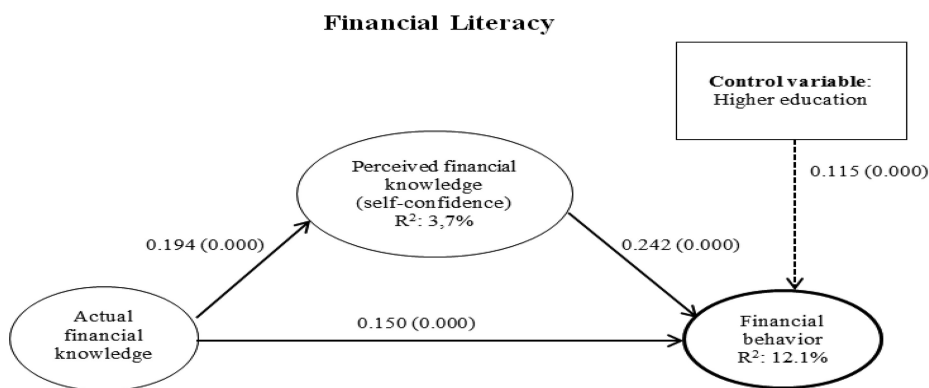| Structural relationship	Structural coefficient	Standard error	t-value	p-value	R-squared (Financial behavior)	Adjusted R-squared (Financial behavior)
Actual financial knowledge → Financial attitude	0.040	0.027	1.487	0.137		
Actual financial knowledge → Perceived financial knowledge	0.194	0.026	7.424	0.000		
Financial attitude → Financial behavior	−0.006	0.024	0.262	0,794		
Actual financial knowledge → Financial behavior	0.168	0.025	6.847	0.000		
Perceived financial knowledge →Financial behavior	0.254	0.025	10.287	0.000	11.0%	10.8%

Note: VIF values of 1.012 for financial attitude, 1.043 for actual financial knowledge and 1.050 for perceived financial knowledge indicate no multicollinearity problems (Hair Jr *et al.*, 2017a, 2017b).
Source: Authors (2017)

Table V.
Structural Model 2 – results

financial behavior, perceived financial knowledge and financial behavior and education and financial behavior, were statistically significant, and all structural relationships show statistical significance for the effect sizes of the structural coefficients, lending sense to the changes made.

Actual financial knowledge exerts an indirect, positive and statistically significant (0.047, p-value 0.000) effect on financial behavior, for a total effect of 0.197 (p-value 0.000), just below the total effect of perceived financial knowledge: 0.242 (p-value 0.000).

4.2 Multi-groups analysis

Considering the sample's heterogeneity as regards the varying levels of actual financial knowledge and perceived financial knowledge, the next subsections show multi-group analyses made to check hypothesis (*H6*) that differences exist in the structural coefficients of the financial literacy model between groups for at least one of the structural relationships investigated by hypotheses (*H1-H5*). To this end, we used the complete model, with all

Financial Literacy

Source: Authors (2017)

Structural relationship	Structural coefficient	Standard error	t-value	p-value	R-squared (Financial behavior)	Adjusted R-squared (Financial behavior)
Actual financial knowledge → Financial attitude	0.150	0.026	5.882	0.000		
Actual financial knowledge → Perceived financial knowledge	0.194	0.026	7.392	0.000		
Perceived financial knowledge → Financial behavior	0.242	0.024	10.181	0.000		
Education → Financial behavior	0.115	0.026	4.410	0.000	12.2%	12.1%

Note: VIF values of 1.063 for actual financial knowledge and 1.051 for perceived financial knowledge, and 1.043 for education indicate no multicollinearity problems (Hair Jr *et al.*, 2017a, 2017b).
Source: Authors (2017)

variables, including control ones – even if they were not statistically significant for the total sample.

The first analysis involved groups with high actual and perceived financial knowledge (1) and the remainder of the sample (2). The results of the multi-group analysis (PLS-MGA) in Table VII show that only the difference between the structural coefficients of control variable education was statistically significant at 5 per cent (p-value: 1-0.97 = 0.03), and higher for the group with high actual and perceived financial knowledge. Both were positively associated with financial behavior. Therefore, as concerns *H1-H5*, there was no statistically significant difference between the groups, rejecting *H6a*.

The second analysis was for the groups with low actual financial knowledge and high perceived financial knowledge (overconfidence) (3), and the remainder of the sample (4). The multi-group analysis (PLS-MGA) results, as seen in Table VIII, show statistical significance at 5 per cent, at least, of the differences between the structural coefficient associated with all hypotheses, thereby confirming *H6b*, that is, for the purposes of the financial literacy structural model discussed in this article, the groups of people showing and not showing overconfidence did in fact respond differently.

The third analysis corresponds to groups with high actual financial knowledge and low perceived financial knowledge (under-confidence) (5) and the remainder of the sample (6). The multi-group analysis (PLS-MGA) results shown in Table IX prove statistical significant at 5 per cent, at least, of the differences between the structural coefficients associated with all

Structural relationship	Structural coefficient	p-value
	2-1	2 vs 1
Actual financial knowledge → Financial attitude	0.114	0.417
Actual financial knowledge → Perceived financial knowledge	0.064	0.817
Financial attitude → Financial behavior	0.105	0.944
Actual financial knowledge → Financial behavior	0.051	0.798
Perceived financial knowledge → Financial behavior	0.086	0.067
Age → Financial behavior	0.024	0.348
Male → Financial behavior	0.016	0.593
Education → Financial behavior	0.134	0.970
Source: Authors (2017)		

Table VII.
Multi-group analysis – PLS-MGA – Groups 1 and 2 – Results

Structural relationship	Structural coefficient	p-value
	4-3	4 vs 3
Actual financial knowledge → Financial attitude	0.147	0.973
Actual financial knowledge → Perceived financial knowledge	0.645	0.000
Financial attitude → Financial behavior	0.198	0.006
Actual financial knowledge → Financial behavior	0.133	0.046
Perceived financial knowledge → Financial behavior	0.165	0.012
Age → Financial behavior	0.055	0.806
Male → Financial behavior	0.023	0.615
Education → Financial behavior	0.016	0.806
Source: Authors (2017)		

Table VIII.
Multi-group analysis – PLS-MGA – Groups 3 and 4 – Results

hypotheses, except for *H3*, which involves the structural relationship between financial attitude and financial behavior (no statistical significance). We can therefore confirm *H6c*, that is, for the purposes of this paper's financial literacy structural model, people showing and not showing under-confidence are indeed different.

The fourth analysis involved the groups with low actual and perceived financial knowledge (7) and the remainder of the sample (8).

The multi-group analysis (PLS-MGA) results shown in Table X indicate that the structural coefficients associated with the relationships between actual and perceived financial knowledge (*H4*), as well as between financial attitude and financial behavior (*H3*), were different between the groups at the 5 statistical significance level, confirming *H6d*.

Based on the results obtained from the first four analyses, this subsection carries out an exploratory analysis of whether differences exist between the over- or under-confident groups (9) and the remainder of the sample (10). As Table XI shows, for the group that was neither over- nor under-confident (10), the same coefficients of the final model for the entire sample showed statistical significance, all with also statistically significant *f*-squared effect size. Particular note is doe to actual financial knowledge in its relationship with perceived financial knowledge (f-squared 0.548; *p*-value 0.000). Because of this, actual financial knowledge had a 0.136 indirect effect on financial behavior, for a total effect of 0.291, statistically significant in both cases, and *R*-squared of 15.8 per cent and adjusted *R*-squared of 15.3 per cent, for the highest percentages out of all models analyzed.

Structural relationship	Structural coefficient	*p*-value
	6-5	6 vs 5
Actual financial knowledge → Financial attitude	0.193	0.011
Actual financial knowledge → Perceived financial knowledge	0.384	0.000
Financial attitude → Financial behavior	0.086	0.860
Actual financial knowledge → Financial behavior	0.274	0.001
Perceived financial knowledge → Financial behavior	0.124	0.048
Age → Financial behavior	0.085	0.849
Male → Financial behavior	0.001	0.503
Education → Financial behavior	0.173	0.032

Source: Authors (2017)

Table IX.
Multi-group analysis
– PLS-MGA –
Groups 5 and 6 –
Results

Structural relationship	Structural coefficient	*p*-value
	8-7	8 vs 7
Actual financial knowledge → Financial attitude	0.038	0.292
Actual financial knowledge → Perceived financial knowledge	0.478	1.000
Financial attitude → Financial behavior	0.152	0.010
Actual financial knowledge → Financial behavior	0.079	0.117
Perceived financial knowledge → Financial behavior	0.103	0.053
Age → Financial behavior	0.080	0.903
Male → Financial behavior	0.002	0.511
Education → Financial behavior	0.035	0.273

Source: Authors (2017)

Table X.
Multi-group analysis
– PLS-MGA –
Groups 7 and 8 –
Results

Structural relationship	Structural coefficient		p-value		R-squared (Financial behavior)		Adjusted R-squared (Financial behavior)	
	9	10	9	10	9	10	9	10
Actual financial knowledge → Financial attitude	0.121	0.009	0.025	0.758				
Actual financial knowledge → Perceived financial knowledge	−0.811	0.595	0.000	0.000				
Financial attitude → Financial behavior	−0.072	0.004	0.172	0.886				
Actual financial knowledge → Financial behavior	−0.063	0.156	0.477	0.000				
Perceived financial knowledge → Financial behavior	0.117	0.228	0.176	0.000				
Age → Financial behavior	0.106	0.018	0.046	0.511				
Male → Financial behavior	0.024	0.028	0.639	0.308				
Education → Financial behavior	0.052	0.134	0.403	0.000	4.7%	15.8%	3.1%	15.3%

Note: All VIF values under 5 for both groups, indicating no multicollinearity problems (Hair Jr *et al.*, 2017a, 2017b)
Source: Authors (2017)

Table XI.
Structural models Groups 9 and 10 – Results

For the over- or under-confident group, its adjusted *R*-squared (3.1 per cent) was not statistically significant, indicating that the model does not apply to this group.

Furthermore, the multi-group analysis (PLS-MGA) results shown in Table XII validate the statistical significance of the differences between the structural coefficients associated with the relationships between actual financial knowledge and perceived financial knowledge and between actual financial knowledge and financial behavior.

Summing up, as was expected after analysis of the correlations between variables, financial attitude was not statistically significant for any structural relationship. This is why it is not included in the final model, which, in addition to control variable education, also included actual financial knowledge with a positive influence on perceived financial knowledge, in line with the results obtained by Hung *et al.* (2009a, 2009b); perceived financial knowledge with a positive effect on financial behavior; and actual financial

Structural relationship	Structural coefficient	p-value
	10-9	10 vs 9
Actual financial knowledge → Financial attitude	0.116	0.964
Actual financial knowledge → Perceived financial knowledge (self-confidence)	1.406	0.000
Financial attitude → Financial behavior	0.076	0.106
Actual financial knowledge → Financial behavior	0.218	0.012
Perceived financial knowledge (self-confidence) → Financial behavior	0.111	0.114
Age → Financial behavior	0.004	0.478
Male → Financial behavior	0.088	0.938
Higher education → Financial behavior	0.082	0.120

Source: Authors (2017)

Table XII.
Multi-group analysis – PLS-MGA – Groups 9 and 10 – Results

knowledge with a positive influence on financial behavior, in direct and indirect terms. All structural coefficients were statistically significant at 0.1 per cent, with the respective effect sizes just above what Cohen (1998) rates as small, for an adjusted R-squared of 12.1 per cent. According to Hair *et al.* (2017a, 2017b), for marketing-related topics, values with R-squared up to 25 per cent are deemed weak. However, in consumer-behavior studies, 20 per cent is deemed high, which makes it difficult to lay down general rules for acceptable R-squared levels. Therefore, the results for the total sample indicate relevance in the sense that they stress that the higher people's actual financial knowledge, in line with the results found in Chen and Volpe (1998), Lusardi and Mitchell (2006, 2007a, 2007b, 2011a, 2011b), Hung *et al.* (2009a, 2009b), Choi *et al.* (2010a), Cole *et al.* (2011), Van Rooij *et al.* (2011a, 2011b, 2012), Fonseca *et al.* (2012), Jappelli and Padula (2013), Klapper *et al.* (2013), Agarwalla *et al.* (2013), Schicks (2014), Potrich *et al.* (2016), OECD (2016), Garber and Koyama (2016) and Allgood and Walstad (2016) and self-confidence, similarly concluded by Robb and Woodyard (2011), Asaad (2015), Allgood and Walstad (2016) and Woodyard *et al.* (2017), the better their financial behavior.

Despite these results, the total sample was clearly heterogeneous in terms of people's actual financial knowledge and self-confidence levels, justifying multi-group analyses to investigate any differences for the study's conceptual model. No differences were found between respondents with high actual and perceived financial knowledge and the remainder of the sample. For the group with low actual and perceived financial knowledge, the adjusted R-squared was not statistically significant, and multi-group analysis indicates that the structural coefficients are different from those for the remained of the sample. The same results were found while analyzing overconfident respondents and the remainder of the sample, as well as under-confident respondents and the remainder of the sample. These findings on the differences between the groups cited represent the main contribution of this study, and the results indicate consistency between observations from the empirical data collected and the theoretical basis used to formulate the majority of hypotheses.

5. Conclusion

The purpose of this paper was to empirically check for and evaluate statistically significant differences in the structural coefficients present in structural relationships of the proposed financial literacy model, considering different groups of respondents with different combinations of actual financial knowledge and perceived financial knowledge. The investigation used data from the OECD (2016) study, which have also been used and made available in Garber and Koyama (2016), resulting, after analysis, in a sample of 1,487 Brazilian respondents.

Differently from what OECD (2016) proposes, this study measured financial literacy not as a variable, but as a set of relationships capable of at least partly explaining people's financial behavior based on a logical rationale: greater financial knowledge, appropriate self-confidence and better financial attitudes are only helpful if they produce desirable financial behaviors. For this reason, in our proposed financial literacy model, the main variable of interest was financial behavior, with statistically significant knowledge and self-confidence as antecedents. The relationships between the antecedents, as recommended in Hair Jr *et al.* (2017a, 2017b), were estimated through partial least squares structural equation modeling (PLS-SEM).

Concerning structural relationships, the final model showed knowledge with a positive influence on self-confidence, self-confidence with a positive effect on behavior and knowledge with a positive influence on behavior, both directly and, through its relationship

with self-confidence, indirectly. This underscores that, for the total sample, the greater people's knowledge and self-confidence, the better their behavior.

The unexpected absence of attitude in the final model, even allowing for potential measurement problems, brings up an important reflection on the mediating effect that the self-control variable may exert between attitude and behavior. A person may believe that saving for the future is important (attitude) but whether they actually save (behavior) may depend on self-control, which is needed to prevent immediate gains from being prioritized in practice.

The findings reported so far concern the study's total sample. However, as expected from the literature review that provides the basis for our sixth and most important hypothesis, respondents were found to be heterogeneous in terms of knowledge and self-confidence levels. These differences were evaluated by means of multi-group analyses that indicated that the model does not apply to respondents with low knowledge and low self-confidence and to those who are over- and under-confident. This implies inferring that financial education programs may be of little use if they only address technical knowledge development and fail to consider behavioral aspects such as those related to self-confidence, as this paper points out, and others. This signals the importance of diagnosing people's profiles to enable developing solutions capable of minimizing the presence of behavioral biases.

This paper's methodological contribution, therefore, lies in multi-group analyses used to investigate difference between groups in the light of differing levels of knowledge and self-confidence in the financial literacy structural model. Its theoretical contribution is the relevance of self-confidence-related behavioral aspects for people's behaviors. Its practical contribution is to suggest the development of financial education programs that also take account of the potential presence of behavioral biases, which may prevent the misallocation of (scarce) public- and private-sector funds stemming from a limited focus on developing the population's actual financial knowledge.

We suggest that this study may be continued by:

- replicating the proposed conceptual model in new studies using other scales with additional indicators, as prescribed in the literature, for the financial attitude, self-confidence and behavior variables, so that they can be operationalized as constructs (latent variables) in the model to enable a better evaluation of the measurement model and, among other benefits, improving the analysis of financial attitude;
- including the self-control variable as a mediator between financial attitude and financial behavior;
- including additional behavioral biases as predictive variables or to serve as references for new multi-group analyses; and
- carrying out panel studies using the proposed financial literacy model.

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*Corresponding author

Denis Forte can be contacted at: denisfortebr@yahoo.com.br

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