Journal of Behavioral and Experimental Finance 27 (2020) 100339

Contents lists available at ScienceDirect

Journal of Behavioral and Experimental Finance

journal homepage: www.elsevier.com/locate/jbef

Full length article

Subjective self-control but not objective measures of executive functions predicts financial behavior and well-being

Camilla Strömbäck [a], Kenny Skagerlund [b], Daniel Västfjäll [b,d], Gustav Tinghög [a,c,*]

[a] Department of Management and Engineering, Division of Economics, Linköping University, 581 83 Linköping, Sweden
[b] Department of Behavioral Sciences and Learning, Linköping University, 581 83 Linköping, Sweden
[c] The National Center for Priority Setting in Health Care, Department of Medical and Health Sciences, Linköping University, 581 83 Linköping, Sweden
[d] Decision Research, Eugene, OR, USA

ARTICLE INFO

Article history:
Received 3 October 2019
Received in revised form 3 May 2020
Accepted 14 May 2020
Available online 26 May 2020

Keywords:
Self-control
Executive functions
Intelligence
Financial behavior
Financial well-being

ABSTRACT

Executive functions consist of three separable but correlated functions; inhibition, working memory, and shifting. Here we used an extensive and validated battery of objective performance measures of executive functions and intelligence to investigate if individual differences in these cognitive abilities can explain sound financial behavior and subjective financial well-being. Additionally, we measured a set of self-reported personality traits, including self-control, optimism, and deliberative thinking. We found that neither executive functions nor intelligence was associated with sound financial behavior and financial well-being in our sample. Although objective self-control, measured as the ability to override impulses (i.e. inhibition), could not be linked to financial behavior and financial wellbeing, subjective (i.e. self-reported) self-control had a strong positive effect. This indicates that the ability to avoid financial temptation is more important than the cognitive ability to override impulses when it comes to sound financial behavior and financial well-being.

1. Introduction

Self-control, or the ability to resist urges and self-regulate unwanted behavioral impulses, is a key determinant of success in most areas in life (see, e.g., Miller et al., 2011; Mischel et al., 1989; Moffitt et al., 2011). This seems to be true also for behavior in the financial domain. Strömbäck et al. (2017) showed that self-control predicted both sound financial behavior and financial well-being. In that study, a self-reported, or subjective, measure of self-control was used. Recent studies have, however, found that the correlation between self-reported measures of self-control and behavioral, or objective, measures of self-control is weak (Dang et al., 2020; Delaney and Lades, 2017; Eisenberg et al., 2019; Saunders et al., 2018), suggesting that they tap on to different underlying cognitive constructs. Moreover, Lind et al. (2020) found that self-reported financial knowledge was a stronger predictor of sound financial behavior and financial well-being than actual financial knowledge, measured by standard financial literacy test questions. In this study we therefore included both a performance-based measure and a self-reported measure of self-control exploring their associations with financial behavior and financial well-being. Since self-control in theory is intricately linked to executive functions (see Table 1 for an overview), we also included an extensive and validated battery of tests for executive functions and intelligence. This allows us to determine whether specific components of executive functions relate to financial well-being and behavior above and beyond measures of self-control.

Executive functions, a concept widely studied within cognitive psychology and cognitive neuroscience, is a collection of top-down cognitive control processes that regulate behaviors, thoughts and feelings (e.g. Diamond, 2013; Miyake and Friedman, 2012; Miyake et al., 2000). The seminal work by Miyake et al. (2000) evaluated an extensive test battery consisting of various cognitive performance tests and used factor analysis to determine that a set of tasks loaded onto an overarching latent variable — Executive Function (EF). The tripartite model of executive functions suggested by Miyake et al. (2000) has received vast empirical support and has replicated throughout various domains of cognitive psychology and cognitive neuroscience. Despite of this, and despite an increasing interest in using "cognitive abilities" in predicting financial outcomes in behavioral economics and behavioral finance, the full extent of this technical model has not yet been thoroughly investigated. This can partly be caused by confusion about the terminology, where many studies in behavioral economics and finance use the umbrella term "cognitive

* Corresponding author at: Department of Management and Engineering, Division of Economics, Linköping University, 581 83 Linköping, Sweden.
E-mail address: gustav.tinghog@liu.se (G. Tinghög).

https://doi.org/10.1016/j.jbef.2020.100339

Table 1
Connection between self-control and executive functions.
Source: Adapted from Hofmann et al. (2012).

Executive functions	Self-control mechanisms
Inhibition	Ability to resist urges and behavioral impulses
Working memory	Ability to formalize self-regulatory goals and the necessary means to achieve these goals Ability to maintain and update information in a mental workspace Ability to keep cognitive tasks and goals from interfering with each other Ability to suppress ruminative thoughts Ability to downplay unwanted urges
Shifting	Ability to switch between different tasks while remaining focused on the general goal Ability to switch between multiple goals and objectives

abilities" which covers other abilities as well, such as numeracy (Burks et al., 2009), nonverbal reasoning (Ballinger et al., 2011), and word fluency (Christelis et al., 2010; Dohmen et al., 2010).

According to the tripartite model, executive functions consist of three separable but moderately correlated functions, namely (1) inhibition, (2) working memory and (3) shifting. Inhibition refers to the ability to control one's attention, behavior, thoughts and emotions and steer them toward appropriate responses, such as continuing working on a boring task instead of doing something more rewarding and pleasurable. Thus, inhibition overlaps with many common definitions of self-control. Working memory or updating involves the ability to maintain and update information in a mental workspace, such as remembering and internally repeating a phone number. Finally, shifting refers to the ability to switch attention flexibly between goal-relevant tasks, i.e. multitasking. Thus, shifting enables individuals to change perspective when stuck on a difficult problem and to consider someone else's point of view. Factor analyses and structural equation models have repeatedly shown that these three basic executive functions are robustly correlated but still belongs to separable constructs (e.g., Miyake et al., 2000). Neuroimaging studies have also shown that they activate both common and specific neural areas in the frontoparietal network of the brain and can be linked to individual differences in neural activation, volume, and connectivity (Friedman and Miyake, 2017). Importantly, given that all executive functions are correlated and tap into overlapping neural substrates, it is essential to incorporate indices of all three executive functions to get reliable estimates of which specific component explains any hypothetical variance. If only measures of one executive function is used in a model, we cannot infer whether any explained variance is due to the specific aspect of that particular executive function or whether the explained variance can be attributed to other common cognitive mechanisms better explained by another executive function not included in the model of interest.

To our knowledge, no previous study has systematically investigated how all three basic components of executive function relate to financial behavior or financial well-being. One explanation behind the lack of studies in this field can likely be attributed to the challenging nature of administering these types of objective cognitive performance tests. It requires the administration of three well-constructed tests tapping into the three different cognitive processes, while preferably controlling for extraneous, but related, abilities. Intelligence is one such ability that correlates with some aspects of EFs, but is also dissociated from it in a number of ways (Friedman et al., 2006). General intelligence refers to the ability to reason, problem-solve, and to see patterns or relations among items (Ferrer et al., 2009). A valid and robust assessment of general intelligence also requires substantial time and supervision, providing yet another demand on time and resources when studying the relationship between executive functions and financial behavior. Further, it is reasonable to include optimism as a control variable when investigating executive functions as previous research has shown inconclusive results of the relationship between executive functions and optimism. For example, Pyone and Isen (2011) and Carpenter et al. (2013) both found that positive feelings promote working-memory capacity and analytical thinking. However, following the so-called *sadder-but-wiser hypothesis*: sadness and pessimism should make individuals less biased in their decisions since it increases reliance on analytical thinking, System 2 as opposed to intuitive thinking, System 1 (Keltner and Lerner, 2011; Lerner et al., 2013). The sadder-but-wiser hypothesis thus suggests that less optimistic individuals should make more sound financial choices. Still, Lerner et al. (2013) found that negative mood increased impatience in intertemporal choices, which instead could indicate that the sadder-but-wiser hypothesis is not applicable for financial choices.

2. Method

2.1. Participants and procedures

200 students from various academic disciplines at a large Swedish university were recruited to participate in a series of tests and laboratory experiments. Each subject participated in three parts, carried out on different days, and spread out during the spring semester 2017. All participants gave their informed consent and were compensated after each completed session. Three completed parts generated a compensation of SEK 1000 (approximately USD 100). Thirty-four students did not complete all three parts and were therefore excluded from the analysis, which leaves us with a total of 166 participants (50% women, age 19–41 [m = 24; SD = 3.46]).[1]

The first part of the study was conducted in a classroom where the participants were asked to individually fill out a computer based survey. Each session contained 1–15 participants and lasted approximately 90 min. During the second and third parts, the participants met individually with an experimenter and performed an extensive battery of cognitive tests, which included assessment of general intelligence as well as measures of the three EFs. The second part contained, among other things, a test of inhibition, while working memory, shifting, and general intelligence were tested during the third part. Part two and three lasted approximately 60 and 90 min, respectively. A list of all tests can be found in the Supplementary Materials.

2.2. Dependent variables

Financial behavior was measured during the first part of the study. Participants were asked to respond to 12 general questions about financial behavior (Financial Management Behavioral Scale; Dew and Xiao, 2011). Table 2 shows all the included items and the observed mean value, standard deviation and range. For each item participants indicated how often they had engaged in the described behavior during the last six months on a scale ranging from 1 (not at all) to 5 (always). Although the scale measures general financial behavior, it can also be divided into three subcategories of financial behavior: four items concerning

[1] T-tests show that the 34 participants not completing the three parts did not differ from the 166 participants in our sample when it comes to subjective self-control, $t(200) = -1.156$, $p = 0.249$, optimism $t(200) = -1.915$, $p = 0.057$, financial behavior $t(200) = -0.732$, $p = 0.465$ and financial wellbeing, $t(200) = -0.494$, $p = 0.622$.

Table 2
Summary statistics of the Financial Management Behavioral Scale and the Financial Well-Being Scale (n = 166).

	Financial Management Behavior Scale	Mean	Std. dev.	Range
1	Comparison shopped when purchasing a product or service	4.37	0.67	1–5
2	Paid all your bills on time	4.63	0.71	1–5
3	Kept a written or electronic record of your monthly expenses	3.29	1.27	1–5
4	Stayed within your budget or spending plan	2.65	1.36	1–5, N/A
5	Began or maintained an emergency savings fund	3.59	1.46	1–5
6	Saved money from every paycheck	3.90	1.26	1–5
7	Saved for a long term goal such as a car, education, home, etc.	3.59	1.42	1–5
8	Contributed money to a retirement account	1.56	1.17	1–5
9	Bought bonds, stocks, or mutual funds	2.36	1.46	1–5
FMBS average		3.33	0.58	1.78–4.78
	Financial Well-Being Scale			
	Financial anxiety			
1	I get unsure by the lingo of financial experts	2.78	1.02	1–5
2	I am anxious about financial and money affairs	2.79	1.05	1–5
3	I tend to postpone financial decisions	2.72	1.18	1–5
4	After making a decision, I am anxious whether I was right or wrong	2.69	1.12	1–5
	Financial security			
5	I feel secure in my current financial situation	3.57	1.16	1–5
6	I feel confident about my financial future	3.78	0.99	1–5
7	I feel confident about having enough money to support myself in retirement, no matter how long I live	3.40	1.17	1–5
Financial well-being, average		3.40	0.67	1.43–5

Note: The response "not applicable" on item 4 in FMBS was coded as "1-not at all" when the aggregated mean value was calculated. Since 84 percent of our sample did not have a credit card, we chose to exclude the three items concerning credit management before calculating the aggregated mean value of FMBS. Financial anxiety 1, 2, 3 and 4 were reversed before calculating the aggregated mean value of financial well-being. A principal axis factor analysis was performed on the seven items of the well-being questionnaire with oblique rotation (direct oblimin). The Kaiser–Meyer–Olkin measure verified the sampling adequacy for the analysis, KMO = .69 (Hutcheson and Sofroniou, 1999). The main analysis showed that two factors showed values over the Kaiser's criterion of 1 and explained 43.24% of the variance combined (Table S1 in Supplementary Materials). This factor analysis thus validates the inclusion of these items as a measure of financial well-being comprising two factors.

cash management, three items concerning credit management and five items concerning savings and investment behaviors. The use of credit cards is less common in Sweden than in the US where this scale was originally developed and 84 percent of our sample did not have a credit card, which made us exclude the credit management subscale from our analysis. Even after excluding those three questions, the internal consistency of the scale was fairly low for our sample ($\alpha = 0.55$). This suggest that the subcategories of the Financial Management Behavior Scale (FMBS) is less correlated in our sample than in previous studies (Strömbäck et al., 2017). Despite this we opted to retain the composite scale to facilitate comparisons with previous studies.

We measured the participants' level of subjective financial well-being with two separate scales; the Financial Anxiety Scale (Fünfgeld and Wang, 2009) and the Financial Security Scale (Strömbäck et al., 2017). All items are presented in Table 2. For both scales, the participants indicated on a five-point Likert scale how well each statement corresponded to their own situation: five indicating that the participant agreed completely with the statement and one indicating that the participant did not agree at all with the statement. When analyzing the data the two scales were combined, which generated a measure of financial well-being with fairly good internal consistency ($\alpha = 0.72$).

2.3. Independent variables

The main independent variables of interest are subjective self-control and executive functions following the tripartite model ("Inhibition", "Shifting" and "Working memory"). Moreover, we also include general intelligence as a control variable. Table 3 shows the mean value, standard deviation, and range for the main independent variables and intelligence.

To be able to fully compare our results to Strömbäck et al. (2017), we used the same measure of self-control. Hence, subjective self-control was assessed with a shorter version of the Brief Self-Control Scale (Tangney et al., 2004) and the Short-Term Future Orientation Scale by Antonides et al. (2011). In both scales, the participants were asked to indicate on a five point Likert scale to which extent they agreed with different statements (e.g. I live more for the day of today than for the day of tomorrow). As both scales measure the same underlying construct, self-control, and adding items measuring the same construct will increase reliability, we combined the mean score of the items in the two scales as a single measure of self-control. The internal consistency of the combined self-report measure was good ($\alpha = 0.76$).

Inhibition was assessed using the Stroop task in which participants were presented with a piece of paper with 30 color words written in two separate columns. This test was divided into two conditions: one with congruent color words and one with incongruent color words. Each condition was completed twice, resulting in 60 words in each of the two conditions. The participant was asked to, as fast as possible, identify and say out loud the color with which each word was written. The idea is that when there is a mismatch between the presented word and color, subjects need to suppress their initial impulse, which is to simply read the word, to give the correct answer. The average response time of the two incongruent rounds was used as an index of inhibition.

Shifting ability was assessed using a paper-and-pencil version of the Trail Making Test (van der Sluis et al., 2004) which is an extensively used neuropsychological test of frontal lobe functioning. This test consists of two conditions. The first condition (A) contained 22 circles, each containing a digit, whereas the second condition (B) also contained 22 circles but now with either a digit or a letter written in it. In condition A the task was to draw a line and connect the circles in ascending order as fast as possible. In condition B, the participants were told to draw the line and connect the circles in ascending order once again, but now in alternating order (1-A-2-B-3-C etc.) as quickly as possible without making any mistakes. The time, measured in seconds, it took to connect the "trail" in condition B was used as an index of shifting ability.

Working memory was measured by the digit span subtest of Wechsler Adult Intelligence Scale IV (WAIS-IV; Wechsler, 2008). The test contained three parts. In the first part the subjects were asked to repeat a series of digits aloud for the experimenter, in the second part they were asked to repeat a series of digits backwards and in the third part they were asked to recall the digits in correct ordinal sequence. This was a progressive test, where the difficulty in each part was increased as the number of digits to repeat increased. For each part the maximum score was 16, which left us with a maximum total score of 48 (see Table 3).

General intelligence was measured through a short version of Raven's Standard Progressive Matrices (RPM; Raven, 1976). The total number of correctly solved matrices (maximum twelve) was used as an index of general intelligence. Additionally, we asked

Table 3
Summary statistics of self-control, EFs and intelligence (n = 166).

Self-control scale		Mean	Std. dev.	Range
Brief self-control scale				
1	I have a hard time breaking bad habits	3.23	1.10	1–5
2	I get distracted easily	3.52	1.02	1–5
3	I am good at resisting temptation	2.90	1.03	1–5
4	I do things that feel good in the moment but regret later on	2.57	1.03	1–5
5	I often act without thinking through all the alternatives	2.37	1.05	1–5
Short-term future orientation scale				
6	I only focus on the short term	2.22	1.05	1–5
7	The future will take care of itself	3.40	1.18	1–5
8	I live more for the day of today than for the day of tomorrow	2.28	1.08	1–5
9	My convenience plays an important role in the decisions I make	3.40	0.99	1–5
Self-control average		3.10	0.62	1.11–4.78
Cognitive abilities				
	Inhibition	25.43	5.01	15.92–45.01
	Shifting	41.85	16.24	20.84–105.30
	Working memory	27.70	4.60	16–40
	Intelligence	8.75	2.49	2–12

Note: Item 1, 2, 4, 5, 6, 7, 8, and 9 were reversed before calculating the aggregated mean value of self-control. Inhibition and shifting are expressed in seconds, while working memory and intelligence are expressed as number of correctly solved tasks.

the respondents to take a short financial literacy test consisting of four questions (see e.g. Van Rooij et al., 2011) and self-report their optimism and deliberative thinking. Optimism was measured by the Revised Life Orientation Test (Scheier et al., 1994) and we used the mean score of the items in the scale ($\alpha = 0.83$). The respondents were asked to indicate to what extent they agreed with different statements on a scale ranging from 1 (do not agree) to 5 (totally agree). To measure the respondents' deliberativeness, two items from the Unified Scale to Assess Individual Differences in Intuition and Deliberation (Pachur and Spaar, 2015) were used: "Developing a clear plan is very important to me" and "I like to analyze problems". The response options were the same as in the Revised Life Orientation Test. Financial literacy was assessed as the total number of correctly answered financial literacy questions. Previous research has shown that both self-control (Achtziger et al., 2015; Gathergood, 2012; Strömbäck et al., 2017), optimism (Puri and Robinson, 2007) and financial literacy (Lusardi and Mitchelli, 2007) predict financial behavior.

2.4. Analysis

To investigate if self-control, EFs, and intelligence could predict general financial behavior and financial well-being, we performed OLS regressions with robust standard errors according to the following model specification:

$$FMBS = \beta_0 + \beta_1 Selfcontrol + \beta_2 Inhibition + \beta_3 Shifting + \beta_4 Workingmemory + \beta_5 Intelligence + \beta' X_{control} + u$$

where FMBS was the average score of the Financial Management Behavioral Scale, and $X_{control}$ was a vector containing our five control variables: optimism, deliberative thinking, financial literacy, age, and gender. The results of the Stroop task and the Trail making task were reversed before they were included in the model, so that a higher number corresponded to better inhibitory or shifting ability, respectively. As a second step in the analysis we changed the dependent variable to financial well-being, but kept the same structure of the dependent variables.

3. Results

The bivariate Pearson's correlations between all included variables can be seen in Table 4. All three basic executive functions and intelligence were positively and moderately correlated, which suggests that the measures are related but far from identical. Subjective self-control was positively correlated with both main dependent variables (FMBS and financial well-being) however there was no correlation (−0.04) with our objective measure of self-control (inhibition). Moreover, subjective self-control had a weak negative correlation with both shifting ability and working memory.

Table 5 shows a summary of the regressions of self-control, executive functions, intelligence, and control variables on financial behavior (Model 1 and 2) and financial wellbeing (Model 3 and 4). Subjective self-control was significantly correlated with financial behavior and financial well-being in all regression models. There were, however, no significant correlations for any of the objective measures of executive functions and intelligence. When adding optimism, deliberativeness, and financial literacy in the regression models, we see that optimism was significantly correlated with higher financial well-being but not with financial behavior and that deliberateness was significantly correlated with financial behavior. Interestingly, financial literacy was not significantly correlated with any of our outcome measures.

4. Discussion

In a previous large-scale study, it was found that subjective self-control predicted financial behavior and financial well-being (Strömbäck et al., 2017). The aim of the present study was to get a better understanding of other abilities that can explain observed differences in people's financial behavior and financial well-being. We focused on performance measures of executive functions and intelligence since these have previously been linked to various life-outcomes, such as work achievements (e.g. Burks et al., 2009; Gottfredson, 1997), stock market participation (Christelis et al., 2010), life quality (Davis et al., 2010), and general well-being (Pronk and Righetti, 2015). Our results showed that extensive and validated measures of executive functions and intelligence did not correlate with financial behavior and financial well-being. However, self-reported self-control still predicted both financial behavior and financial well-being. Although we were initially surprised that we did not find any association between executive functions and our financial outcome variables, our findings are in line with Biljanovska and Palligkinis (2018) who found that working memory was uncorrelated with financial outcome variables such as wealth accumulation and the ability to pay one's bills, while self-reported self-control failure was negatively correlated with both these financial behaviors.

As indicated, the finding that self-control had a positive impact on financial behavior and financial well-being is not new, but our results indicate that this relationship crucially depends on how self-control is measured. Although our measure of subjective self-control predicted financial behavior and financial well-being, our measure of objective self-control (i.e. inhibition tested through a Stroop task) did not. This may seem puzzling and counterintuitive. However, we argue that it is not. With a correlation of $r = -0.04$, subjective and objective self-control are clearly measuring different constructs. Self-control scales, measuring subjective self-control, focus on self-reported habits and behavioral dispositions when making decisions, which is different from objective self-control. Objective self-control is a performance measure tapping into the capacity to inhibit impulses. Thus, subjective self-control may reflect behavioral patterns and inclinations that are dissociated from cognitive capacity per se. As

Table 4
Bivariate Pearson's correlations of included variables.

	Financial behavior (FMBS)	Financial well-being	Subjective self-control	Inhibition	Shifting	Working memory	Intelligence	Optimism	Deliberative	Financial literacy	Age
Financial behavior (FMBS)											
Financial well-being	0,03										
Subjective self-control	0.35***	0.19**									
Inhibition	−0,06	0,06	−0,04								
Shifting	−0,12	0.13***	−0.17**	0.39***							
Working memory	−0.18**	−0,02	−0.17**	0.27***	0.39***						
Intelligence	−0,1	0,03	−0,11	0.26***	0.37***	0.35***					
Optimism	−0,01	0.52***	0,05	0.19**	0,1	0,01	−0,03				
Deliberative	0.26***	−0,04	0.18**	−0,06	−0,02	0,04	0.16**	−0,13			
Financial literacy	−0,06	0,11	0,08	0.16**	0.19**	0.18**	0.37***	0,08	0.18**		
Age	−0.15***	0,01	−0,01	0,06	−0,02	0,09	−0,08	0.17**	−0,07	0.21***	
Female	0.14***	−0.15**	0,05	0,02	0,07	−0,12	−0,06	−0.13***	−0.17**	−0.35***	−0.25***

***p < 0.01.
**p < 0.05.

Table 5
Financial behavior and financial well-being as functions of self-control, executive functions, intelligence and control variables.

	Financial behavior (1)	Financial behavior (2)	Financial well-being (3)	Financial well-being (4)
Subjective self-control	0.2955***	0.2485***	0.2442***	0.2185***
	(0.0606)	(0.0646)	(0.0847)	(0.0755)
Inhibition (objective self-control)	−0.0003	0.0016	0.0031	−0.0103
	(0.0102)	(0.0100)	(0.0106)	(0.0110)
Shifting	−0.0012	−0.0011	0.0088**	0.0063
	(0.0033)	(0.0032)	(0.0039)	(0.0039)
Working memory	−0.0105	−0.0113	−0.0119	−0.0062
	(0.0108)	(0.0100)	(0.0115)	(0.0102)
Intelligence	−0.0065	−0.0144	−0.0049	0.0082
	(0.0215)	(0.0216)	(0.0230)	(0.0215)
Optimism		0.0282		0.4354***
		(0.0557)		(0.0751)
Deliberative		0.1881***		−0.0440
		(0.0574)		(0.0648)
Financial literacy		−0.0131		0.0122
		(0.0540)		(0.0552)
Age	−0.0198*	−0.0157	−0.0042	−0.0179
	(0.0111)	(0.0114)	(0.0161)	(0.0153)
Female	0.0959	0.1481*	−0.2632**	−0.1825*
	(0.0886)	(0.0889)	(0.1135)	(0.1040)
(Intercept)	3.2612***	2.5457***	2.6151***	1.7458***
	(0.4443)	(0.5091)	(0.5709)	(0.5901)
Observations	166	166	166	166
R-squared	0,161	0,216	0,104	0,338

Note: All regressions are ordinary least square. Histogram showing the distribution of the dependent variables can be found in the Supplementary Materials. The dependent variable in (1) and (2) is the mean score on the Financial Management Behavior Scale (FMBS), the possible range is between 1 and 5. The dependent variable in (3) and (4) is the mean score of the Financial Anxiety Scale (reversed) and the Financial Security Scale, the possible range is between 1 and 5. All independent variables are continuous variables except female which is a dummy. Robust standard errors in parentheses.
***p < 0.01.
**p < 0.05.
*p < 0.1.

such, one can display mediocre cognitive capacity while engaging in insightful behaviors and applying useful strategies that prove beneficial for financial decision making. Thus, our results suggest that good habits and neglecting the quick and easy choice are important factors for sound financial behavior and seem to play a greater role than inhibitory control when it comes to successfully managing one's financial behavior and well-being. This is in line with previous studies that have concluded that people with good subjective self-control are more likely to form habits that contribute to efficient and steady performance in various areas of life, such as academic and professional domains (De Ridder et al., 2012). People with good self-control also form such habits that allow them to avoid situations where they have to exercise self-control and resist temptation in the first place (Ent et al., 2015). From a policy perspective, this is good news. As it is widely debated if it is possible to improve people's executive functions, including inhibition, (e.g. Diamond, 2013; Thorell et al., 2009) helping people organize their financial situation and implement good habits in the financial domain is most certainly

possible. Such help would not only lead to better financial behavior, but also to less anxiety and better financial well-being for people in vulnerable financial situations. Additionally, this is also good news for researchers interested in the effect of self-control of financial decisions. Instead of using time-consuming and hard-to-administer performance test of executive functions, these researchers can simply measure self-reported self-control using short standardized scales. Still, it is important to note that the weak association between self-reported self-control and performance-based measures of self-control found in this and in other recent studies clearly suggests that they are inherently different and thus should not be considered as interchangeable indicators of the same underlying construct when conducting research.

When looking at the other self-reported measures included, there are a few interesting findings. Optimism, which is associated with positive mood, can be connected to the sadder-but-wiser hypothesis (Lerner et al., 2013) suggesting that less optimistic individuals should make better financial decisions. In the current study, we found no correlation between optimism and financial behaviors. Thus, we found no support for the sadder-but-wiser hypothesis in a financial context. Instead, more optimistic individuals had better financial well-being with lower levels of anxiety connected to financial matters and higher perceived financial security. This is not surprising, given that optimism has been shown to be associated with general well-being (Strunk et al., 2006) and financial well-being is of great importance for general well-being (Netemeyer et al., 2017). A somewhat more surprising finding in this study was the lack of association between financial literacy and financial behavior, as previous studies have shown that financial literacy predicted various financial outcomes including for example retirement preparedness (Lusardi and Mitchell, 2017) and the probability of having an emergency fund (Babiarz and Robb, 2014). It should however be noted that the current study is limited in that only self-reported financial outcomes was used, and this may in part explain the lack of some expected relationships. Thus, the results from this study should be replicated in other samples with other objective measures of financial behaviors.

An important contribution of the current research project was to thoroughly investigate the role of executive functions and intelligence in financial behavior and financial well-being. Given the necessity of supervised and time-consuming test administration in order to get valid estimates of executive functions and intelligence, we chose to recruit individuals from a student population to facilitate data collection. A limitation here is that a student sample is relatively homogeneous in terms of age and education. Moreover, young adults often have limited experience with financial matters. It is possible that individual cognitive abilities, such as intelligence and executive functions, will have an increasingly greater impact throughout adulthood as individuals face more difficult financial choices. Numerous studies indicate that executive functions (Miller et al., 2012) and intelligence (Ceci, 1996) become more predictive of various desirable outcomes as a function of age, such as income and better physical and mental health. Thus, as newcomers on the financial market, individuals with higher intelligence and executive functions have not been given enough time to capitalize on their cognitive resources. Still, it is important to investigate the role of these cognitive abilities in young adulthood when individuals are faced with novel economic situations. Even more so, however, is it to utilize the same methodological approach to investigate older adults and see whether this pattern holds true.

CRediT authorship contribution statement

Camilla Strömbäck: Conceptualization, Formal analysis, Methodology, Software, Writing - original draft, Writing - review & editing. **Kenny Skagerlund:** Conceptualization, Methodology, Software, Writing - review & editing. **Daniel Västfjäll:** Conceptualization, Funding acquisition, Methodology, Writing - review & editing. **Gustav Tinghög:** Conceptualization, Funding acquisition, Methodology, Writing - original draft, Writing - review & editing.

Acknowledgments

This research was funded by Länsförsäkringar Alliance Research Foundation [grant number: P15/2] and the Swedish Research Council [grant number: 2018.01755]. The funders had no role in study design, data collection, analysis, decision to publish, or preparation of the manuscript.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.jbef.2020.100339.

References

Achtziger, A., Hubert, M., Kenning, P., Raab, G., Reisch, L., 2015. Debt out of control: The links between self-control, compulsive buying, and real debts. J. Econ. Psychol. 49, 141–149.
Antonides, G., De Groot, I.M., Van Raaij, W.F., 2011. Mental budgeting and the management of household finance. J. Econ. Psychol. 32 (4), 546–555.
Babiarz, P., Robb, C.A., 2014. Financial literacy and emergency saving. J. Family Econ. Issues 35 (1), 40–50.
Ballinger, T.P., Hudson, E., Karkoviata, L., Wilcox, N.T., 2011. Saving behavior and cognitive abilities. Exp. Econ. 14 (3), 349–374.
Biljanovska, N., Palligkinis, S., 2018. Control thyself: Self-control failure and household wealth. J. Bank. Financ. 92, 280–294.
Burks, S.V., Carpenter, J.P., Goette, L., Rustichini, A., 2009. Cognitive skills affect economic preferences, strategic behavior, and job attachment. Proc. Natl. Acad. Sci. 106 (19), 7745–7750.
Carpenter, S.M., Peters, E., Västfjäll, D., Isen, A.M., 2013. Positive feelings facilitate working memory and complex decision making among older adults. Cogn. Emot. 27 (1), 184–192.
Ceci, S.J., 1996. General intelligence and life success: An introduction to the special theme. Psychol. Public Policy Law 2 (3–4), 403–417.
Christelis, D., Jappelli, T., Padula, M., 2010. Cognitive abilities and portfolio choice. Eur. Econ. Rev. 54 (1), 18–38.
Dang, J., King, K.M., Inzlicht, M., 2020. Why are self-report and behavioral measures weakly correlated?. Trends Cogn. Sci. 24 (4), 267–269.
Davis, J.C., Marra, C.A., Najafzadeh, M., Liu-Ambrose, T., 2010. The independent contribution of executive functions to health related quality of life in older women. BMC Geriatr. 10 (16).
De Ridder, D.T., Lensvelt-Mulders, G., Finkenauer, C., Stok, F.M., Baumeister, R.F., 2012. Taking stock of self-control: A meta-analysis of how trait self-control relates to a wide range of behaviors. Personal. Soc. Psychol. Rev. 16 (1), 76–99.
Delaney, L., Lades, L.K., 2017. Present bias and everyday self-control failures: a day reconstruction study. J. Behav. Decis. Mak. 30 (5), 1157–1167.
Dew, J., Xiao, J.J., 2011. The financial management behavior scale: Development and validation. J. Financ. Couns. Plann. 22 (1), 43–59.
Diamond, A., 2013. Executive functions. Ann. Rev. Psychol. 64, 135–168.
Dohmen, T., Falk, A., Huffman, D., Sunde, U., 2010. Are risk aversion and impatience related to cognitive ability?. Amer. Econ. Rev. 100 (3), 1238–1260.
Eisenberg, I.W., Bissett, P.G., Zeynep Enkavi, A., Li, J., MacKinnon, D.P., Marsch, L.A., Poldrack, R.A., 2019. Uncovering the structure of self-regulation through data-driven ontology discovery. Nature Commun. 10 (1).
Ent, M.R., Baumeister, R.F., Tice, D.M., 2015. Trait self-control and the avoidance of temptation. Personal. Individ. Differ. 74, 12–15.
Ferrer, E., O'Hare, E.D., Bunge, S.A., 2009. Fluid reasoning and the developing brain. Front. Neurosci. 3 (1), 46–51.
Friedman, N.P., Miyake, A., 2017. Unity and diversity of executive functions: individual differences as a window on cognitive structure. Cortex 86, 186–204. http://dx.doi.org/10.1016/j.cortex.2016.04.023.
Friedman, N.P., Miyake, A., Corley, R.P., Young, S.E., DeFries, J.C., Hewitt, J.K., 2006. Not all executive functions are related to intelligence. Psychol. Sci. 17 (2), 172–179.

Fünfgeld, B., Wang, M., 2009. Attitudes and behaviour in everyday finance: evidence from Switzerland. Int. J. Bank Mark. 27 (2), 108–128.
Gathergood, J., 2012. Self-control, financial literacy and consumer over-indebtedness. J. Econ. Psychol. 33 (3), 590–602.
Gottfredson, L.S., 1997. Why g matters: The complexity of everyday life. Intelligence 24 (1), 79–132.
Hofmann, W., Schmeichel, B.J., Baddeley, A.D., 2012. Executive functions and self-regulation. Trends Cogn. Sci. 16 (3), 174–180.
Hutcheson, G.D., Sofroniou, N., 1999. The Multivariate Social Scientist: Introductory Statistics using Generalized Linear Models. Sage.
Keltner, D., Lerner, J.S., 2011. Emotion. In: Gilbert, D., Fiske, S., Lindsay, G. (Eds.), The Handbook of Social Psychology. McGraw Hill, New York, NY, pp. 312–347.
Lerner, J.S., Li, Y., Weber, E.U., 2013. The financial costs of sadness. Psychol. Sci. 24 (1), 72–79.
Lind, T., Ahmed, A., Skagerlund, K., Strömbäck, C., Västfjäll, D., Tinghög, G., 2020. Competence, confidence, and gender: The role of objective and subjective financial knowledge in Household finance. J. Family Econ. Issues http://dx.doi.org/10.1007/s10834-020-09678-9, in press.
Lusardi, A., Mitchell, O.S., 2017. How ordinary consumers make complex economic decisions: Financial literacy and retirement readiness. Q. J. Finance 7 (3), 1–31.
Lusardi, A., Mitchelli, O.S., 2007. Financial literacy and retirement preparedness: Evidence and implications for financial education. Bus. Econ. 42 (1), 35–44.
Miller, H.V., Barnes, J., Beaver, K.M., 2011. Self-control and health outcomes in a nationally representative sample. Amer. J. Health Behav. 35 (1), 15–27.
Miller, M., Nevado-Montenegro, A.J., Hinshaw, S.P., 2012. Childhood executive function continues to predict outcomes in young adult females with and without childhood-diagnosed ADHD. J. Abnorm. Child Psychol. 40 (5), 657–668.
Mischel, W., Shoda, Y., Rodriguez, M.I., 1989. Delay of gratification in children. Science 244 (4907), 933–938.
Miyake, A., Friedman, N.P., 2012. The nature and organization of individual differences in executive functions: Four general conclusions. Curr. Dir. Psychol. Sci. 21 (1), 8–14.
Miyake, A., Friedman, N.P., Emerson, M.J., Witzki, A.H., Howerter, A., Wager, T.D., 2000. The unity and diversity of executive functions and their contributions to complex frontal lobe tasks: A latent variable analysis. Cogn. Psychol. 41 (1), 49–100.
Moffitt, T.E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R.J., Harrington, H., Houts, R., Poulton, R., Roberts, B.W., Ross, S., 2011. A gradient of childhood self-control predicts health, wealth, and public safety. Proc. Natl. Acad. Sci. 108 (7), 2693–2698.
Netemeyer, R.G., Warmath, D., Fernandes, D., Lynch, Jr., J.G., 2017. How am I doing? Perceived financial well-being, its potential antecedents, and its relation to overall well-being. J. Consum. Res. 45 (1), 68–89.
Pachur, T., Spaar, M., 2015. Domain-specific preferences for intuition and deliberation in decision making. J. Appl. Res. Mem. Cogn. 4 (3), 303–311.
Pronk, T.M., Righetti, F., 2015. How executive control promotes happy relationships and a well-balanced life. Curr. Opin. Psychol. 1, 14–17.
Puri, M., Robinson, D.T., 2007. Optimism and economic choice. J. Financ. Econ. 86 (1), 71–99.
Pyone, J.S., Isen, A.M., 2011. Positive affect, intertemporal choice, and levels of thinking: Increasing consumers' willingness to wait. J. Mark. Res. 48 (3), 532–543.
Raven, J., 1976. Oxford Psychologists Press. Oxford, England.
Saunders, B., Milyavskaya, M., Etz, A., Randles, D., Inzlicht, M., 2018. Reported Self-control is not Meaningfully Associated with Inhibition-related Executive Function: A Bayesian analysis. Collab.: Psychol. 4 (1).
Scheier, M.F., Carver, C.S., Bridges, M.W., 1994. Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): a reevaluation of the Life Orientation Test. J. Pers. Soc. Psychol. 67 (6), 1063–1078.
van der Sluis, S., de Jong, P.F., van der Leij, A., 2004. Inhibition and shifting in children with learning deficits in arithmetic and reading. J. Exp. Child Psychol. 87 (3), 239–266.
Strömbäck, C., Lind, T., Skagerlund, K., Västfjäll, D., Tinghög, G., 2017. Does self-control predict financial behavior and financial well-being?. J. Behav. Exp. Finance 14, 30–38.
Strunk, D.R., Lopez, H., DeRubeis, R.J., 2006. Depressive symptoms are associated with unrealistic negative predictions of future life events. Behav. Res. Ther. 44 (6), 861–882.
Tangney, J.P., Baumeister, R.F., Boone, A.L., 2004. High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. J. Personal. 72 (2), 271–324.
Thorell, L.B., Lindqvist, S., Bergman Nutley, S., Bohlin, G., Klingberg, T., 2009. Training and transfer effects of executive functions in preschool children. Dev. Sci. 12 (1), 106–113.
Van Rooij, M., Lusardi, A., Alessie, R., 2011. Financial literacy and stock market participation. J. Financ. Econ. 101 (2), 449–472.
Wechsler, D., 2008. Wechsler Adult Intelligence Scale–Fourth Edition (WAIS–IV). NCS Pearson, San Antonio, TX, p. 22.