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The effect of Financial Literacy on Household Saving and Borrowing Behavior

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Abstract

This study examines whether individuals' overconfidence regarding their financial literacy affects household saving and borrowing behavior. This paper uses data from De Nederlandsche Bank's Household Survey (DHS). The data suggest that confidence in one's financial literacy is positively associated with households' total savings per year, while individuals' actual financial literacy is not related with saving and borrowing behavior. Moreover, the data indicate that financial literacy overconfidence does not affect saving or borrowing behavior. Lastly, households with high levels of financial literacy that perceive themselves as highly financial literate have significantly greater annual savings.

Key words: Household financial decision making, financial literacy overconfidence, borrowing, saving

Word count: 11,920

1. Introduction

Modern households have increased responsibilities concerning saving, borrowing, and investing. For instance, financial planning and financial responsibility (e.g., purchasing retirement plans and health insurance) have shifted onto the shoulders of consumers. Moreover, financial decisions have become more complicated. Therefore, financial products and markets have become harder to understand. Many households indicate that they have difficulties managing these financial responsibilities. As a result, under-saving and over-borrowing have been documented by multiple researches. For instance, Boonen (2015) states that four out of ten households in the Netherlands have insufficient funds to handle financial setbacks. Further, Gross and Souleles (2002a) state that more than half of households with bank cards carry debt from month to month and are not able to save any money. Lastly, Lusardi and Mitchell (2007b) state that many households are nearing retirement with little or no wealth.

Researchers have begun to examine consumers' financial literacy and the implications that a lack of necessary skills and financial knowledge has for household financial decisions. Multiple researchers have found that households make suboptimal financial decisions because they have a limited degree of financial literacy. For instance, Lusardi and Mitchell (2007b) state that many households are unfamiliar with the basic economic concepts needed to make decisions regarding savings and investment. They report that financial illiteracy negatively influences households in regards to financial decision-making. Additionally, Stango and Zinman (2008) demonstrate that individuals who are unable to correctly calculate interest rates from a stream of payments end up borrowing more and accumulating less wealth. Alessie, van Rooij, and Lusardi (2011) report that financial illiteracy leads to lower savings and more borrowing as compared with savings and borrowing in financially literate households.

Policymakers have embraced financial education as a necessary tool for increasing the complexity of consumers' financial decision-making. Increasing financial literacy is, therefore, a potential solution to the problem of suboptimal financial behavior. However, a recent study conducted by Fernandes, Lynch, and Netemeyer (2014) on the impact of financial education on financial literacy reveals that education only explains 0.1% of the variance in the financial behaviors studied. Therefore, questions arise concerning the effectiveness of financial education as a means to improve financial literacy. This makes it essential to identify other factors that affect household saving and borrowing behavior in order to prevent problems regarding financial decisions.

An important factor that could affect financial behavior is consumers' confidence in their own financial knowledge. According to Hadar, Sood, and Fox (2013), an individual who might have sufficient objective financial knowledge will not engage in efficient financial behavior because of self-perceived low financial literacy. Furthermore, Health and Tversky (1991) state that

people are more willing to act on their ideas when they perceive themselves to be more competent. McCannon, Asaad, and Wilson (2016) state that the perceived financial competence of an individual may be different from their actual level of financial competence, which can vary considerably among individuals.

The difference between actual and perceived financial literacy may also affect financial behavior. According to Allgood and Walstad (2012), a combined measure of perceived and actual financial literacy provides a greater understanding of how financial literacy affects behavior. Therefore, it is important to measure whether the difference between actual and perceived financial literacy influences household financial decision-making. According to Lüders and Lao (2005), misjudging one's actual financial literacy level can lead to suboptimal decision-making. Households that misjudge their actual financial literacy level are defined as overconfident households. According to Marc Kramer (2014), overconfidence refers primarily to miscalibration. He defines overconfidence as "The degree of self-perceived literacy, which is not explained by actual financial literacy and thus refers to the degree of misjudgement of one's financial knowledge."

In this study, a three-part measure of financial literacy is used to investigate the effects of financial literacy on saving and borrowing behavior. The first part of the measure is an objective test evaluating correct and incorrect answers to financial literacy questions. It measures actual financial literacy. The second part of the measure is a subjective evaluation that focuses on what subjects think they know about personal finance based on self-assessments of their financial literacy; it evaluates perceived financial literacy. The third part of the measure is a combined evaluation of actual and perceived financial literacy, which aims to measure financial literacy overconfidence. The term "overconfidence" includes measures of both underconfidence and overconfidence; therefore, the overconfidence proxy identifies households that over-perceive or under-perceive their actual financial literacy level.

I use data from the De Nederlandsche Bank (DNB) household survey (DHS) for the year 2005, which assesses a representative sample of Dutch households and provides information on a broad range of economic and socio-demographic characteristics. I use the 2005 dataset because a special financial literacy module was added to the survey that year.

Several previous studies have evaluated the effect of actual financial literacy on financial behavior in order to improve the financial decisions made by households. This study distinguishes itself from related studies by implementing a three-part financial literacy measure as a means to explain household saving and borrowing behavior. While there is extensive literature on the concept of overconfidence, existing literature often does not specifically examine financial literacy overconfidence. This project focuses on financial literacy

overconfidence. Lastly, to my knowledge, this is the first study to observe the impact of financial literacy overconfidence on household saving and borrowing behavior.

The main findings are as follows. There is a strong and significant positive relationship between perceived financial literacy and total savings per year, while there is no such relationship between actual financial literacy and annual savings. The findings align with the competence hypothesis (Heath and Tversky, 1991), which posits that people are more willing to act on their own ideas when they perceive themselves as more competent. However, the data suggest that there is no relationship between perceived and actual financial literacy on borrowing behavior. Additionally, the data indicate that financial literacy overconfidence does not affect saving or borrowing behavior. Households that are highly financially literate and perceive themselves as such have higher annual savings.

This study is relevant for policymakers because they want individuals to make sound financial decisions, and the data illustrates how various financial literacy measures influence financial behavior. However, there are still uncertainties regarding household financial decision-making, as well as the ways in which perceived and actual financial literacy separately and jointly contribute to financial behavior. Research on these topics should provide a more in-depth understanding of the effect of household financial literacy overconfidence on saving and borrowing behavior.

The remainder of this paper is organized as follows. Section two provides an overview of previous studies on financial literacy and overconfidence. Section three discusses the methodology. Section four describes the sample selection process and gives statistics of the pooled sample. The main results and additional analyses are presented and discussed in section five. Finally, section six includes a conclusion, a list of the limitations of the study and recommendations for future research.

2. Literature review

This chapter contains a literature review that focuses on the relationship between actual financial literacy, perceived financial literacy, financial literacy overconfidence, and household saving and borrowing behavior. It also provides definitions of financial literacy and overconfidence. The hypotheses derived in this chapter will be tested in chapter five.

2.1 Financial literacy and household behavior

The relationship between financial literacy and household financial decision-making is becoming more important. Therefore, many studies have discussed the role that financial literacy plays in financial behavior. According to Lusardi and Mitchell (2011), financial illiteracy is widespread in both well-developed and emerging markets. Furthermore, they find that women are less financially literate than men, that younger and older households are less financially literate than middle-aged households, and that consumers who are more educated are more financially knowledgeable.

Although financial literacy has become a common research topic, there is no universally accepted definition of the term. Prior research definitions of financial literacy vary quite substantially. In this study, we will follow the definition used by Mandell (2007). Mandell defines financial literacy as "the ability to evaluate new and complex financial instruments and make informed judgments in both choice of instruments and extent of use which would be in their own best long-run interests."

Several studies have revealed the influence of actual financial literacy on financial decision-making, suggesting that financial literacy has a positive and significant influence on financial behavior. For instance, Lusardi and Mitchell (2014) examine the importance of financial literacy in household decision-making, using several surveys that are representative of the general U.S. population and include subjects of all ages. Their questionnaire was designed to measure financial literacy. They find that far too many Americans do not have the necessary basic skills to develop and maintain a budget, to understand credit, to understand investment vehicles, and to take advantage of the banking system. Another study, Lusardi (2007), also examines the effect of financial literacy on household decision-making. She finds that many individuals are not well-equipped to make sound savings decisions. The study indicates that there is widespread financial illiteracy among the U.S. population, and that financial literacy affects financial decision-making. A lack of basic financial knowledge can be linked to failure to plan for retirement, lack of participation in the stock market, and poor borrowing behavior. Finally, she concludes that financial education programs can result in improved savings behavior and financial decision-making.

Furthermore, multiple studies examine the effect of financial literacy on all kinds of financial behavior. For instance, Lusardi and Mitchell (2007b) state that financial literacy is a key factor in retirement planning. Financially illiterate households reach retirement with little or no wealth. Kimball and Shumway (2006), Christelis et al. (2010), and van Rooij et al. (2011) find that financial literacy is positively linked to stock market participation. Additionally, Graham et al. (2009) state that financially literate households have more internationally diversified portfolios. Stango and Zinman (2008) and Lusardi and Tufano (2015) find that financial literacy is generally low, with about one-third of the population grasping the basics of compound interest. Moreover, they find a relationship between financial literacy and a consumer's financial experiences and debt load. Individuals with lower levels of financial literacy tend to engage in high-cost transactions, incurring higher fees, and using high-cost borrowing options. These findings indicate that there is a positive relationship between financial literacy and financial behavior.

The first hypotheses examined in this study are mainly based on the previous literature regarding the effect of financial literacy on household decision-making. Most studies find that households with higher actual financial literacy levels exhibit more prudent financial behavior. Based on these results, this study proposes the following hypotheses regarding the effect of actual financial literacy:

Hypothesis 1a: Actual financial literacy increases households' annual savings.

Hypothesis 1b: Actual financial literacy decreases households' total debt.

An alternative way to assess financial literacy is to use subjective measures such as a self-assessment of financial literacy or knowledge. According to Health and Tversky (1991), people are more willing to act on their ideas when they perceive themselves as more competent. Households may not be able to assess their actual financial knowledge and instead base their decisions on how much they think they know. McCannon et al. (2016) state that an individual's perceived financial competence may differ from their actual level of financial competence, which can vary considerably among individuals. Allgood and Walstad (2012) find that a combined measure of perceived and actual financial literacy offers a more precise understanding of the relationship between financial literacy and behavior. They also state that a consumer makes decisions based on their perceived knowledge and their actual or objective knowledge. Van Rooij et al. (2011) state that there is a strong positive correlation between the actual and perceived financial literacy of households. According to Parker et al. (2008), a consumer's confidence in his or her own knowledge is correlated with increased retirement planning and savings, as well as improved performance on a hypothetical investment task, independently of the effect of actual knowledge. Based on these results, I conclude that a higher level of perceived financial literacy positively influences households' financial decision-

making. Therefore, this study proposes the following hypotheses regarding the effect of perceived financial literacy on saving and borrowing behavior:

Hypothesis 2a: Perceived financial literacy increases households' annual savings.

Hypothesis 2b: Perceived financial literacy decreases households' total debt

2.2 Overconfidence and financial decision-making

It is important to develop an index of financial knowledge that measures the combination of actual financial knowledge and self-perceived knowledge, which has a more significant influence on financial behavior than objective knowledge alone (Allgood & Walstad, 2016). Some of the existing literature compares actual and perceived financial literacy; these studies report that perceived knowledge has a greater effect than actual knowledge. If households over-perceive their financial literacy level, they are defined as overconfident. Overconfidence is an important psychological concept, which has been studied extensively in order to explain the behavior of certain households. According to Barber and Odean (2001), men are more overconfident than women and trade more excessively than women, 45% more than their female counterparts. The finding that men are more overconfident than women has been supported by several studies (Barber and Odean, 2001; Pirinsky, 2013; van Rooij et al., 2011; Almenber and Dreber, 2015). Other studies have found that overconfidence increases with income and education (Pirinsky, 2013), as well as with age (Pirinsky, 2013; Pak and Chatterjee, 2016).

According to Moore and Healy (2008), there are three definitions of overconfidence: (1) overestimation of one's actual performance, (2) over-placement of one's performance relative to others, and (3) extreme precisions in one's beliefs. This paper uses the definition of overconfidence as overestimation of one's actual performance. In this case, households are overestimating their actual financial literacy. I also apply the definition formulated by Kramer (2014): "Overconfidence measures the degree of self-perceived literacy which is not explained by actual financial literacy and thus refers to the degree of misjudgement of one's financial knowledge." It should be noted that the overconfidence proxy is given by the difference between perceived and actual financial literacy measures household who over-perceive and under-perceive their actual financial literacy.

There is extensive research that studied 'investors' overconfidence. According to Lüders and Lao (2005), overconfident individuals tend to make suboptimal financial decisions. In addition, overconfident investors tend to trade more than rational investors (Grinblatt and Kelohariu, 2009). According to Odean (1998), overconfidence affects financial markets; overconfidence increases expected trading volume, increase market depth, and decreases the expected utility of

overconfident traders. In a later paper by Barber and Odean (2001), they find that overconfidence reduces men's net trading by 2.65% per year as opposed to 1.72% for women.

Unfortunately, there is limited research on household financial literacy overconfidence. A few studies provide some evidence of the effect of financial literacy overconfidence on household behavior. For instance, Gentile, Linciano, and Soccorso (2016) and Porto and Xiao (2016) find that overconfidence is negatively related to the demand for financial advice. Gentile et al. (2016) find that high self-assessment of one's competence turns out to be significantly and negatively associated with high levels of financial knowledge, which in turn is more abundant among males and among wealthier and more risk-averse individuals. Moreover, behavioral traits such as self-confidence do play a role in financial choices and are related to consumers' levels of financial literacy. Additionally, Xiao (2016) finds that overconfident consumers are less likely to seek professional financial advice when making savings, investment and mortgage decisions, but are more likely to exhibit a demand for advice related to debt counselling and tax planning. Kramer (2014) finds that many households make poor financial decisions that result from low levels of financial literacy. Moreover, he finds that households that are more (over)confident about their financial knowledge are less inclined to consult an advisor. McCannon et al. (2016) find that overconfident individuals are more likely to engage in risky financial behavior, but confident household tends to make wiser financial decisions.

According to Erev, Wallsten, and Budescu (1994), overconfidence and underconfidence can be measured using the same dataset. Van Rooij et al. (2011) briefly comment on the influence of overconfidence and underconfidence. They state that underconfidence has a negative effect on wealth in their sample, whereas overconfidence does not appear to have a significant association with wealth. Bannier and Neubert (2016) find that highly educated women are strongly underconfident, while men remain overconfident regardless of level of education.

Based on the fact that overconfident households and investors make suboptimal financial decisions, I have formulated the following hypotheses:

Hypothesis 3a: Financial literacy overconfidence decreases households' annual savings.

Hypothesis 3b: Financial literacy overconfidence increases households' total debt.

2.3. Socioeconomic control variables

Many studies have yielded results that address saving and borrowing behavior. It is essential to control for relevant variables. I have examined previous studies, looking for variables that affect saving and borrowing behavior. According to Hira and Mugenda (2000), there are differences in the way that men and women perceive financial issues. For instance, women are far more likely than men to make purchases they do not need. These differences between men and

women could indicate that women have different saving behaviors than men. Bruciol and Veronesi (2014) support this finding, stating that women seem to save fewer savings when compared to men. Another variable that affects household saving and borrowing behavior is age. According to the life cycle model, households can be divided into three groups, namely pre-working age, working age, and retirement age. A typical household borrows during the first phase and then starts to save at the beginning of the second phase in order to accrue wealth that can be used to finance consumption during the third phase. Webley and Nyhus (2012) support this observation and find that young adults have a reduced willingness to save and that savings amounts are lower for older individuals. According to Oosterbeek and Broek (2009), a higher level of education also affects the probability of healthy borrowing habits. Nyhus and Webley (2001) support this statement. They find that individuals with a high level of education have higher savings and less debt. Household characteristics also influence saving and borrowing behavior. According to Nyhus and Webley (2001), larger households have a reduced willingness to save and lower saving amounts per year. They also find that a higher net income increases the amount saved. Based on the research discussed above, I decided to include the following socio-economic variables as control variables in our multivariate analysis: gender, age, retirement status, education, occupation, children, and income.

3. Methodology

This study aims to discover whether there is a relationship between three different measures of financial literacy and household saving and borrowing behavior. This section presents the methodology applied in this study. To test the effect of financial literacy (overconfidence) on financial behavior, two main models will be created using the Ordinary Least Squares (OLS) method:

Firstly, to test the effect of actual financial literacy and perceived financial literacy on saving and borrowing behavior, the following model is used:

$$Y_i = \alpha_1 + AFL_i * \beta_1 + PFL_i * \beta_2 + CV_i * \theta + \varepsilon_i \quad (1)$$

Y_i is an observable variable that is replaced with two different dependent variables: saving behavior and borrowing behavior, AFL_i represents the score of correctly answered financial literacy questions for respondent i , PFL_i represents the score of the subjective evaluation of self-perceived financial knowledge for respondent i , and CV_i represents a set of control variables for respondent i .

Next, to estimate the effect of financial literacy overconfidence on saving and borrowing behavior, the following model is used:

$$Y_i = \alpha_2 + FLOV_i * \beta_3 + CV_i * \Delta + \varepsilon_i \quad (3)$$

$FLOV$ represents a dummy variable measuring financial literacy overconfidence for respondent i that is equal to one for households that are overconfident and zero otherwise. The other variables are as defined previously stated.

The error term of the regressions may suffer from heteroscedasticity. For this reason, heteroskedasticity-robust standard errors are used in this study to avoid biased standard errors.

Additionally, I investigate whether there are any interaction effects involving overconfidence. This is in line with the thesis of Kaylie Maathuis (2017), The effect of one independent variable could depend on another independent variable. In the previous chapter, I explained that men are more overconfident than women and that overconfidence increases with income, education, and age. Therefore, this study examines whether there are any interaction effects between overconfidence and gender, age, education, and income. To capture any interaction effects, an additional term is included in the OLS regression, namely, financial literacy overconfidence multiplied by the variable for which we want to study a possible interaction term.

4. Data and descriptive statistics

Before conducting the analysis, I define parameters for measuring saving behavior, borrowing behavior, actual financial literacy, perceived financial literacy, and financial literacy overconfidence. First, section 4.1 discusses data selection. Then, section 4.2 describes the key variables examined in this study.

4.1. Data selection

We use the data from a special financial literacy module that was added to the De Nederlandsche Bank (DNB) Household Survey (DHS) in 2005. DHS is a representative group of more than 2,000 Dutch households. It provides detailed information about financial and demographic characteristics. The extra module contains a set of financial knowledge questions,¹ and is used to measure actual financial literacy and derive a proxy for financial literacy overconfidence. The questions were administered to the individuals who are responsible for their household's finances. According to Nyhus and Webley (2001), the head of household has the most influence on households' financial decision-making. Therefore, only answers from heads of households are considered in this study.

The dataset is considered to be of high quality. To prevent selection bias, households without a computer or an Internet connection were provided with a TV set-top box or a computer with an Internet connection. Attrition was accounted for by replacing households in the data set over the years. Replacing households ensures that the sample remains representative of the Dutch population aged 16 and older.

I merge the module on financial literacy with the 2005 data from DHS; the combined datasets contain 4989 observations. Prior to analysis, 2,543 observations were deleted because saving and borrowing behavior could not be measured for these households. Next, households that did not participate in van Rooij et al.'s extra module (2011) were deleted from the sample. Finally, 162 additional observations were deleted because households did not provide a response regarding their perception of their financial literacy. The final sample consists of 1,109 households that participated in both surveys and for which financial behavior is known.

Table 1 provides description of the variables studied. The average age of respondents is 51, and approximately 22.5% of the individuals are retired. Men are slightly overrepresented, as 57% of the respondents are male. Sixty-five percent of the households save an average of €4,227 per year, which represents an average of 29% of their net income. Additionally, 16% of the respondents have loans with an average total debt of €2,683, which represents an average of 25% of their net income. On average, four out of five basic financial literacy questions are

¹ Please refer to Van Rooij et al. (2011) for a detailed description of the dataset.

answered correctly. In comparison, only six out of eleven advanced financial literacy questions are answered correctly. Lastly, we see that only 7.5% of the households in our sample are overconfident, while 36% are underconfident.

Table 1 Summary statistics - pooled sample

This table provides an overview of summary statistics of the pooled sample. Saving behavior refers to four variables, which measure the saving behavior of households. Debt behavior refers to three variables, which measure the debt behavior of households. Financial literacy refers to three variables, which measure the financial literacy score of households. Financial literacy overconfidence refers to the distribution between actual and perceived financial literacy. Control variables refer to socio-demographic characteristics of the respondents. The data are from the 2005 DNB Household survey.

Variable	Range	Obs.	Mean	Std. Dev.
Saving behavior				
Total savings per year (€)		1,109	4,227	5,509
Willingness to save	0-1	1,109	0.6429	0.4793
Willingness to save in the future	0-1	1,109	0.4067	0.4914
Savings to net income		935	0.2878	0.6086
Debt behavior				
Total debt (€)		1,022	2,683	13,009
Presence of a loan	0-1	1,022	0.1641	0.3705
Total debt to net income		876	0.2564	2.6010
Financial literacy				
Basic financial literacy score	0-5	1,109	4.0757	1.1029
Advanced financial literacy score	0-11	1,109	6.4382	3.1891
Perceived financial literacy score	1-4	1,109	2.1506	0.6850
Financial literacy overconfidence				
High perceived – High actual	0-1	1,109	0.1867	0.3898
High perceived – Low actual (overconfidence)	0-1	1,109	0.0748	0.2633
Low perceived – Low actual	0-1	1,109	0.3787	0.4853
Low perceived – High actual (underconfidence)	0-1	1,109	0.3598	0.4802
Control variables				
High education	0-1	1,109	0.3841	0.4866
Middle education	0-1	1,109	0.577	0.4942
Low education	0-1	1,109	0.0378	0.1910
Employee	0-1	1,109	0.5194	0.4998
Self-Employee	0-1	1,109	0.0442	0.2056
No work	0-1	1,109	0.0298	0.1700
Retired	0-1	1,109	0.2245	0.4175
Other occupation	0-1	1,109	0.2020	0.4017
Female	0-1	1,109	0.4319	0.4956
Male	0-1	1,109	0.5681	0.4956
Children (1 or more)	0-1	1,109	0.3309	0.4708
No children	0-1	1,109	0.6691	0.4708
Age		1,109	51	14.957
Net income (€)		955	24,705	25,277

4.2. Construction of key variables

4.2.1. Saving and borrowing behavior

The dependent variables in this study are households' saving and borrowing behaviors. Saving behavior is defined based on the quantity of money that a household does not consume, but

instead sets aside on a yearly basis. Saving behavior is measured by observing the total amount of savings (money saved) in a given year, using a discrete answer scale. This scale has seven tiers, ranging between 0 Euros and 75,000+ Euros. The continuous variable is set equal to the median value of each range. For the extreme ranges, the threshold value is used to create a continuous variable. The natural logarithm of total savings is taken to minimize the effect of outliers.

To check for robustness, I use three other measures of savings. First, willingness to save in a given year is determined by assigning a value of one (yes) if the household put any money aside during the previous year; if not, the household is assigned the value zero (no). The second measure is the ratio of savings in a given year relative to net income. This ratio is measured by dividing the sum of total savings in a given year by net income during that year. The third measure is propensity to save in the future. This is measured by asking the question, “Is your household planning to put money aside in the next 12 months?” The answer is included as an ordinal variable.

Borrowing behavior is defined as the total amount of debt in each household. Therefore, borrowing behavior is measured by combining the total debt associated with all loans. In the DHS dataset, there are eight different types of loans: private loans; extended lines of credit; credit from mail-order companies; finance credit; loans from family, friends, or acquaintances; study loans; credit cards; and other loans. The total amount of debt is calculated as the sum of the debt accrued from all of the loans. The natural logarithm of the total debt is taken to minimize the effect of outliers.

To check for robustness, I use two other measures of borrowing. First, the presence of a loan is included as a dummy variable in this study. The variable takes a value of one (yes) if the household has one or more loans as described above; if not, it has a value of zero (no). Secondly, I consider the ratio of the total amount of debt to net income. This ratio is measured by dividing the total amount of debt by net income.

4.2.2. Actual financial literacy

Actual financial literacy can be measured by examining the extra module devised by van Rooij et al. (2011). Out of the 2,028 households included in the study, 1,508 completed the financial literacy module, which was implemented in September 2005. The DHS contains 16 questions designed to assess financial literacy. The basic five questions relate to financial numeracy, while the 11 more advanced questions address knowledge of financial instruments.

Panel A in Table 2 displays the score distribution for the basic financial literacy questions. On average, respondents answered four out of five questions correctly. About half of the respondents (43.91%) answered all five basic financial literacy questions correctly, and around

one third (33.63%) answered four out of five questions correctly. As a result, 75% of the respondents answered all of the basic financial literacy questions correctly or made only one mistake. Therefore, the majority of the respondents have an acceptable grasp of basic financial literacy. For this reason, the basic financial literacy questions are not used to measure the actual financial literacy of the respondents in this study. We can see from the table that total debt is much higher among individuals who answered none of the basic financial literacy questions correctly, and total savings per year tends to increase when more basic financial literacy questions are answered correctly.

Panel B provides an overview of the distribution of the advanced financial literacy questions and their relationship with total debt and total savings per year. The number of correct answers is more evenly distributed for advanced financial literacy questions than for basic financial literacy questions; hence, the advanced financial literacy questions are a more accurate estimate of actual financial literacy. There are 11 advanced financial literacy questions in the financial literacy module designed by van Rooij et al. (2011). The mean of the advanced financial literacy score is 6.4. On average, respondents answer approximately six out of the 11 advanced financial literacy questions correctly. Individuals with more than six correct answers are defined as having a high level of actual financial literacy, while individuals with six or fewer correct questions are defined as having a low level of actual financial literacy. The table illustrates an increase in total debt when fewer advanced financial literacy questions are answered correctly, and total savings per year tend to increase when there are more questions answered correctly.

In addition to the actual financial literacy calculation, a factor analysis similar to the analysis conducted by van Rooij et al. (2011) and Kramer (2014) is performed as a robustness check. Based on the factor analysis, an index of advanced financial literacy is created. In particular, information obtained from the difference between incorrect answers and "don't know" answers is taken into account. According to Lusardi and Mitchell (2017), households that selected the response "don't know" are less likely to plan and succeed in a planning effort, even when compared with those that give an incorrect answer. For each advanced financial literacy question, two dummy variables are created. The first dummy indicates whether the questions were answered correctly, and the second dummy refers to whether the household answered with "don't know." Therefore, the factor analysis is performed on 22 variables. To view the results of the factor analysis, please refer to appendix B. The Kaiser-Meyer-Olkin (KMO) test of sampling adequacy returns a value of 0.917, which indicates that the factor analysis performed is appropriate. The index obtained from the factor analysis and the advanced financial literacy score are highly correlated (0.9144). Because of this high level of correlation, the factor loadings, as well as the financial literacy score, can be used as a variable to measure actual financial literacy. In this paper, the actual financial literacy score is used as to represent actual financial literacy.

Table 2. Distribution financial literacy

This table provides an overview of the financial literacy scores for the number of correct answers in the financial literacy module by van Rooij et al. (2011). Panel A represents the distribution of the number of correct answers for the five basic financial literacy questions. Panel B represents the distribution of the number of correct answers for the 11 advanced financial literacy questions. Panel C presents the perceived financial literacy score based on the following questions: *"How knowledgeable do you consider yourself with respect to financial matters?"* Based on a four-point scale. Panel D presents the distribution of the four groups on the actual and perceived financial literacy combined. The data are from the 2005 DNB Household survey.

	DHS Household (%)	Total debt (€)	Total Savings per year (€)
Panel A: Basic financial literacy			
None correct	1,62%	€13,409	€3,402
1	2,16%	€1,282	€1,875
2	4,69%	€769	€2,909
3	13,98%	€4,118	€3,355
4	33,63%	€1,796	€4,384
5	43,91%	€2,860	€4,674
Mean score (#)	4.1		
N	1,109		
Panel B: Advanced financial literacy			
None correct	5,95%	€8,206	€3,257
1	4,42%	€1,652	€2,934
2	4,51%	€2,052	€2,875
3	5,68%	€1,647	€2,837
4	6,04%	€2,332	€4,179
5	9,38%	€1,314	€3,617
6	9,38%	€1,832	€3,281
7	10,82%	€3,082	€4,927
8	11,45%	€1,946	€4,124
9	12,35%	€4,951	€3,723
10	12,71%	€1,800	€6,206
11	7,30%	€1,454	€6,297
Mean score (#)	6.4		
N	1,109		
Panel C: Perceived financial literacy			
Not knowledgeable	14,07%	€1,869	€3,061
More or less knowledgeable	59,78%	€2,752	€4,159
Knowledgeable	23,17%	€3,216	€4,611
Very Knowledgeable	2,98%	€1,129	€8,144

Mean score (#)	2.2		
N	1,109		
Panel D: Overconfidence			
High Perceived – High actual	18.67%	€3,632	€5,778
Low perceived – Low actual	37.87%	€2,868	€3,384
High perceived – Low actual (overconfidence)	7.48%	€1,245	€3,102
Low Perceived – High actual (underconfidence)	35.98%	€2,276	€4,546
N	1,109		

4.2.3. Perceived financial literacy

Perceived financial literacy is measured based on one question in the DHS dataset. The answer is recorded as an ordinal variable, and the question is as follows: *"How knowledgeable do you consider yourself with respect to financial matters? (based on a score ranging from 1 'not knowledgeable' to 4 'very knowledgeable')."* The question is asked at the beginning of the survey; hence, the households have to answer this question before answering the questions that assess their actual literacy.

Panel C of Table 2 presents the distribution of the perceived financial literacy of the respondents. It illustrates that total savings per year increase when people perceive their financial literacy level to be higher. Furthermore, total debt is also lower in respondents who describe their financial literacy level as "very knowledgeable." These findings suggest that perceived financial literacy has a positive effect on saving and borrowing behavior.

4.2.4. Financial literacy overconfidence

I use the method employed by Allgood and Walstad (2012) to measure financial literacy over- and underconfidence. This method is similar to the method used by Kramer (2016) and Porto and Xiao (2016). Actual and perceived financial literacy must be considered in order to measure overconfidence. To establish an overconfidence proxy, the mean value is calculated for actual financial literacy and perceived financial literacy. The mean for actual financial literacy is six, and the mean for perceived financial literacy is two. Based on the average for both financial measures, the households are divided into four groups. For each of the groups, a dummy variable is created; the value of the dummy variable is one if a respondent belongs to that group and zero otherwise. I divide the households into the following groups: High Perceived – High Actual; Low Perceived – Low Actual; High Perceived – Low Actual, and Low Perceived – High Actual.

Panel D of Table 2 presents the distribution of the combined actual and perceived financial literacy scores. Respondents are marked as Low Perceived if they see themselves as "not knowledgeable" or "somewhat knowledgeable." Respondents are marked as High Perceived if they see themselves as "knowledgeable" or "very knowledgeable." Respondents with a lower-than-average perceived financial literacy level and a lower-than-average actual financial literacy score are placed in the "Low Perceived – Low Actual" group, which includes 37.9% of the respondents. Respondents with a higher-than-average perceived financial literacy level and a higher-than-average actual financial literacy score are placed in the "High Perceived – High Actual" group, which consists of 18.9 % of respondents; hence, more than 50% of the respondents measured their financial literacy correctly. Respondents who have a higher-than-average perceived financial score but a lower-than-average actual financial literacy score think that they are more financially literate than they are. Therefore, these individuals are defined as overconfident and placed in the group "High Perceived – Low Actual." Only 7.5% of the respondents are defined as overconfident. Respondents who have a lower-than-average perceived financial score but a higher-than-average actual financial literacy score believe that they are less financially literate than they really are. Therefore, these individuals are defined as underconfident and placed in the group "Low Perceived – High Actual." Thirty-six percent of respondents are defined as underconfident.

5. Results

A three-part measure of financial literacy is used in this study to investigate the effects of financial literacy on saving and borrowing behavior. First, the results of actual financial literacy and perceived financial literacy analyses are discussed. Then, I discuss the financial literacy overconfidence results. Finally, any interaction effects are illustrated.

5.1. Financial literacy

First, the effect of actual financial literacy and perceived financial literacy on saving and borrowing behavior will be discussed. The results of this study encompass saving and borrowing behavior, as presented below.

5.1.1. Saving behavior

Multiple OLS regressions were performed using financial literacy measures. Table 3 reports the influence of actual and perceived financial literacy on the logarithm of households' total savings in 2005. The first model does not include control variables, and only considers actual financial literacy as an independent variable. The results indicate that, when the actual financial literacy score increases by one, total savings per year increase by 5.51% (at a 1% significance level). More financially knowledgeable households are more likely to have more annual savings. These results confirm our first hypothesis; actual financial literacy has a positive and significant effect on annual household savings.

In the second OLS regression, perceived financial literacy is included in order to measure its effect on total savings per year (logarithm). No control variables are included in this regression. I find, at a 1% significance level, that perceived financial literacy has a positive effect on saving behavior. The results imply that a one-unit increase in perceived financial literacy increases total savings per year by 18.05%, indicating that people who are more confident about their financial literacy save more. These results support our second hypothesis; thus, perceived financial literacy has a positive and significant effect on annual household savings.

One reason why both literacy measures are significant could be the high level of correlation. Table 16 in Appendix D illustrates that actual financial literacy and perceived financial literacy are positively correlated at a 1% confidence interval, which means that people with a higher actual financial literacy score perceive themselves as more literate. The correlation between the two independent variables is 25.53%, meaning that multicollinearity does not seem to be a problem.

Next, I include both actual financial literacy and perceived financial literacy in a regression. According to Allgood and Walstad (2012), a combined measure of perceived and actual financial literacy allows for a greater understanding of how financial literacy affects behavior. The results indicate that actual financial literacy is significant at a 1% significance level, and perceived financial literacy is significant at a 5% significance level. However, I conclude that

the effect of both actual and perceived financial literacy has decreased. A one-unit increase in the actual financial literacy score increases total savings per year by 4.8% and the same increase in perceived financial literacy increases total savings per year by 11.56%. This finding confirms previous findings that actual financial literacy and perceived financial literacy positively influence total savings per year.

Model four, presented in Table 3, incorporates both actual financial literacy and perceived financial literacy. Moreover, we also include control variables. In this regression, actual financial literacy is no longer significant, and perceived financial literacy is again significant at a 1% significance level. The results imply that actual financial literacy does not have a significant effect on total savings when control variables are included. This could mean that a variable treated as a control variable may function as a moderating variable instead of a control variable. Hence, the effect of the control variables on total savings per year is greater than the effect of actual financial literacy on total savings per year. The results for perceived financial literacy imply that individuals who feel more confident about their financial literacy, experience an increase of 14.21% in their total savings per year. These results imply that, when households perceive themselves as more financially literate, their total savings per year tend to increase. A few control variables also indicate a significant effect on saving behavior. As consumers get older, their savings per year increase dramatically. Households' total savings per year increase by 45.31% (at a 1% significance level) when their age is between 51 and 60, as compared with people who are under 30 years old. Also, the total savings per year of people who are between 61 and 70 years old increase by 51.10% (at a 1% significance level), as compared with people who are younger than 30. Additionally, the variable "children" is significant at a 5% significance level. Households that have children tend to have 20.24% less savings per year. Finally, people with a higher income tend to have greater total savings per year. For example, people whose monthly net income is higher than €2,600 save 86.54% more than people whose monthly net income is below €1,150, at a 1% significance level.

On average, the control variables have the same expected sign as in previous studies; please refer to the outcomes of model four in Table 3 for the exact results for each control variable. As expected, men have more savings than women, adults with a higher net income save more, households without work save less, and households with more children save less. However, the influence of education on saving behavior is not as expected; this study suggests that having a higher level of education leads to less savings. A possible explanation is that only 3.9% of the households surveyed are marked as having a low level of education, which could produce contradictory results.

As a robustness check, I attempt to measure the saving behavior of households across dependent variables. Table 11 in Appendix C details multiple OLS regressions designed to measure the effect of financial literacy on willingness to save, willingness to save in the future, and the ratio

of savings to net income. I measure these dependent variables with and without control variables. The outcomes are consistent with the results from Table 3.

The results of the regression presented in Table 3 are not consistent with the many types of research that have examined the effect of actual financial literacy on a wide range of financial households' decision-making. When control variables are included, it becomes apparent that actual financial literacy does not influence the saving behavior of households. Therefore, I accept the null hypothesis, that financial literacy does not influence saving behavior. A possible explanation of this contradictory result is that other studies use different measures to estimate actual financial literacy. Therefore, it is hard to compare different actual financial literacy outcomes. Moreover, most studies examine multiple years' data to measure the effect of actual financial literacy on saving behavior, where we only observed saving behavior in 2005. However, the results for the perceived financial literacy score correspond with the findings of Allgood and Walstad (2012) and Parket et al. (2008), even when control variables are included. Therefore, I reject the null hypothesis at a 1% significance level, meaning that perceived financial literacy positively influences saving behavior.

Table 3 Financial literacy and saving behavior

This table reports the effects of multivariate analysis of the actual and perceived financial literacy and several control-variables and dummy-variables on total saving per years (logarithm) using an ordinary least squares model. The data are from the 2005 DNB Household Survey. The robust standard errors are reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1

	(1)	(2)	(3)	(4)
Total savings per year (logarithm)				
Actual financial literacy	0.0536*** (0.0095)		0.0475*** (0.0097)	0.0126 (0.0117)
Perceived financial literacy		0.1659*** (0.0477)	0.1094** (0.0480)	0.1329*** (0.0511)
Age dummies (base group: Age ≤30)				
31 – 40				0.1372 (0.1383)
41 – 50				0.2514* (0.1322)
51 – 60				0.3737*** (0.1276)
61 – 70				0.4127*** (0.1452)
> 70				0.2782

				(0.1766)
Education dummies (Base group: Low education)				
High education				-0.0619 (0.1656)
Middle education				-0.0083 (0.1636)
Male				0.0447 (0.0796)
Children				-0.1843** (0.0801)
Occupation dummies (Base group: Other)				
Employee				-0.0344 (0.1115)
Self-Employee				0.1204 (0.2196)
No work				-0.2658 (0.2164)
Retired				-0.1651 (0.1328)
Household net monthly income dummies (Base Group \leq €1,150)				
€1,150 < Income \leq €1,800				0.2132* (0.1208)
€1,800 < Income < €2,600				0.3935*** (0.1236)
Income \geq 2600				0.6235*** (0.1312)
Constant	8.2107*** (0.7236)	8.2042*** (0.1085)	8.0127*** (0.1149)	7.7060*** (996.60)
R ²	0.0468	0.0212	0.0555	0.1854
Observations	690	690	690	606

5.1.2. Borrowing behavior

Multiple regressions are performed using financial literacy measures. Table 4 reports the influence of actual and perceived financial literacy on the borrowing behavior of adults, measured as the logarithm of total debt. The first model does not include any control variables. The results suggest that actual financial literacy does not have a significant effect on consumers' borrowing behavior.

Model 2 in Table 4 includes only perceived financial literacy as variable. Hence, no control variables are included in this model. I find at a 10% level of significance that perceived financial literacy has a positive effect on borrowing behavior. The results indicate that a one-unit increase in perceived financial literacy increases total debt by 37.07%. Therefore, households that are more confident about their financial literacy tend to have a higher level of total debt.

The third model includes both actual financial literacy and perceived financial literacy. As previously stated, a combined measure of perceived and actual financial literacy enables us to better understand how financial literacy affects behavior. The results indicate that actual financial literacy is not significant, and perceived financial literacy is again significant at a 10% significance level. The results also suggest that combining actual financial literacy and perceived financial literacy results in a decrease in the effect of perceived financial literacy on borrowing behavior. A one-unit increase in the perceived financial literacy score results in a 34.1% increase in total debt. Therefore, households that are more confident about their financial literacy tend to have a higher level of total debt.

Model four in Table 4 includes both actual financial literacy and perceived financial literacy. Moreover, we also include control variables. In this regression, advanced financial literacy and perceived financial literacy are no longer significant. The results imply that actual financial literacy and perceived financial literacy do not have a significant effect on total debt.

Furthermore, the control variables generally have the same expected sign as in previous studies; please refer to the outcomes of model four in Table 4 for the exact results for each control variable. As expected, adults with a higher net income, households without work, and households with children have a larger total amount of debt, and households with higher levels of education have a lower amount of total debt. However, the influence of age and gender on borrowing behavior is not as expected. The results indicate that women have less debt than men do. This was not found in previous studies. A possible explanation is that females take fewer risks than men. Moreover, we find that having a higher age (>70) leads to significantly more debt. This may be attributable to the fact that the base group is households younger than 30. Households younger than 30 have not yet accumulated much debt, and this causes contradictory results.

As a robustness test, I measure the borrowing behavior of households across different dependent variables. Table 12 in Appendix C contains multiple OLS regressions designed to measure the effect of financial literacy on the presence of a loan and the ratio of debt to net income. I measure these dependent variables with and without control variables. The outcomes are consistent with the results displayed in Table 4.

The results of the regression presented in Table 4 are not consistent with the many types of studies that have examined the effect of actual financial literacy on a wide range of households' financial decision-making. I find that actual financial literacy does not influence the borrowing behavior of households. Therefore, I accept the null hypothesis, meaning that actual financial literacy does not influence borrowing behavior. Moreover, the results for the perceived financial literacy score are also not consistent with the previous literature. Again, I accept the null hypothesis, meaning that perceived literacy does not influence borrowing behavior. A possible explanation of this contradictory result is that other studies use different measures of actual financial literacy. Furthermore, most studies use data from multiple years to measure the effect of financial literacy on borrowing behavior, whereas we only observed total debt in 2005. Moreover, only 188 households in our dataset had any amount of debt, while other researchers used a bigger sample to measure the effect of financial literacy on borrowing behavior. Finally, other studies were able to measure the amount of debt held by each household throughout the years. In this study, we only measure the total amount of debt held at a certain point in time.

Table 4 financial literacy and borrowing behavior

This table reports the effects of multivariate analysis of the actual and perceived financial literacy and several control-variables and dummy-variables on total debt (logarithm) using an ordinary least squares model. The data are from the 2005 DNB Household Survey. The robust standard errors are reported in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

	(1)	(2)	(3)	(4)
Total debt (logarithm)				
Actual financial literacy	0.0387 (0.0415)		0.0279 (0.0411)	0.0149 (0.0470)
Perceived financial literacy		0.3153* (0.1777)	0.2934* (0.1739)	0.1845 (0.1972)
Age dummies (base group: Age ≤ 30)				
31 – 40				-0.0978 (0.4302)
41 – 50				0.1598 (0.4646)
51 – 60				0.1939 (0.4267)

61 – 70				-0.7058 (0.7499)
> 70				2.1771*** (0.6557)
Education dummies (Base group: Low education)				
High education				-0.7773 (0.9737)
Middle education				-0.3610 (0.9447)
Male				-0.2097 (0.3292)
Children				0.4521 (0.3137)
Occupation dummies (Base group: Other)				
Employee				0.5426 (0.4179)
Self-Employee				0.2788 (0.5382)
No work				1.1318*** (0.6757)
Retired				0.4998 (0.6044)
Household net monthly income dummies (Base Group \leq €1,150)				
€1,150 < Income \leq €1,800				0.1218 (0.3947)
€1,800 < Income < €2,600				-0.1167 (0.3947)
Income \geq 2600				0.8662* (0.5171)
Constant	8.1460*** (0.2876)	7.7251*** (0.3911)	7.6005*** (0.4646)	7.6343*** (0.9909)

R ²	0.0052	0.0162	0.0188	0.1483
Observations	188	188	188	164

5.2. Overconfidence

In the previous section, we examined the relationship between both financial knowledge dimensions and saving for retirement, separately and then together. Developing an index of financial knowledge enhanced by the combination of actual financial knowledge with self-perceived knowledge can allow us to detect a more significant influence on financial behavior than that exerted by objective knowledge alone (Allgood & Walstad, 2016). To determine whether a combination of actual financial literacy and perceived financial literacy relate to saving and borrowing behavior, we estimate various ordinary least squares regressions. First, the results regarding saving behavior will be discussed, and next, the results for borrowing behavior.

5.2.1. Saving behavior

Table 14 in Appendix D demonstrates that financial literacy and total savings per year are negatively correlated at a 5% confidence interval. These findings confirm the hypothesis of the effect of financial literacy overconfidence on saving behavior of this paper, in which I stated that overconfidence harms household saving behavior.

In addition to the correlation matrix described above, multiple regressions are performed assessing the effect of financial literacy overconfidence on the logarithm of total savings per year. The first model in Table 5 includes only the overconfidence dummy; hence, no control variables are included. The results illustrate that financial literacy overconfidence has a significant negative effect on total savings per year (at a 1% significance level). This suggests that, when a household is overconfident in its financial literacy, total savings per year decrease by 24.04%.

Control variables are added in model 2 in Table 5 to mitigate endogeneity problems. However, when these control variables are included, the results are insignificant. This could mean that the effect of the control variables on total savings per year is greater than the effect of financial literacy overconfidence on total savings per year.

Finally, the other combined measures of financial literacy are added to the regression. The variable “Low Perceived – Low Actual” is used as a base group to prevent the problem of perfect multicollinearity. Financial literacy overconfidence and underconfidence are insignificant, meaning that people who misperceive their financial literacy do not exhibit differences in saving behavior. Additionally, “High Perceived – High Actual” is significant at a 5% confidence level. The results imply that people who score higher than average on the financial literacy test and believe that they are financial literate have 21.14% more savings (at

a 1% significance level). However, the results should be interpreted with caution because these variables can be biased by multicollinearity, as the combined financial literacy measures are all negatively correlated with one another (see Table 15 in Appendix C). Multicollinearity occurs when two or more explanatory variables are very highly correlated with each other. However, when the relationship involves more than two collinear variables, multicollinearity is difficult to detect.

The results of the regression presented in Table 5 are not consistent with the finding that investors make suboptimal financial decisions when they are overconfident. When adding control variables, I found that financial literacy overconfidence does not influence the saving behavior of households. Therefore, I accept the null hypothesis, meaning that financial literacy overconfidence does not influence saving behavior. An explanation of this contradictory result could be that most studies report on investor overconfidence, whereas this study reports on household overconfidence. Also, it depends on a proxy to measure overconfidence. Other studies may have used different estimates to measure overconfidence.

Table 5 Financial literacy overconfidence and saving behavior

This table reports the effects of analysis of the combined financial literacy measures and several control variables on the total savings per year (logarithm) using ordinary least squares. The data are from the 2005 DNB Household Survey. The robust standard errors are reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1

	1	2	3
Total savings per year (logarithm)			
Overconfidence	-0.2749*** (0.1149)	-0.0801 (0.1282)	-0.0324 (0.1361)
Underconfidence			0.0407 (0.0790)
High perceived – High actual			0.1918** (0.0867)
Control variables (see Table 2)	NO	YES	YES
Observations	690	606	606
R ²	0.0084	0.1706	0.1772

5.2.2. Borrowing behavior

Table 13 in Appendix D illustrates that financial literacy and total debt are negatively correlated. These findings are consistent with the hypothesis of the effect of financial literacy

overconfidence on borrowing behavior of this paper, which states that overconfidence causes poor household borrowing behavior.

In addition to the above correlation matrix, this study includes multiple regressions of financial literacy overconfidence on the logarithm of total debt. The first model in Table 6 includes only the overconfidence dummy; hence, no control variables are added. The results indicate that financial literacy overconfidence has an insignificant negative effect on total savings. Including control variables in the second model does not change the results.

Finally, the other combined measures of financial literacy are added to the regression. Low Perceived – Low Actual is used as a base group to avoid the problem of perfect multicollinearity. All of the explanatory variables are insignificant in this regression. The results should be interpreted with caution, as these variables can be biased by multicollinearity; all of the combined financial literacy measures are negatively correlated with one another (see Table 16 in Appendix C).

The results of the regression presented in Table 6 do not correspond with the finding that investors make suboptimal financial decisions when they are overconfident. I find that financial literacy overconfidence does not influence the borrowing behavior of households. Therefore, I accept the null hypothesis, meaning that financial literacy overconfidence does not influence borrowing behavior. This contradictory result may have occurred because most studies report on investor overconfidence, whereas this study reports on household overconfidence. It also depends on a proxy variable for overconfidence, while other studies could have used different estimates to measure overconfidence.

Table 6 Financial literacy overconfidence and borrowing behavior

This table reports the effects of multivariate analysis of the combined financial literacy measures and several control variables on the total debt (logarithm) using ordinary least squares. The data are from the 2005 DNB Household Survey. The robust standard errors are reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1

	1	2	3
Total debt (logarithm)			
Overconfidence	-0.4300 (0.3214)	-0.4097 (0.4300)	-0.2870 (0.4665)
Underconfidence			0.1701 (0.3415)
High perceived – High actual			0.4119 (0.3764)

Control variables (see table 2)	NO	YES	YES
Observations	188	164	164
R ²	0.0049	0.1459	0.1509

5.3. Additional test for interaction effects

In the literature, it is stated that men are more overconfident than women (Barber and Odean, 2001; Pirinisky, 2013; van Rooij et al., 2011; Almenber and Dreber, 2015). Overconfidence increases with income and education (Pirinsky, 2013), and with age (Pirinsky, 2013; Pak and Chatterjee, 2016). There could be an interaction effect between the above-named variables and overconfidence. Therefore, I examine whether there is an interaction term linking overconfidence with gender, income, education, and age. The interaction effect would affect saving and borrowing behavior.

The results of the analysis of interaction effects on saving behavior are presented in Table 17 in Appendix E. They reveal no interaction effects between any variable and financial literacy overconfidence.

I also try to measure any interaction effects on borrowing behavior. The results of the analysis of interaction effects on borrowing behavior are presented in Table 7. In the first OLS-regression, the interaction term for gender is included. The interaction term between male and financial literacy overconfidence has a significant positive effect (1% significance level). This suggests that there is indeed an interaction effect between these variables, implying that the effect of an increase in financial literacy overconfidence on total debt is dependent on gender. The positive sign of the interaction effects implies that the effect of financial literacy overconfidence on total debt is dependent on gender. Hence, the effect on men is more significant than it is for women. However, as can be seen in Table 7, the variable “male” is not statically significant. These results imply that men do not have more debt when compared with women, but gender does influence the effect of financial literacy overconfidence on total debt. In addition to the interaction effect produced by gender, I examine the interaction effects of income, education, and age. The results indicate no interaction effects between these variables and financial literacy overconfidence.

Table 18 in Appendix E presents the results for the interaction effect between gender and financial literacy overconfidence, as well as the control variables. Including control variables in the first and second models renders the interaction terms “gender” and “financial literacy overconfidence” insignificant. Therefore, I cannot conclude that the effect of an increase in

financial literacy overconfidence on total debt is dependent on gender, nor can I prove that this effect is more significant for men than for women.

Table 7 Interaction effects borrowing behavior

This table reports the interaction effects of gender, income, education, and age with financial literacy overconfidence on the logarithm of total debt using ordinary least squares. The data are from the 2005 DNB Household Survey. The robust standard errors are reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1

	1	2	3	4
Total debt (logarithm)				
Overconfidence	-1.0659*** (0.3304)	0.6513 (0.7873)	-0.4208 (0.3981)	-1.8013* (1.0748)
Male	-0.0157 (0.2738)			
Overconfidence * male	1.4485*** (0.5591)			
Income		0.0000 (0.000)		
Overconfidence * income		0.0000 (0.000)		
High education			0.0794 (0.2713)	
Overconfidence * high education			0.0243 (0.5098)	
Age				0.0028 (0.0108)
Overconfidence * Age				0.0355 (0.0287)
Observations	188	164	188	188
R ²	0.0194	0.0248	0.0054	0.0103

6. Conclusion and discussion

Multiple studies have evaluated the role of financial literacy in financial behavior in order to prove the importance of financial literacy education. However, a recent study conducted by Fernandes, Lynch, and Netemeyer (2014) on the impact of financial education on financial literacy demonstrates that education only explains 0.1% of the variance in financial behaviors studied. Therefore, questions arise concerning the effectiveness of financial education in order to improve financial literacy. A three-part measure of financial literacy is used in this study to reveal other factors that affect saving and borrowing behavior. The first part of the measure examines actual financial literacy. The second part looks at perceived financial literacy. The third part assesses financial literacy overconfidence. I find evidence that only perceived financial literacy has a positive effect on total savings per year and willingness to save. Both actual financial literacy and financial literacy overconfidence do not seem to influence household savings and borrowing behavior.

The first hypothesis predicts a positive relationship between actual financial literacy and saving and borrowing behavior. The analysis conducted in this study indicates that actual financial literacy does not influence financial behavior, contradicting the existing literature. For example, Van Rooij et al. (2011) conclude that actual financial illiteracy leads to lower levels of saving and more borrowing. One possible explanation for this disparity is that Van Rooij et al. (2011) use a financial literacy index based on factor analysis to measure actual financial literacy, whereas we use the number of advanced financial literacy questions answered correctly. They also use the basic financial literacy score to measure financial behavior, whereas I have decided to use the advanced financial literacy score.

The second hypothesis predicts that perceived financial literacy positively influences saving and borrowing behavior. The data indicate that perceived financial literacy influences saving behavior. When households have more confidence in their financial literacy level, their total savings per year increase. This is consistent with the results obtained by Allgood and Walstad (2012). Especially when measures of actual financial literacy and perceived financial literacy are both high, this study finds that an individual is more likely to have more savings.

The final hypothesis predicts a negative relationship between financial literacy overconfidence and saving and borrowing behavior. The results obtained in this study contradict the results discussed in the existing literature. For instance, Lüders and Lao (2005) prove that overconfidence can lead to suboptimal results. In this study, I cannot find evidence that overconfidence influences saving or borrowing behavior. This may have occurred because most studies investigate investor overconfidence, while this study looks at household overconfidence.

This study points to the crucial role of perceived financial literacy in saving behavior. Households that are more confident about their own financial knowledge have more total savings per year. This is a key conclusion, given the fact that policymakers have embraced financial education as a necessary tool for addressing the increasing complexity of consumers' financial decision-making. Although actual knowledge plays an important role, our results demonstrate that actual knowledge should not be the only driving factor in financial education training and programs. According to this study, policymakers should provide solutions to increase the confidence of households in order to bring about more responsible saving behavior.

The primary limitations of this study, which in turn provide avenues for future research, are as follows. First, the sample size for studying the effect of financial literacy on borrowing behavior was relatively small. Testing these relationships in a larger sample is a topic for future research.

Secondly, the data is drawn from one year and one country. We could only measure households' actual financial literacy level in 2005, and the outcome could be biased if we do not match the actual financial literacy score with saving or borrowing behavior in the same year. Additionally, as the extra module was implemented in 2005, the data could be outdated. It would be interesting to see whether this behavior reveals any dynamic patterns, and whether the relationships are similar to those observed in other countries. Moreover, future research could redo the financial literacy module in order to get more reliable and up-to-date results.

Thirdly, the sample consists of households that are willing to share information about their savings and loans. It could be that households that are willing to share information about their financial situation exhibit more responsible financial behavior.

Fourthly, the perceived financial literacy score is based on a score ranging from [1] "not knowledgeable" to [4] "very knowledgeable" in answer to the following question: *"How knowledgeable do you consider yourself with respect to financial matters?"* Future research could expand this measure by creating more questions concerning perceived financial literacy. An expansion of this measure would result in outcomes that are more reliable.

Finally, the total amount of savings in a given year is measured using a discrete answer scale. This can cause the outcome to be biased. Future research should try to measure total savings per year using a continuous answer scale.

Overall, these findings contribute to a broader understanding of the concept of financial knowledge and its influence on household saving and borrowing behavior. However, future research on this topic is needed in order to develop a better understanding of what increases a consumer's confidence in his or her financial literacy.

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Appendix A: Wording of Survey Questions and Key Variables Construction

Saving behavior	Willingness to save	Dummy variable indicating [1] when respondents answered: “Yes” to the following question: “Did your household put any money aside in the past 12 months?” and [0] otherwise
	Total savings per year	The amount of savings per year. Derived from the following question: "How much money did your household put aside in the past 12 months?" with a discrete answer scale. This scale has seven tiers between 0 and more than 75,000 Euros. The continuous variable is set equal to the median value of each range. For the extreme ranges, the threshold value is used to create a continuous variable.
	Willingness to save in future	Ordinal variable indicating: [1] when respondents answered: “No, certainly not”, [2] when respondents answered: “No, probably not”, [3] when respondents answered: “Yes, perhaps”, and [4] when respondents answered: “Yes, certainly” to the following question: “Is your household planning to put money aside in the next 12 months?”
	Savings to net income	Measured as total savings per year divided by net income
Borrowing behavior	Presence of a loan	Dummy variable indicating [1] when respondents answered: "Yes" to the following question: "Did you, on 31 December <year>, have one or more <type of loans>?" and [0] otherwise. The type of loan is one of the following: private loans; extended lines of credit; credits by mail-order companies; finance credit; loans from family, friends, or acquaintances; study loans; credit cards; and other loans.
	Total debt (€)	The amount of total debt on the different loans of the respondents. Derived from the following question: “What was the remaining debt on your <type of loan> on 31 December <year>?”
	Total debt to net income	Measured as total debt divided by net income.
Actual financial literacy	Basic	<p>The score obtained from a factor analysis on five questions of the following financial literacy questions: [All questions also included a "don't know" and a "refusal" option].</p> <p>1) Suppose you had €100 in a savings account and the interest rate was 2% per year. After five years, how much do you think you would have in the account if you left the money to grow? [More than €102; Exactly €102; Less than €102]</p> <p>2) Suppose you had €100 in a savings account and the interest rate is 20% per year, and you never withdraw money or interest payments. After five years, how much would you have on this account in total? [More than €200; Exactly €200; Less than €200].</p> <p>3) Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After one year, how much would you be able to buy with the money in this account? [More than today; Exactly the same; Less than today]</p>

		<p>4) Assume a friend inherits €10,000 today and his sibling inherits €10,000 three years from now. Who is richer because of the inheritance? [My friend; His sibling; They are equally Rich]</p> <p>5) Suppose that in the year 2010, your income has doubled and the prices of all goods have doubled too. In 2010, how much will you be able to buy with your income? [More than today; The same; Less than today]</p>
	Advanced	<p>The score obtained from a factor analysis on 11 questions of the following financial literacy questions: [All questions also included a "don't know" and a "refusal" option].</p> <p>1) Which of the following statements describes the main function of the stock market? [The stock market helps to predict stock earnings; The stock market results in an increase in the price of stocks; The stock market brings people who want to buy stocks together with those who want to sell stocks; None of the above.]</p> <p>2) Which of the following statements is correct? [Once one invests in a mutual fund, one cannot withdraw the money in the first year; Mutual funds can invest in several assets, for example, invest in both stocks and bonds; Mutual funds pay a guaranteed rate of return which depends on their past performance; None of the above.]</p> <p>3) If the interest rate falls, what should happen to bond prices? [Rise; Fall; Stay the same; None of the above.]</p> <p>4) True or false? Buying a company stock usually provides a safer return than a stock mutual fund. [True; False].</p> <p>5) True or false? Stocks are normally riskier than bonds. [True; False].</p> <p>6) Considering a long time period (for example, 10 or 20 years), which asset normally gives the highest return? [Savings accounts; Bonds; Stocks].</p> <p>7) Normally, which asset displays the highest fluctuations over time? [Savings accounts; Bonds; Stocks].</p> <p>8) When an investor spreads his money among different assets, does the risk of losing money: [Increase; Decrease; Stay the same].</p> <p>9) Which of the following statements is correct? If someone buys the stock of firm B in the stock market: [He owns part of firm B; He has lent money to firm B; He is liable for firm 's debt, None of the above]</p> <p>10) Which of the following statements is correct? If someone buys a bond of firm B: [He owns part of firm B; He has lent money to firm B; He is liable for a firm 's debt, None of the above]</p> <p>11) True or false? If you buy a 10-year bond, it means you cannot sell it after five years without incurring a major penalty.[True; False].</p>
Perceived financial literacy		<p>A score ranging from [1] "not knowledgeable" to [4] "very knowledgeable" on the following question: "How knowledgeable do you consider yourself with respect to financial matters?"</p>

Overconfidence dummy		Dummy indicating [1] if respondents ranked high in self-assessed financial literacy (specifically: 3 &4), while their actual financial literacy ranked below the mean, and [0] otherwise
Underconfidence dummy		Dummy indicating [1] if respondents ranked low in self-assessed financial literacy (specifically: 1&2), while their actual financial literacy ranked above the mean, and [0] otherwise.
Control variables	Male	Dummy indicating [1] if respondents are male and [0] for female.
	Age	Age of the respondent
	Retired (age>65)	Dummy indicating [1] if respondents are above 65 and [0] otherwise.
	Education	Highest attained educational degree of the respondent.
	Employee	Dummy indicating [1] if respondents work as an employee and [0] otherwise.
	Self-employed	Dummy indicating [1] if respondents are self-employed and [0] otherwise.
	Participation in a partnership	Dummy indicating [1] if respondents are participating in a partnership and [0] otherwise.
	Number of Children	The number of children of the respondent.
	Net income (€)	Net income of the respondent. This variable is computed through the DHS itself. In order to create net income, mortgage interest payments, and income tax are subtracted from a large range of different sources of income.

APPENDIX B: Factor Analysis

Table 8 Factor analysis financial literacy

This table reports the eigenvalues, differences, proportions, and cumulative proportions of the factor analysis used for the advanced financial literacy questions. The iterated principal component method is used to obtain the factor loadings. The factor analysis is performed over 22 dummy variables. Eleven dummy variables are created for the correct answers of the advanced financial literacy questions, assigning a [1] when the answer is correct, and a [0] otherwise. The 11 other dummies are created for the "I don't know" answers which are assigned an [1] if the respondent answered "I don't know" and a [0] otherwise. The data are from the 2005 DNB Household Survey.

Factor analysis/correlation
Method: principal factors
Rotation: (unrotated)

Number of obs = 1,109
Retained factors = 1
Number of params = 22

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	9.014	8.102	0.772	0.772
Factor2	0.913	0.172	0.078	0.850
Factor3	0.741	0.229	0.063	0.913
Factor4	0.512	0.108	0.044	0.957
Factor5	0.403	0.036	0.035	0.992
Factor6	0.367	0.024	0.031	1.023
Factor7	0.343	0.027	0.029	1.053

Factor8	0.316	0.086	0.027	1.080
Factor9	0.230	0.115	0.020	1.099
Factor10	0.115	0.032	0.010	1.109
Factor11	0.082	0.014	0.007	1.116
Factor12	0.069	0.109	0.006	1.122
Factor13	-0.040	0.048	-0.003	1.119
Factor14	-0.088	0.025	-0.007	1.111
Factor15	-0.113	0.013	-0.010	1.101
Factor16	-0.125	0.011	-0.011	1.091
Factor17	-0.136	0.022	-0.012	1.079
Factor18	-0.158	0.014	-0.013	1.065
Factor19	-0.172	0.012	-0.015	1.051
Factor20	-0.185	0.015	-0.016	1.035
Factor21	-0.200	0.009	-0.017	1.018
Factor22	-0.209	.	-0.018	1.000

LR test: independent vs. saturated: $\chi^2(231) = 1.4e+04$ Prob> $\chi^2 = 0.0000$

Table 9 Factor loadings and unique variances

This table reports the factor loadings and the uniqueness of the factor analysis used for the advanced financial literacy questions. The iterated principal component method is used to obtain the factor loadings. The factor analysis is performed over 22 dummy variables. Eleven dummy variables are created for the correct answers of the advanced financial literacy questions, assigning a [1] when the answer is correct, and a [0] otherwise. The 11 other dummies are created for the "I don't know" answers which are assigned an [1] if the respondent answered "I don't know" and a [0] otherwise. Adv corresponds to a correct answer of the advanced financial literacy question with the number of the question followed. DK stands for "Don't know" and corresponds to the advanced financial literacy question when it is answered with "I don't know." The data are from the 2005 DNB Household Survey.

Variable	Factor1	Uniqueness
Advanced_1	-0.591	0.650
Don't know	0.713	0.492
Advanced_2	-0.428	0.817
Don't know	0.602	0.638
Advanced_3	-0.659	0.566
Don't know	0.767	0.412
Advanced_4	-0.614	0.623
Don't know	0.741	0.451
Advanced_5	-0.381	0.855
Don't know	0.700	0.511

Advanced_6	-0.526	0.724
Don't know	0.739	0.454
Advanced_7	-0.625	0.610
Don't know	0.753	0.433
Advanced_8	-0.517	0.733
Don't know	0.741	0.451
Advanced_9	-0.661	0.563
Don't know	0.779	0.393
Advanced_10	-0.565	0.681
Don't know	0.736	0.458
Advanced_11	-0.494	0.755
Don't know	0.532	0.716

Table 10 Kaiser-Meyer-Olkin measure of sampling adequacy

This table reports the Kaiser-Meyer-Olkin (KMO) test of sampling adequacy of the factor analysis performed on the 22 dummies for the advanced financial literacy questions. The iterated principal component method is used to obtain the factor loadings. The data are from the 2005 DNB Household Survey.

Variable	KMO
Advanced_1	0.895
Don't know	0.912
Advanced_2	0.924
Don't know	0.940
Advanced_3	0.905
Don't know	0.914
Advanced_4	0.908
Don't know	0.921
Advanced_5	0.936
Don't know	0.955
Advanced_6	0.916
Don't know	0.935
Advanced_7	0.858
Don't know	0.904
Advanced_8	0.935
Don't know	0.927
Advanced_9	0.897
Don't know	0.902
Advanced_10	0.921

Don't know	0.947
Advanced_11	0.923
Don't know	0.923
Overall	0.917

APPENDIX C: Robustness check additional dependent variable

Table 11 Multivariate results, saving behavior

This table reports the effects of multivariate analysis of the actual and perceived financial literacy and several control-variables and dummy-variables on the willingness to save, willingness to save in the future and the Savings to net income. Using an ordinary least squares model. The data are from the 2005 DNB Household Survey. The robust standard errors are reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1

		Willingness to save	Willingness to save	Willingness to save in future	Willingness to save in future	Savings to net income	Savings to net income
Advanced financial literacy		0.0066 (0.0047)	0.0036 (0.0058)	-0.0019 (0.0048)	0.0017 (0.0059)	-0.0205*** (0.0069)	0.0059 (0.0067)
Perceived financial literacy		0.0280 (0.0217)	0.0240 (0.0245)	0.0255 (0.0222)	0.0299 (0.0244)	0.0498* (0.0296)	0.0768** (0.0297)
Control variables (see Table 2)		NO	YES	NO	YES	NO	YES
R ²		0.0044	0.0465	0.0012	0.0652	0.0109	0.1646
Observations		1,109	955	1,109	955	935	935

Table 12 Multivariate results, borrowing behavior

This table reports the effects of multivariate analysis of the actual and perceived financial literacy and several control-variables and dummy-variables on the presence of a loan and the debt to net income using an ordinary least squares model. The data are from the 2005 DNB Household Survey. The robust standard errors are reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1

	Presence of a loan	Presence of a loan	Debt to net income	Debt to net income
Advanced financial literacy	-0.0042 (0.0037)	-0.0011 (0.0044)	-0.0787 (0.0596)	-0.3256 (0.0384)
Perceived financial literacy	-0.0189 (0.0189)	-0.04475** (0.0194)	0.1342 (0.1020)	0.1040 (0.1106)
Control variables (see table 2)	NO	YES	NO	YES

R ²	0.0032	0.0916	0.0082	0.0509
Observations	1,109	955	876	876

APPENDIX D: Correlation Matrix

Table 83 correlation matrix overconfidence and saving behavior

This table presents the correlation between overconfidence and total savings per year. The data are from the 2005 DNB Household Survey.

	Total savings per year	Overconfidence
Total savings per year	1.0000	
Overconfidence	-0.0915**	1.0000

Table 14 correlation matrix overconfidence and borrowing behavior

This table presents the correlation between overconfidence and total savings per year. The data are from the 2005 DNB Household Survey.

	Total debt	Overconfidence
Total debt	1.0000	
Overconfidence	-0.0698	1.0000

Table 15 Correlation matrix combined financial literacy measures

This table presents the correlation between all the financial literacy measures. The data are from the 2005 DNB Household Survey.

	High perceived – High actual	Low perceived – Low actual	Overconfidence	Underconfidence
High perceived– High actual	1.0000			
Low perceived– Low actual	-0.3740***	1.0000		
Overconfidence	-0.1363***	-0.2221***	1.0000	
Underconfidence	-0.3591***	-0.5853***	-0.2132***	1.0000

Table 16 correlation matrix overconfidence and saving behavior

This table presents the correlation between perceived financial literacy and actual financial literacy. The data are from the 2005 DNB Household Survey.

	Actual financial literacy	Perceived financial literacy
Actual financial literacy	1.0000	
Perceived financial literacy	0.2553***	1.0000

APPENDIX E: Interaction effects saving behavior**Table 17 Interaction effects saving behavior**

This table reports the interaction effects of gender, income, education, and age with financial literacy overconfidence on the logarithm of total savings per year using ordinary least squares. The data are from the 2005 DNB Household Survey. The robust standard errors are reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1

	1	2	3	4
Total Savings per year (logarithm)				
Overconfidence	-0.1047 (0.1510)	-0.2207 (0.2267)	-0.1610 (0.1325)	0.0341 (0.3518)
Male	0.3754*** (0.0622)			
Overconfidence * male	-0.2523 (0.2342)			
Income		0.0000*** (0.000)		
Overconfidence * income		0.0000 (0.000)		
High education			0.2275*** (0.0607)	
Overconfidence * high education			-0.2951 (0.2722)	
Age				0.0085*** (0.0022)
Overconfidence * Age				-0.0059 (0.0068)
Observations	690	606	690	690
R ²	0.0613	0.1013	0.0278	0.0324

Table 18 Interaction effects financial literacy overconfidence and gender

This table reports the interaction effects of gender and financial literacy overconfidence on the logarithm of total debt using ordinary least squares, controlling for the control variables in the first model and additional control variables in the second model. In the second model, the combined measures of financial literacy are included (omitted variable is Low perceived – Low actual). The data are from the 2005 DNB Household Survey. The robust standard errors are reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1

	1	2
Total debt (logarithm)		
Overconfidence	0.0128 (0.1810)	0.0331 (0.1827)
Male	0.1017 (0.0783)	0.0693 (0.0811)
Overconfidence * male	-0.2416 (0.2530)	-0.1817 (0.2586)
Underconfidence		0.0338 (0.0800)
High perceived – High actual		0.1817** (0.0885)
Control variables	YES	YES
Observations	188	164
R ²	0.0194	0.0248