



Competence, Confidence, and Gender: The Role of Objective and Subjective Financial Knowledge in Household Finance

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Abstract

We studied the association of individual differences in objective financial knowledge (i.e. competence), subjective financial knowledge (i.e. confidence), numeric ability, and cognitive reflection on a broad set of financial behaviors and feelings towards financial matters. We used a large diverse sample (N = 2063) of the adult Swedish population. We found that both objective and subjective financial knowledge predicted frequent engagement in sound financial practices, while numeric ability and cognitive reflection could not be linked to the considered financial behaviors when controlling for other relevant cognitive abilities. In addition, both objective and subjective financial knowledge served as a buffer against financial anxiety, while we did not detect similar buffering effects of numeric ability and cognitive reflection. Subjective financial knowledge was found to be a stronger predictor of sound financial behavior and subjective wellbeing than objective financial knowledge. Women reported a lower level of subjective financial wellbeing even though they reported a more prudent financial behavior than men, when controlling for sociodemographics and cognitive abilities. Our findings help to understand heterogeneity in people's propensity to engage in sound financial behaviors and have implications for important policy issues related to financial education.

Keywords Financial literacy · Objective financial knowledge · Subjective financial knowledge · Household finance · Numeracy · Cognitive reflection

Introduction

People regularly make unwise financial decisions: they buy things they can't afford, they do not save enough for retirement, and they fail to pay their bills on time. However, there

is a substantial degree of heterogeneity in people's propensity to engage in financial behaviors that could be considered unsound (Campbell 2006). Independent of their financial behavior, people also differ in the extent to which they worry about financial matters (Joo and Grable 2004). Despite the growing recognition of these issues, and rapidly evolving financial markets forcing people to deal with increasingly complex financial products and services, our understanding

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of individual differences that affect financial behaviors and subjective financial wellbeing is limited. This is surprising given that this knowledge is key when designing adequate interventions and educational programs aimed at improving financial behavior. Hence, it is important to increase knowledge about the role of financial knowledge when it comes to being able to tackle financial challenges. In this study we explored how individual differences in *objective financial knowledge* (competence) and *subjective financial knowledge* (confidence), *numeracy*, and *cognitive reflection* were associated with sound financial behavior and subjective financial wellbeing.

Financial knowledge here refers to the stock of knowledge specifically related to personal finance concepts and products. This can be assessed both objectively, by using knowledge-based questions, and subjectively, by asking people to rate their level of financial knowledge. The term, financial knowledge, is often used interchangeably with financial literacy. However, they do not completely overlap. As Huston (2010) puts it: “Financial knowledge is an integral dimension of, but not equivalent to, financial literacy. Financial literacy has an additional application dimension which implies that an individual must have the ability and confidence to use his/her financial knowledge to make financial decisions” (p. 307). Thus, a person that has low skills may be able to compensate by using tools (e.g., a calculator or a computer) and thereby be able to navigate successfully in matters related to personal finance.

Previous research suggests that objective financial knowledge, measured by standard financial literacy test questions, is key to understanding individual differences in financial behavior. Positive associations have been shown in connection to specific financial behaviors, such as retirement planning (Almenberg and Säve-Söderbergh 2011; Lusardi and Mitchell 2017a; van Rooij et al. 2011a), stock investing (van Rooij et al. 2011b), having an emergency fund (Babiarz and Robb 2014), and accumulation of credit-card debt (Norvilitis et al. 2006). Thus, there is substantial evidence that objective financial knowledge is positively correlated with important financial behaviors. Most studies of the role of financial knowledge in financial behavior have, however, neither considered aggregate measures of financial behaviors nor controlled for related cognitive abilities such as numeric ability and cognitive reflection.¹ Thus, it is unclear if financial knowledge or numeric processing is the key driver of financial behavior (Skagerlund et al. 2018). Indeed, previous research has shown that both numeric processing and the ability to inhibit impulses are predictive of financial behaviors (Cheung et al. 2014; Corgnet et al. 2015; Gerardi et al.

2013; Ghazal et al. 2014; Oechssler et al. 2009; Strömbäck et al. 2017). Thus, there is a need to measure these abilities simultaneously, and test the extent to which they are associated with (un)sound financial behavior.

Subjective financial knowledge, or the confidence in one’s ability to engage in a particular behavior, has also been shown to be an important driver of behavior in a variety of financial settings (e.g., Farrell et al. 2016; Robb et al. 2015). For example, Anderson et al. (2017) showed that people’s subjective financial knowledge (i.e., confidence) was a better predictor of savings behavior than their objective financial knowledge (i.e., competence). Similarly, Allgood and Walstad (2013) found that subjective financial knowledge was a stronger predictor of less costly practices in credit card use than objective financial knowledge. A possible mechanism is that people with high financial confidence might be less reluctant to avoid financial information, which could affect behavior (Barrafrem et al. 2020). Beliefs about the extent of one’s own knowledge might thus be as important (or more) as actual knowledge when it comes to sound financial behavior. To explore the role of financial competence in relation to financial confidence, we measured both objective and subjective financial knowledge in this study.

Subjective financial knowledge or confidence in one’s own financial competence is, however, not always perfectly correlated with performance (Parker et al. 2012). The extent to which one’s own beliefs are calibrated with actual financial competence is commonly referred to as financial sophistication (Woodyard and Robb 2016). Miscalibrated individuals with high subjective financial knowledge but low objective financial knowledge can be thought of as overconfident. Prior studies have shown that overconfidence in own competence often leads to worse financial performance (Barber and Odean 2001; Camerer and Lovallo 1999; Robb et al. 2015; Statman et al. 2006), as well as reluctance to seek financial advice (Kramer 2016; Lewis 2018). Similarly, individuals with low subjective financial knowledge but high objective financial knowledge can be thought of as underconfident. Underconfidence may also influence financial behavior negatively if, for example, individuals become increasingly reluctant to make necessary active financial choices. Peters et al. (2019) showed that people who exhibit “mismatched” levels of objective and subjective numeric ability self-report worse financial and medical outcomes. In addition to confidence, it is therefore important to assess the link between under- and overconfidence and financial behavior.

Although the primary focus of most financial education programs is to promote sound financial behavior, a perhaps equally important goal is to contribute to subjective financial well-being. This is emphasized by the American Consumer Financial Protection Bureau (CFPB) which proclaims that “...the ultimate measure of success for financial literacy

¹ Exceptions are Almenberg and Widmark (2011) and Fernandes et al. (2014).

efforts should be individual financial wellbeing” (CFPB, p. 9). Satisfaction in regards to financial matters has also been shown to be an important component of general life satisfaction (Diener et al. 2010; Easterlin 2006; Hojman et al. 2016; Johnson and Krueger 2006; van Praag et al. 2003; Woodyard and Robb 2016). Thus, it is important to understand if the abilities that influence financial behavior also affects subjective financial wellbeing in similar ways. Prior studies that have examined the relationship between financial knowledge and financial satisfaction have found mixed results (see Tharp 2017 for a review of relevant empirical studies). However, the general pattern from previous studies on financial satisfaction seems to be that subjective financial knowledge has a positive association (Joo and Grable 2004; Xiao et al. 2014), while objective financial knowledge has a negative association (Seay et al. 2015; Xiao et al. 2014). Most previous studies have used single-item measures of financial satisfaction simply by asking individuals to rate how satisfied they are with their current financial situation. This can lead to an imprecise measure of subjective financial wellbeing. In this study we therefore used multiple-item measures of two facets of subjective financial wellbeing: financial security and financial anxiety. Thus, subjective financial wellbeing was defined as (a) a sense of security about one’s own financial situation and (b) the lack of negative emotions (i.e. anxiety, worry) caused by financial matters.

Gender differences have been explored and established for different financial behaviors, such as trading behavior (Barber and Odean 2001), savings behavior (Fisher 2010), and keeping to a budget (Hayhoe et al. 2000). Gender differences have also been demonstrated for objective financial knowledge and numeric ability, where males typically perform better than females (Chen and Volpe 2002; Fonseca et al. 2012; Lusardi and Mitchell 2008). Less is known about gender differences related to subjective financial wellbeing and broader measures of financial behavior. Thus, there exists a knowledge gap concerning how gender differences in objective financial knowledge affects financial behavior and subjective financial wellbeing while taking differences in relevant cognitive abilities and demographics into account.

Method and Data

Recruitment and Procedure

Participants were recruited in collaboration with Origo Group and drawn from a sample of the general adult population previously included in their subject pool. Origo Group (www.origogroup.com) is a Swedish research company that specializes in data collection for national and international surveys. We hired them to collect a representative sample

of 2000 participants (based on age and gender in the Swedish adult population). The survey was conducted online and was closed once the target of 2000 subjects was reached. However, at the time the survey actually closed, the number of participants had reached 2063. Participants received a small monetary payment upon completion of the survey. The survey was programmed in Qualtrics.

Materials

The survey collected information about financial behavior, subjective financial wellbeing, objective and subjective financial knowledge, cognitive reflection, numeric ability, self-control and sociodemographics.

Financial behavior was measured using the Financial Management Behavior Scale (FMBS) developed by Dew and Xiao (2011). The FMBS covers a wide range of financial behaviors needed to ensure a sound financial situation, both in the short run (e.g., paying all bills on time) and in the long run (e.g., saving for retirement or another long-term goal). The FMBS scale consists of 12 items, displayed in Table 1. For each item, participants were asked to indicate how often they had engaged in a certain financial behavior over the past 6 months on a scale from 1 (not at all) to 5 (every month). A higher FMBS score indicated that the individual more frequently engaged in sound financial behaviors. The average FMBS score was 3.53 ($SD=0.69$) for the total sample, indicating that participants on average had engaged quite regularly in the listed activities over the past six months. Cronbach’s alpha was calculated and showed a reliability coefficient of 0.75.

To measure Subjective financial well-being, we combined two scales: the Financial Anxiety Scale (FAS) (Fünfgeld and Wang 2009) and the Financial Security Scale (FSS) (Strömbäck et al. 2017). All items used to measure subjective financial wellbeing are presented in Table 2. Respondents indicated on a five-point Likert scale how well each statement corresponded to their own experience: 5 indicating complete agreement with the statement and 1 indicating complete disagreement with the statement. A higher FAS score indicated that the individual felt more anxiety related to financial matters. A higher FSS score indicated that the individual experienced a higher level of security concerning own financial situation. On average participants scored 2.81 ($SD=0.80$) on FAS and 3.03 ($SD=1.20$) on FSS. Factor analysis confirmed that the two scales for subjective financial wellbeing measured different underlying constructs. A person can feel quite comfortable with his or her financial situation but still feel anxiety about financial matters. Cronbach’s alpha was calculated and showed a reliability coefficient of 0.68 (FAS) and 0.91 (FSS).

To measure *objective financial knowledge*, four knowledge-based questions commonly used to assess financial

Table 1 The Financial Management Behavior Scale (FMBS)

Item	Mean score	SD
1. Comparison shopped when purchasing a product or service [§]	3.86	1.00
2. Paid all your bills on time	4.56	0.84
3. Kept a written or electronic record of your monthly expenses	3.54	1.34
4. Stayed within your budget or spending plan*	3.76	0.99
5. Paid off credit card balance in full each month*	4.55	0.90
6. Maxed out the limit on one or more credit cards ^{#*}	1.94	1.16
7. Made only minimum payments on a loan [#]	2.50	1.35
8. Began or maintained an emergency savings fund	3.22	1.41
9. Saved money from every paycheck	3.54	1.40
10. Saved for a long-term goal such as a car, education, home, etc	3.10	1.40
11. Contributed money to a retirement account [§]	2.90	1.56
12. Bought bonds, stocks, or mutual funds [§]	2.53	1.45
FMBS average	3.53	0.69

The range for all items was 1 to 5. *Cronbach's* $\alpha=0.75$

[#]Item was reverse coded when calculating the average level

*Also included a “not applicable” response option. A total of 586 participants answered “not applicable” to item 4, 787 participants answered “not applicable” to item 5, and 751 participants answered “not applicable” to item 6. These responses were omitted from the analysis. More women than men answered “not applicable” to items 6 and 7. There was no difference between genders with regards to the “not applicable” alternative to item 4

[§]Men and women differed significantly with regards to item 1 ($M_{\text{men}}=3.92$, $SD=0.97$; $M_{\text{women}}=3.80$, $SD=1.03$; $t=2.61$, $p=0.0092$), item 11 ($M_{\text{men}}=2.97$, $SD=1.56$; $M_{\text{women}}=2.83$, $SD=1.57$; $t=2.12$, $p=0.0340$) and item 12 ($M_{\text{men}}=2.81$, $SD=1.51$; $M_{\text{women}}=2.25$, $SD=1.33$; $t=8.80$, $p<0.0001$)

Table 2 Measures of subjective financial wellbeing

Items	Mean score	SD
The Financial Anxiety Scale (FAS)		
1. I get unsure by the lingo of financial experts	3.14	1.12
2. I am anxious about financial and money affairs	2.88	1.08
3. I tend to postpone financial decisions as long as possible	2.51	1.18
4. After making a decision, I am anxious whether I was right or wrong	2.70	1.12
FAS average	2.81	0.80
The Financial Security Scale (FSS)		
1. I feel secure in my current financial situation	3.27	1.28
2. I feel confident about my financial future	3.05	1.30
3. I feel confident about having enough money to support myself in retirement, no matter how long I live	2.75	1.36
FSS average	3.03	1.20

The range for all items was 1 to 5. For FAS *Cronbach's* $\alpha=0.68$ and for FSS *Cronbach's* $\alpha=0.91$

literacy were included. All questions were multiple-choice and have been used in previous studies (van Rooij et al. 2012). The first three questions tested rudimentary financial knowledge: Question 1 was about the interest rate, Question 2 was about inflation, and Question 3 concerned diversification. The last question tested participants' knowledge of the relationship between bond prices and the interest rate. The mean number of correct answers was

2.1 ($SD=1.17$), and 10.2% of the participants responded all four of the financial literacy questions correctly.

To measure *subjective financial knowledge* participants were asked to rate their own financial knowledge on a scale from 1 to 7 (1 meaning very low, and 7 meaning very high). On average participants rated their subjective financial knowledge as 4.32 ($SD=1.26$). The correlation between the objective and the subjective financial

knowledge was 0.34, suggesting that the two measures of financial knowledge were related but not identical.

To measure *financial sophistication*, we took the scores from the objective and subjective financial knowledge measures and categorized individuals into four mutually exclusive groups. Following prior work on financial sophistication by Woodyard and Robb (2016) and Allgood and Walstad (2013) individuals were divided into high and low for both measures. On subjective financial knowledge, individuals were categorized as “high” or “low” depending on whether they responded correctly on half or more of the questions. For subjective financial knowledge we did a mean split of the sample, so that subjects who rated their knowledge as five and above on the Likert scale were categorized as high, while subjects who rated their knowledge as four and below were categorized as low. When combining these measures individuals could be grouped into the following categories: (a) correct high confidence (high subjective–high objective), (b) correct low confidence (low subjective–low objective), (c) over confident (high subjective–low objective), and (d) under confident (low subjective–high objective).

Numeracy was measured using a combination of the three items adopted from Schwartz et al. (1997) and the Berlin Numeracy Test (BNT) developed by Cokely et al. (2012) (validated in Swedish by Lindskog et al. 2015). For example, participants were asked to predict how many times out of 1000 tosses a fair coin would show tails. The BNT was chosen since it tests statistical numeracy and risk literacy, both of which are important in financial issues. The combination of the questions from Schwartz et al. (1997) and the BNT was applied to a wider population; the original BNT items assessed numeracy in more educated samples. Cokely et al. (2012) advocated the combined use of these instruments.

To measure *cognitive reflection*, or deliberation, we administered the Cognitive Reflection Test (CRT) containing the three original items from Frederick (2005). The problems were phrased in such a way that there were intuitive but wrong solutions. The questions were: (1) “A bat and a ball cost \$1.10. The bat costs \$1.00 more than the ball. How much does the ball cost?”; (2) “If it takes five machines five minutes to make five widgets, how long would it take 100 machines to make 100 widgets?”; (3) “In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?” The number of correct answers was used as an indicator of cognitive reflection ability.

To measure self-control, we used five items from a scale developed by Tangney et al. (2004). Participants responded to statements such as: “I get distracted easily” on a five-point Likert scale, with 5 indicating complete agreement with the statement and 1 indicating complete disagreement with the

statement. Cronbach’s alpha was calculated and showed a reliability coefficient of 0.76. Complete instructions of all measures included can be found in the Supplementary Materials.

Hypotheses and Strategy for Analysis

We set out to test the following main hypotheses:

Hypothesis 1: Objective financial knowledge/Subjective financial knowledge/ Numeracy/Cognitive reflection are positively associated with sound financial behavior measured by FMBS.

Hypothesis 2: Objective financial knowledge/Subjective financial knowledge/ Numeracy/Cognitive reflection are positively associated with increased level of Financial satisfaction measured as financial security and financial anxiety.

To explore how the level of each cognitive ability (objective financial knowledge, subjective financial knowledge, numeracy and cognitive reflection) relates to financial behavior, we divided the sample into subgroups, those with low levels and those with high levels of a particular cognitive ability. People were categorized as “high” if they responded correctly on half or more of the questions for each of the performance-based measures. Accordingly, people who failed to answer at least half of the questions correctly were categorized as “low”. For subjective financial knowledge we did a mean split of the sample, so that subjects who rated their knowledge as five and above on the Likert scale were categorized as high, while subjects who rated their knowledge as four and below were categorized as low. In order to test for a difference between the divided sample with respect to their financial behavior we performed t-tests.

As a second step, we utilized an ordinary least squares regression framework to estimate the association between objective and subjective financial knowledge and sound financial behavior and financial satisfaction. In these regressions we included all cognitive measures as continuous variables. The full regression specification (Model 5) was:

$$Y_i = \beta_1 + \beta_2 \text{Objective financial knowledge}_i + \beta_3 \text{Subjective financial knowledge}_i + \beta_4 \text{Numeracy}_i + \beta_5 \text{CRT}_i + \beta_6 X_i + u_i$$

where Y_i is either financial behavior (measured by the FMBS) or level of subjective financial wellbeing (measured by the FAS or the FSS) for individual i . Before running the full regression model we first included each cognitive measure of interest separately (Model 1–4). We then included all cognitive abilities of interest: objective financial

Table 3 Descriptive statistics divided by gender

	Gender		Sig.
	Male	Female	
N	1015 (49.2%)	1048 (50.8%)	
Female, n (%)			
Objective financial knowledge, mean (sd)	2.46 (1.12)	1.69 (1.09)	***
Subjective financial knowledge, mean (SD)	4.56 (1.21)	4.10 (1.26)	***
Numeracy, mean (sd)	3.07 (1.89)	2.06 (1.72)	***
Cognitive reflection, mean (SD)	1.11 (1.07)	0.68 (0.93)	***
Self-control, mean (SD)	3.23 (0.71)	3.12 (0.77)	***
Age, mean (SD)	50.3 (16.07)	48.0 (16.05)	***
Born outside Europe, n (%)	31 (3.1%)	19 (1.8%)	
Education			
Compulsory school, n (%)	136 (13.4%)	130 (12.4%)	
Upper secondary, n (%)	427 (42.1%)	475 (45.3%)	
University less than 3 years, n (%)	153 (15.1%)	157 (15.0%)	
University at least 3 years, n (%)	299 (29.5%)	286 (27.3%)	
Income:			***
< 15,000 SEK, n (%)	117 (11.5%)	183 (17.5%)	
15,000–24,999, n (%)	186 (18.4%)	244 (23.3%)	
25,000–34,999, n (%)	188 (18.6%)	226 (21.6%)	
35,000–44,999, n (%)	149 (14.7%)	134 (12.8%)	
45,000–54,999, n (%)	90 (8.9%)	82 (7.8%)	
55,000–64,999, n (%)	93 (9.2%)	72 (6.9%)	
65,000–74,999, n (%)	78 (7.7%)	44 (4.2%)	
> 75,000, n (%)	112 (11.1%)	63 (6.0%)	
FMBS, mean (SD)	3.58 (0.69)	3.47 (0.69)	***
Financial anxiety, mean (SD)	2.67 (0.76)	2.94 (0.81)	***
Financial security, mean (SD)	3.26 (1.17)	2.80 (1.20)	***

*** $p < 0.001$

knowledge, subjective financial knowledge, numeracy and cognitive reflection. In all regressions we controlled for gender, stated self-control, age, if the participant was born in a non-European country, educational attainment, and income.

Results

Table 3 displays the sample characteristics as well as the general results for all included measures, separated by gender. The final sample consisted of 2063 participants (50.8% women). The mean age in the sample was 49.15 years ($SD = 6.10$) and 28.4% of the sample had at least a bachelor's degree. When comparing the unadjusted results, males consistently scored higher than females on all measured cognitive abilities, including objective and subjective financial knowledge, numeracy, and cognitive reflection. Males also reported a more prudent financial behavior, while women felt less secure and more anxious about financial matters.

Financial Behavior

Figure 1 shows the association between sound financial behavior and the cognitive abilities under investigation without adjusting for sociodemographics and other cognitive abilities. As shown in Fig. 1a, respondents with low levels of objective financial knowledge engaged less frequently in sound financial behaviors. On average, respondents categorized as having low objective financial knowledge scored 3.27 ($SD = 0.68$) on the FMBS, while respondents with high objective financial knowledge scored 3.64 ($SD = 0.67$; $t(2061) = -11.86$, $p < 0.001$). With regards to subjective financial knowledge the same pattern emerged: respondents with low self-reported knowledge had an average score of 3.30 ($SD = 0.66$), while individuals with a high level on average had a score of 3.78 ($SD = 0.64$; $t(2061) = -16.88$, $p < 0.001$). The corresponding results for numeric ability and cognitive reflection are shown in Fig. 1c and d. Respondents with low numeric skills had a significantly lower score on the FMBS than

Table 4 Financial behavior as a function of financial knowledge and other characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
Objective knowledge	0.127*** (0.013)				0.086*** (0.015)	0.146
Subjective knowledge		0.175*** (0.013)			0.157*** (0.013)	0.285
Numeracy score			0.029*** (0.008)		-0.005 (0.009)	-0.013
CRT score				0.039** (0.014)	0.008 (0.016)	0.012
Female	0.069* (0.029)	0.040 (0.027)	0.009 (0.029)	-0.003 (0.027)	0.093*** (0.028)	0.067
Self-control	0.187*** (0.021)	0.133*** (0.018)	0.179*** (0.019)	0.191*** (0.021)	0.144*** (0.018)	0.155
R ²	0.229	0.278	0.199	0.196	0.294	
Number of observations	2060	2060	2060	2060	2060	2060

All regressions are ordinary least square. The dependent variable is the mean score on the Financial Management Behavior Scale (FMBS), the possible range is between 1 and 5. All independent variables are continuous variables except female which is a dummy. Specification (6) reports standardized estimates. All specifications include controls for age, if a person is born in a non-European country, educational attainment and reported income levels, an extended table showing these estimates can be found in Table S3 in the Supplementary Materials. Robust standard errors in parentheses

*p < 0.05, **p < 0.01, ***p < 0.001

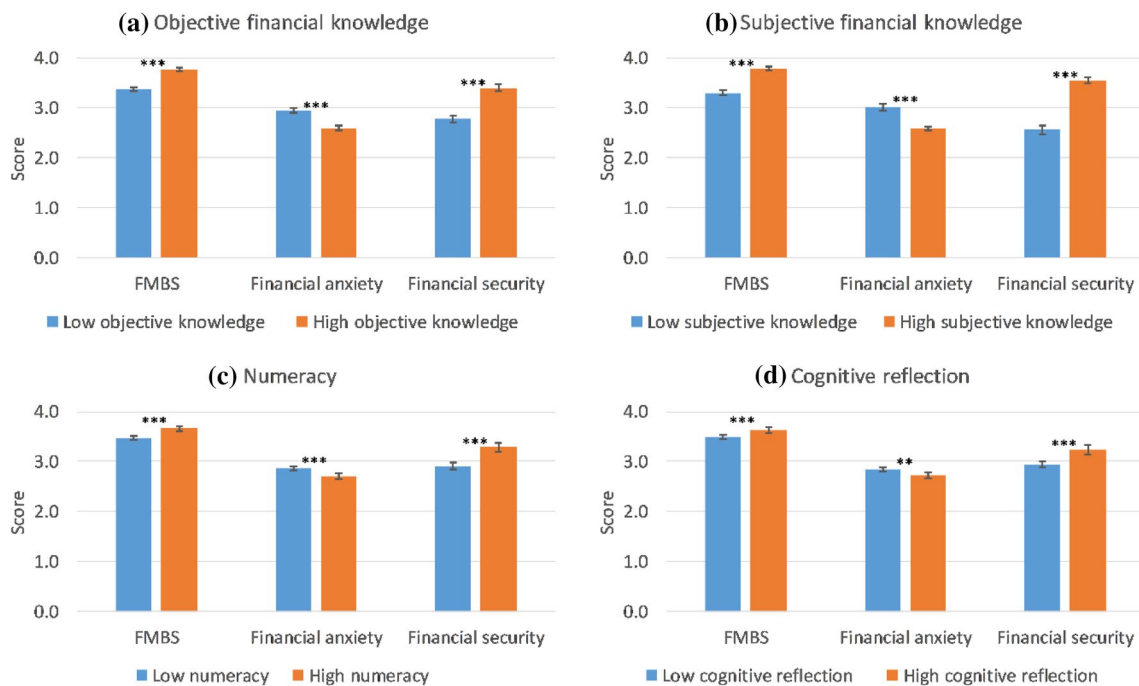


Fig. 1 Financial Behavior and subjective financial wellbeing varying by cognitive abilities. *p < .05, **p < .01, ***p < .001

those with high numeric skills (low numeracy M = 3.47 (SD = 0.69), high numeracy M = 3.66 (SD = 0.67), $t(2061) = -5.89, p < 0.001$). Similarly, respondents categorized as having a low reflective ability also had a significantly lower score on FMBS (low CRT 3.49 (SD = 0.70),

high CRT 3.63 (SD = 0.68), $t(2061) = -4.09, p < 0.001$). Consequently, all analyses conducted when not taking sociodemographic factors and other cognitive abilities into account were supportive of Hypothesis 1.

Table 5 Financial anxiety as a function of financial knowledge and other characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
Objective knowledge	−0.079*** (0.016)				−0.054** (0.018)	−0.079
Subjective knowledge		−0.120*** (0.017)			−0.110*** (0.017)	−0.172
Numeracy score			−0.013 (0.010)		0.011 (0.012)	0.026
CRT score				−0.024 (0.016)	−0.013 (0.018)	−0.017
Female	0.142*** (0.034)	0.155*** (0.032)	0.183*** (0.034)	0.186*** (0.033)	0.126*** (0.035)	0.079
Self-control	−0.369*** (0.025)	−0.338*** (0.026)	−0.371*** (0.026)	−0.371*** (0.026)	−0.339*** (0.026)	−0.315
R^2	0.199	0.219	0.190	0.190	0.223	
Number of observations	2060	2060	2060	2060	2060	2060

All regressions are ordinary least square. The dependent variable is the mean score on the Financial Anxiety Scale (FAS), the possible range is between 1 and 5. All independent variables are continuous variables except female which is a dummy. All specifications include controls for age, if a person is born in a non-European country, educational attainment and reported income levels, an extended table showing these estimates can be found in Table S4 in the Supplementary Material. Robust standard errors in parentheses

** $p < 0.01$, *** $p < 0.001$

To further explore the descriptive results on financial behavior shown in Fig. 1, we conducted regression analysis controlling for relevant sociodemographics and differences in cognitive abilities. Table 4 shows the results from these analyses. The estimate for objective financial knowledge in Model 1 shows that one more correct answer to the financial literacy questions raised the average score on the FMBS by 0.13 points, all else equal. For subjective financial knowledge, the estimate increased to 0.18. For numeric ability and cognitive reflection, the effect sizes were smaller but still significant. In Model 5, where financial knowledge (objective and subjective), numeric ability and cognitive reflection entered the model specification simultaneously, only objective and subjective financial knowledge remained statistically significant predictors of financial behavior. Given that previous studies have shown a strong association between numeric ability and better decision making, it is noteworthy that there was no association between numeracy and financial behavior when financial knowledge was taken into account. In Model 6 the standardized beta coefficients are shown, allowing for a magnitude comparison between the measures. Subjective financial knowledge was the strongest predictor of financial behavior, followed by self-reported self-control and then objective financial knowledge. Thus, financial confidence seems to be more important than financial competence when it comes to sound financial behavior. Indeed, the coefficient for subjective financial knowledge was significantly larger than the coefficient for objective financial knowledge ($F(1, 2041) = 11.12, p < 0.001$). Looking at gender difference, the results from our general

regression model (Model 5) showed that when controlling for all cognitive abilities, women were more likely to engage in sound financial behaviors compared to men.

Subjective Financial Wellbeing

To explore how financial knowledge and other cognitive abilities are associated with feelings of financial security and anxiety (Hypothesis 2) we performed the same type of analyses as conducted for financial behavior. As shown in Fig. 1 similar patterns emerged also for feelings related to financial anxiety and security. Figure 1a shows that participants categorized as having low objective financial knowledge felt more anxiety related to financial matters than those with higher objective financial knowledge. Those with low objective financial knowledge scored, on average, 2.98 (SD = 0.82) on the FAS and those with high levels of financial knowledge scored, on average, 2.73 (SD = 0.78; $t(2061) = 6.86, p < 0.001$). Similar results were found for subjective financial knowledge, as can be seen in Fig. 1b. Those who self-reported low levels of financial knowledge scored, on average, 3.01 (SD = 0.74) on the FAS and those who self-reported high levels scored, on average, 2.58 (SD = 0.80; $t(2061) = 12.62, p < 0.001$). Figure 1c shows a similar result but with regards to numeracy: people with low numeracy levels worried somewhat more about financial matters than those with high numeracy levels. Participants with low numeracy scored 2.86 (SD = 0.81) and those with high numeracy scored 2.70 (SD = 0.77, $t(2061) = 4.11, p < 0.001$). Participants with low levels of cognitive

Table 6 Financial security as a function financial knowledge and other characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
Objective knowledge	0.131*** (0.022)				0.036 (0.023)	0.035
Subjective knowledge		0.354*** (0.019)			0.347*** (0.020)	0.361
Numeracy score			0.029* (0.014)		−0.001 (0.015)	−0.002
CRT score				0.034 (0.023)	0.015 (0.025)	0.013
Female	−0.161*** (0.049)	−0.131** (0.043)	−0.223*** (0.049)	−0.237*** (0.047)	−0.104* (0.045)	−0.043
Self-control	0.361*** (0.034)	0.266*** (0.031)	0.364*** (0.034)	0.365*** (0.034)	0.267*** (0.031)	0.267
R ²	0.291	0.394	0.280	0.279	0.395	
Number of observations	2060	2060	2060	2060	2060	2060

All regressions are ordinary least square. The dependent variable is the mean score on the Financial Security Scale (FSS), the possible range is between 1 and 5. All independent variables are continuous variables except female which is a dummy. All specifications include controls for age, if a person is born in a non-European country, educational attainment and reported income levels, an extended table showing these estimates can be found in Table S5 in the Supplementary Material. Robust standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

reflection scored, on average 2.72 ($SD = 0.76$) whereas those with high levels scored on average 2.84 ($SD = 0.82$, $t(2061) = 3.12$, $p = 0.002$).

As shown in Table 5, however, objective and subjective financial knowledge were the only measures besides self-control that had a statistically significant effect on financial anxiety when controlling for relevant demographics and differences in cognitive abilities. The signs were negative, indicating that higher financial knowledge (both objective and subjective) entailed less anxiety. The negative associations were robust across model specifications as shown in Table 5. Thus, objective and subjective financial knowledge independently influenced financial anxiety. Model 6, with standardized coefficients, showed that confidence in the form of subjective financial knowledge was more important than objective financial knowledge. Indeed, the coefficient for subjective financial knowledge was significantly larger than the coefficient for objective financial knowledge ($F(1, 2041) = 5.19$, $p = 0.023$). The full model in Table 5 also shows that women, independently of other factors, worried more about financial matters than men did.

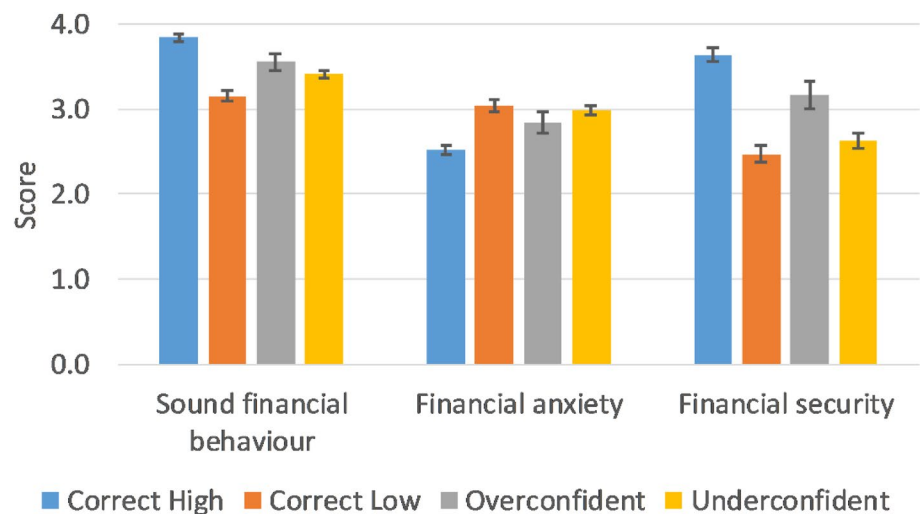
Table 6 shows the results related to feeling of financial security. Objective financial knowledge was associated with a greater sense of financial security also when controlling for sociodemographics (Model 1 and 2). For numeracy the effect was also positive and statistically significant, but the effect size was small. The association between cognitive reflection and financial security was no longer significant when controlling for socio demographics. In Model 5, where all measures were included,

the only measure that remained as a significant predictor was subjective financial knowledge. Thus, similar to the results presented for financial behavior, subjective financial knowledge was a stronger predictor than objective financial knowledge. Indeed, the coefficient for subjective financial knowledge was yet again significantly larger than the coefficient for objective financial knowledge ($F(1, 2041) = 92.13$, $p < 0.001$). The full model in Table 6 also shows that women felt less secure about their financial situation, albeit this association was significant only on 10% level.

Financial Sophistication

Figure 2 shows how miscalibrated levels of subjective and objective financial knowledge were associated with our main dependent variables (FMBS, financial anxiety and financial security). Individuals with matched levels of high subjective knowledge and high objective knowledge were the group with the highest FMBS Score (3,83), while individuals with matched levels of low subjective and objective knowledge had the lowest FMBS score (3,15). For miscalibrated individuals, overconfident individuals had a slightly higher FMBS score compared to individuals categorized as underconfident (FMBS score: 3,55 vs. 3,41). For financial anxiety and financial security similar patterns emerged. For additional regression analyses see Table S6 in the Supplementary Material. In general terms our results indicated that it was most beneficial to have

Fig. 2 Financial behavior and subjective financial wellbeing varying by financial sophistication



matched levels of high subjective knowledge and high objective knowledge. However, it was also more beneficial for the individual to be overconfident rather than underconfident, i.e., having high objective knowledge but low subjective knowledge. Thus, it seemed like subjective financial knowledge had a positive effect in itself when it came to general financial behaviors and feelings about financial matters.

Discussion

Every day, individuals make countless decisions, many of which involve complex considerations and have both short- and long-term financial consequences. In addition, financial products and markets are becoming increasingly more complex, while individuals at the same time increasingly are becoming responsible for making adequate financial decisions. This puts a heavy burden on the individual decision maker within the financial domain. Being adequately equipped with skills and abilities to face these complex decisions is thus important both from an individual standpoint and from a societal perspective. Understanding how financial knowledge relates to financial behavior and subjective financial wellbeing is therefore important for policy-makers when thinking about designing interventions and educational programs.

A main finding from this study is that knowledge, both objective and subjective, predicts (un)sound financial behaviors, while other cognitive abilities are less influential. The finding that knowledge predicts (un)sound financial behaviors is perhaps not surprising and is in line with prior studies exploring similar matters for specific financial behaviors such as retirement planning (Almenberg and Säv-Söderbergh 2011; Lusardi and Mitchell 2017) and having emergency funds (Babiarz and Robb 2014). However, the

finding that numeracy did not matter substantially for everyday financial behavior, when taking financial knowledge into account, is both novel and important since previous research has found that numeracy correlates with better decision making (Peters et al. 2006).

In this study we also investigated whether financial knowledge is related to subjective financial wellbeing, measured by combining two facets—financial anxiety and security. The determinants of these two aspects of financial wellbeing has been a largely neglected area of research; thus, our results make an important contribution. We show that financial anxiety is predicted by both subjective and objective financial knowledge, while financial security is predicted by subjective financial knowledge only. Importantly, neither numeric ability nor cognitive reflection were robustly linked to financial anxiety/security. The finding that subjective financial knowledge is positively related to subjective financial wellbeing is in line with previous studies showing that subjective financial knowledge is positively related to measures of financial satisfaction (Joo and Grable 2004; Seay et al. 2015; Xiao et al. 2014). However, the finding that objective financial knowledge is also positively related to subjective financial wellbeing is in contrast with previous research, which has shown a negative relationship between objective financial knowledge and financial satisfaction (Seay et al. 2015; Xiao et al. 2014). A possible explanation for this discrepancy is that our measures of subjective financial wellbeing focus more on emotions and feelings related to finance in general, while measures of financial satisfaction typically focus more on level of satisfaction related to current financial conditions.

Our results also show that women feel less secure in their financial situation and worry more about it than men. Further, we found a significant difference in financial behavior suggesting that women have more sound financial behaviors than men, when controlling for sociodemographic and cognitive measures. This suggests that although women more

frequently engage in sound financial behaviors, they still feel more anxiety related to financial matters, also when controlling for factors such as income.

A particularly noteworthy finding from this study is that financial confidence (i.e., subjective financial literacy) seems to be more important than financial competence (i.e., objective financial knowledge). This was found in relation to both financial behavior and subjective financial wellbeing. The interplay between objective and subjective financial knowledge has been explored for some financial behaviors in prior studies (Allgood and Walstad 2013, 2016; Anderson et al. 2017; Robb et al. 2015). These studies have suggested that subjective financial knowledge may be as important as actual financial knowledge. Our results support these claims by showing that subjective financial knowledge is a stronger predictor than subjective financial competence when it comes to sound financial behavior. This finding is also in line with research showing that confidence is an important driver of behavior in the financial domain (Farrell et al. 2016; Robb et al. 2015). Although the best combination of subjective and objective financial knowledge is to have corresponding high levels on both, our results also indicate that subjective financial knowledge in itself is beneficial for financial outcomes. Thus, our results are not consistent with studies suggesting that the benefits from having high confidence accrue only on individuals with adequate competences (Peters et al. 2019). Further research is needed on when overconfidence is beneficial/harmful for financial behavior, and which underlying psychological mechanisms can help to explain why. A suggestive explanation for why confidence, regardless of competence, have positive effect on everyday financial behavior and feelings is that a stronger belief about own ability makes people more likely to approach everyday financial problems as ‘challenges to be mastered, rather than as threats to be avoided (Bandura 1994). Such an attitude toward everyday financial matters is likely to have a positive effect on both financial outcomes and wellbeing.

To sum up, our study makes several contributions to the literature on financial literacy and decision making. First, we explore how financial knowledge can be linked to both daily financial behaviors and subjective financial wellbeing. Second, we use broad and comprehensive measures of financial behavior, in contrast to previous studies that have mostly focused on specific financial behaviors. Third, we test for a rigorous set of cognitive control variables which have been shown to affect financial behavior. Fourth, we measure both objective and subjective financial knowledge so that we can explore the relative importance of financial competence and financial confidence. Finally, we have a large and diverse sample of the population so that we can examine if financial literacy differs between genders, and how financial literacy relates to financial behaviors across all levels of society.

Some limitations should be noted. First, the analyses presented in this paper are correlative in nature. Thus, we cannot make inferences about causality. Although it seems reasonable to believe that, for example, higher confidence leads to better financial behavior, it could also be that better financial behaviors lead to higher financial confidence. Future studies should attempt to experimentally manipulate financial confidence and competence in order to establish causality. Second, our measure of financial behavior relies on self-reports. Thus, we cannot be completely sure that people report behavior correctly. It is possible that a potential positive bias in self-reporting is correlated with confidence. For future studies it would be ideal to get access to objective data on financial behavior from banks or financial institutions. Third, our sample is limited to Swedish participants. Thus, we do not know how well our findings translate into other populations. However, given that our results seem to be much in line with some previous studies that used similar methods but were conducted on different samples, we see no obvious reason for why our findings should not extend to non-Swedish populations.

Implications and Conclusions

Our findings suggest that there is still lot to be learned about how financial knowledge contributes to (un)sound financial behavior and subjective financial wellbeing, and how one might help individuals to achieve better objective and subjective wellbeing. The finding that subjective financial knowledge (i.e., confidence) is (at least) as important as objective financial knowledge (i.e., competence) suggests that educators on financial matters should seek to boost a combination of the two in order to achieve the greatest possible effects. In addition, our findings also have clear implications for researchers on financial literacy who commonly only use test scores when assessing financial knowledge. Without also measuring subjective financial knowledge such an approach is likely to underestimate the effect of financial knowledge on behavior and subjective wellbeing. Thus, our findings underscore the importance of taking both subjective and objective financial knowledge into account when assessing financial literacy and how this affects financial behaviors and wellbeing.

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Compliance with Ethical Standards

Conflict of interest The study was conducted in compliance with ethical standards. All authors declare no conflict of interest that could have appeared to influence the submitted work.

Informed Consent All participants gave informed consent and were informed that they could withdraw from the study at any time.

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