Beyond financial literacy. Finding a measure for financial decision making competence regarding the use of simple rules.

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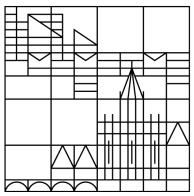

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Abstract

The present study applies the perspective of ecological rationality to the question how financial decision making competence can be explained. To extend our answer beyond the notion of financial literacy, we further develop a measure of financial wisdom (FW), defined as the repertoire and adaptive selection of behaviors and simple rules to deal with money. Using survey data collected from an mTurk sample, relationships between five dimensions of financial wisdom and related concepts showed some evidence for the discriminant and congruent validity of FW. FW showed relationships to saving behavior and financial satisfaction beyond other predictors and financial literacy. However, FW was not clearly empirically distinguishable from a general tendency to save and delay of gratification and its relation to actual behavior on an investment task was not clear. Overall, results suggest that FW and adaptive simple rules are a promising explanation of financial decision making competence beyond financial literacy.

Zusammenfassung

Die vorliegende Studie wendet den theoretischen Hintergund der ökologischen Rationalität, auf die Frage an, wie finanzielle Entscheidungskompetenz erklärt werden kann. Um eine Antwort über finazielle Bildung (financial literacy, FL) hinaus geben zu können, wird ein Messinstrument für finanzielle Weisheit (FW), die als das Repertoire und die adaptive Auswahl von Verhaltensweisen und einfachen Regeln definiert ist, entwickelt. In Umfragedaten aus einer mTurk Stichprobe, wiesen Zusammenhänge zwischen fünf dimensionen finanzieller Weisheit und verbundenen Konzepten auf diskriminante und konvergente Konstruktvalidität hin. FW wies zudem Zusammenhänge zu Sparverhalten und fianzieller Zufiredenheit auf. Allerdings konnte FW nicht klar von einer generellen Tendez zu sparen und Belohnungsaufschub unterschieden werden. Auch der Zusammenhang von FW und tatsächlichem Verhalten in einer Anlageaufgabe war unklar. Insgesamt legen die Ergebnisse nahe, dass FW und adaptive einfache Regeln eine vielversprechende Erklärung für finanzielle Entscheidungskompetenz über finanzielle Bildung hinaus sein können.

Keywords: Financial wisdom, financial decision making, financial literacy, ecological rationality, simple rules, financial satisfaction

Contents

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Individuals are faced with increased responsibility in an increasingly complex and uncertain financial world (Ryan, Trumbull, & Tufano, 2011). For example, in the US saving for retirement and pensions has been changed from "defined benefits" to "defined contributions", so that employees now are in charge to decide how much to contribute. Likewise, the number of financial products one can invest one's money in has greatly increased and credit and borrowing have become more easily accessible (Hastings, Madrian, & Skimmyhorn, 2013). It has been found that individuals commit a wide variety of financial mistakes in this decision environment, including the suboptimal use of credit cards and not using financial products like stocks (for overviews see, e.g., Hastings et al., 2013; Agarwal, Skiba, & Tobacman, 2009). Individual financial mistakes, like a lack of financial planning, have also been linked to the global financial crisis of 2008 (Lynch, Netemeyer, Spiller, & Zammit, 2010; Lusardi, 2011).

Financial behaviors, including saving, planning, as well as borrowing and accumulation debt are related to financial satisfaction (Joo & Grable, 2004; Woodyard & Robb, 2016). This relation also applies to individuals' financial situation, including savings and debt (Prawitz et al., 2006; Shim, Xiao, Barber, & Lyons, 2009). Financial satisfaction or, more generally, financial well-being, in turn, are linked to a variety of more general correlates like subjective well-being (Diener & Biswas-Diener, 2002), as well as health (Taylor, Jenkins, & Sacker, 2011) and behavior in the working place (Prawitz et al., 2006). This illustrates that financial behavior and decision making may be important both directly and indirectly for individual well-being (Taylor et al., 2011).

However, many individuals do seem to have problems with financial decision making and behavior, making financial mistakes like borrowing with high interest (Agarwal et al., 2009), and experiencing adverse financial events like overindebtedness and bankruptcy (von Stumm, O'Creevy, & Furnham, 2013). The ensuing question then is, how individuals can be aided to manage their finances more successfully and navigate the increasingly complex and uncertain financial world, in order to achieve a satisfying financial situation (Hastings et al., 2013; Stolper & Walter, 2017).

Therefore, it is necessary to understand how financial decision making and financial behavior are shaped. To this end, two related attempts to explain differences in financial behaviors will be considered in turn: financial literacy (for reviews on financial literacy see Stolper & Walter, 2017; Hastings et al., 2013; Lusardi & Mitchell, 2014) and its advancement financial capability (Remund, 2010; Atkinson, McKay, & Kempson, 2006; Xiao, Chen, & Chen, 2014). Following the reviews, financial literacy has been frequently proposed as a remedy to financial mistakes and problems like debt (Alsemgeest, 2015). It will be shown that the evidence for the explanatory value of financial literacy is mixed and financial capability may only provide an insufficient explanation of individual decision competence.

In the present thesis the perspective of ecological rationality will be applied to explain financial decision making behavior (e.g., Gigerenzer, Todd, & the ABC Research Group, 1999; Gigerenzer & Gaissmaier, 2011). One main tenet of this framework is, that it is crucial to simultaneously consider the environment, the capacities of an individual to judge the rationality of a decision strategy. Considered from this framework it has been found that simple strategies are frequently adaptive (Gigerenzer et al., 1999). From this perspective the concept of financial wisdom will be introduced as an alternative explanation and measure of financial decison making competence. Financial wisdom involves the repertoire of simple strategies, behavioral practices, and related attitudes an individual has at her disposal, as well as the ability to adaptively select among these strategies. It will be shown, that a measure of financial wisdom is positively related to financial outcomes beyond the established concept of financial literacy.

Financial literacy

Low *financial literacy* is one of the most cited causes of poor financial decision making, which is coupled to the frequently prescribed remedy of increasing individuals' low levels of financial literacy (Lusardi & Mitchell, 2014; Hilgert, Hogarth, & Beverly, 2003; Lusardi & Mitchelli, 2007). This view locates many financial problems in the fact that "individuals lack requisite levels of financial literacy for effective financial decision making" (Hastings et al., 2013, p. 351). Generally, financial literacy has been defined in many different ways (Remund, 2010), so that a "lack of conceptualiza-

tion and definition" have been noted (Huston, 2010, p. 305).

For example, has financial literacy been defined by the Jump$tart Coalition for Personal Financial Literacy as "the ability to use knowledge and skills to manage one's financial resources effectively for lifetime financial security" (cf. Hastings et al., 2013; Stolper & Walter, 2017), or, more broadly, as "the ability to make informed judgments and to take effective decisions regarding the use and management of money" (Noctor, Stoney, & Stradling, 1992, cf. Huston, 2010, p. 311), as well as "knowledge and understanding of financial concepts and risks, and the skills, motivation and confidence to apply such knowledge and understanding in order to make effective decisions across a range of financial contexts, to improve the financial well-being of individuals and society, and to enable participation in economic life" (OECD, 2014, p. 33).

In summary, financial literacy has been broadly defined as knowledge and its application, ability, as well as skill, motivation, and confidence, thought to explain financial decision making competence. Despite its broad scope, financial literacy has most frequently been measured using knowledge questions (Huston, 2010; Stolper & Walter, 2017; Fernandes, Lynch, & Netemeyer, 2014). There are two main ways, in which financial knowledge has been assessed: objectively and subjectively (Stolper & Walter, 2017). In objective assessment, individuals are presented with a set of test-questions, which are related to financial products (like stocks) or concepts (like inflation or compound interest). An example question is

> "Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account? (i) More than today; (ii) Exactly the same; (iii) Less than today; (iv) Do not know; (v) Refusal." (Van Rooij, Lusardi, & Alessie, 2011, p. 452)

The idea is that individuals who cannot answer this question will face problems in investment decisions, as they do not understand that the value of money decreases over time (Lusardi & Mitchell, 2009). Overall, it is being assumed that consumers apply their knowledge to make "informed financial decisions" (Stolper & Walter, 2017, p. 2).

When subjective knowledge is measured, individuals are usually asked:

> "On a scale from 1 to 7, where 1 means very low and 7 means very high, how would you assess your overall financial knowledge?" (Lusardi & Mitchell, 2014, p. 11)

Measures of subjective knowledge are typically related to measures of objective knowledge (Stolper & Walter, 2017). Both objective and subjective measures of financial knowledge have been shown to be positively related to a wide variety of positive financial behaviors and outcomes (for reviews see Hastings et al., 2013; Stolper & Walter, 2017). Examples of related behaviors and outcomes include planning for retirement (Lusardi & Mitchelli, 2007), participating in the stock market (Van Rooij et al., 2011), wealth accumulation (Van Rooij, Lusardi, & Alessie, 2012), and satisfaction with one's financial situation (Taft, Hosein, Mehrizi, & Roshan, 2013). More recent work additionally provides evidence that financial literacy influences general financial planning practices, which in turn influence financial satisfaction (Ali, Rahman, & Bakar, 2015). Following this rationale, increasing financial knowledge is assumed to improve decision quality and finally individuals' financial situation and financial satisfaction (Alsemgeest, 2015). This has led to the deployment of a host of interventions to increase financial literacy, the costs of which have been estimated in the range of billions of dollars each year (Fernandes et al., 2014).

It has, however, been criticized that it is unclear, what financial literacy actually measures (Schuhen & Schürkmann, 2014). Influences of mathematical skills have been mentioned (Schuhen & Schürkmann, 2014), especially, as counting backwards and subtracting were shown to be related to measures of financial literacy (De Meza, Irlenbusch, & Reyniers, 2008; Lusardi & Mitchell, 2007). This poses the question, whether financial literacy assesses competence, knowledge, attitudes or rather cognitive abilities like numeracy (Stolper & Walter, 2017; Hastings et al., 2013; Schuhen & Schürkmann, 2014). Objective measures of financial knowledge have additionally been criticized for a lack of psychometric testing (Fernandes et al., 2014), even if there are some exceptions (Wobker, Kenning, Lehmann-Waffenschmidt, & Gigerenzer, 2014; Van Rooij et al., 2012).

Moreover, there is no established consensus that increasing financial knowledge through education has sustainable beneficial effects at all (Willis, 2008; Fernandes et al., 2014; Stolper & Walter, 2017; but see Lusardi & Mitchell, 2014 for a different perspective). Firstly, despite the positive relationships of financial literacy measures to financial behaviors (Lusardi & Mitchell, 2014)

and outcomes (Van Rooij et al., 2012), the causal role of financial literacy has remained unclear due to endogeneiety concerns (Stolper & Walter, 2017; Huston, 2010). In fact, it has been noted earlier that reverse causality might play a role in the relationship of financial literacy and financial outcomes (Huston, 2010). Gustman, Steinmeier, and Tabatabai (2012) find that pension wealth and pension knowledge are positively related. They argue that a higher value of the pension is an incentive to understand this pension. Similarly, Hilgert et al. (2003) find that experience is considered important for the acquisition of knowledge. Therefore, they argue that gaining experience with saving and investing money might increase knowledge in these domains as likely as the other way round. Problematically, there have been no randomized controlled experiments so far (Stolper & Walter, 2017). Moreover, studies have, if at all, rarely attempted to relate financial literacy to actual behaviors in experimental tasks but rather focussed on self-reports or data from household surveys. This precludes a clear understanding of the causal role of financial wisdom.

Related to this unclear causal role, Fernandes et al. (2014) show in a meta-analysis that when financial literacy was manipulated by financial education interventions, only minor effects on financial behavior and outcomes occur (but see Kaiser & Menkhoff, 2017, for evidence that the effects might be slightly larger). Fernandes and colleagues also showed evidence that these effects decay rapidly over time. Moreover, they provide evidence that ommited variables like cognitive ability or personality also play a role. They find that traits like propensity to plan, confidence in information search, and the willingness to take prudent investment risks are predictive of beneficial financial behaviors. Behaviors included, saving for emergencies, figuring out how much money will be needed for retirement, and not having to pay late fees on bills. Financial literacy, in turn, was no significant predictor of these behaviors after the traits had been controlled for. This suggests, that effects of financial literacy might be better explained by personality traits and attitudes. As the causal direction is unclear and other variables might be a better explanation, findings on the impact of financial literacy might be upwardly biased (Stolper & Walter, 2017).

The above casts doubt on what financial literacy is and whether it is actually a valid explanation of financial decision making and financial behavior. Accordingly, financial literacy education might not be an appropriate intervention to improve financial decision making competence. In fact,

attepts to increase financial knowledge may even cause problems. Firstly, a comparison of objective and subjective knowledge suggests, that individuals estimate to be on the high end of the distribution, even if they are not (Gamble, Boyle, Yu, & Bennett, 2015; Kramer, 2014). This has led researchers to argue that individuals are overconfident (Stolper & Walter, 2017). According to Willis (2008) increasing financial literacy without actually altering behavior, might then lead to higher subjective knowledge and ultimately overconfidence, which results in worse financial decisions. Together with the problematic evidence of the causal role of financial literacy Willis (2008) concludes that the costs of financial education do not outweigh its benefits. A lack of clear evidence for the link of financial literacy and behavior suggests that financial knowledge is neither necessary nor sufficient. This calls for considering other attempts to explain financial decision making, to ultimately improve individual decision making competence. Another attempt to explain financial decison making is based on the notion of financial capability.

Financial capability

The concept of *financial capability* is seen as a next step to financial literacy (Remund, 2010). It adresses the narrow measurement of financial literacy to some degree. Financial capability provides a broader perspective. It is thought to reflect individuals' ability to handle one's finances successfully in order to achieve financial well-being (Xiao et al., 2014). It includes financial literacy or knowledge, financial behavior, and financial self-efficacy (Taylor, 2011). Based on work by Kempson, Collard, and Moore (2005), Atkinson et al. (2006) provided evidence for the relevance of the dimensions of managing money, planning ahead, staying informed, and being knowledgeable. The concept thus includes to some degree the application dimension of financial literacy, which is found in definitions (e.g., OECD, 2014) but to a lesser degree in measurement (Huston, 2010; Fernandes et al., 2014).

It has been found that financial capability is related to demographic characteristics like age and income in the UK (Atkinson et al., 2006; Taylor, 2011). Moreover, it has been shown that financial capability is positively related to psychological health (Taylor et al., 2011) and negatively related to adverse financial events, like bankruptcy, repossessions, not meeting payments or experiencing

unexpected overdraft (von Stumm et al., 2013). Finally, it has been shown that financial capability is associated with financial satisfaction (Xiao et al., 2014). Interestingly, in the latter study the relationship of objective financial literacy and financial satisfaction was negative and close to zero, when the performance of financial behaviors and demographic variables were controlled for. This has been explained by an overall high objective knowledge and low financial satisfaction within the sample. However, this also suggests that behaviors may be more important than knowledge.

Measures of financial capability have included different aspects thought to reflect individuals' financial capability. Among these aspects have been: (a) a mixture of outcome measures and behaviors (Taylor, 2011), (b) desirable financial behaviors, knowledge, and attitudes (Atkinson et al., 2006), (c) desirable and undesirable financial behaviors, objective and subjective measures of financial literacy, and financial self-efficacy or perceived financial capability (Xiao et al., 2014). The latter aspects also have recently been combined into a comprehensive index to measure financial capability (Xiao & O'Neill, 2016). The explanation for differences in financial capability is grounded in financial literacy. Accordingly, individuals use their knowledge to perform beneficial financial behaviors (Xiao et al., 2014). The other idea, that remains mostly implicit, is that beneficial behaviors and knowledge capture an underlying capacity for financial decision making that is reflected in financial behaviors (Kempson et al., 2005; Atkinson et al., 2006).

Thus, most measures of financial capability share that financial behaviors are considered in addition to financial literacy or knowledge. However, most articles mentioned above stay mute on why individuals differ in their behaviors or financial capability, beyond differences in financial knowledge. There is evidence that financial knowledge is related to financial behaviors (Ali et al., 2015; Stolper & Walter, 2017; Hastings et al., 2013) and financial satisfaction (Joo & Grable, 2004). The positive relationships of financial capability to financial outcomes have been used as an argument that financial behaviors should be fostered (Taylor, 2011; Xiao et al., 2014). However, research on financial capability does hardly seem to consider explanations of why people differ in their financial behaviors that go beyond knowledge. Nevertheless, following evidence from research on financial literacy, knowledge does not necessarily seem to translate into behavior and financial satisfaction. Partially, in line with this, Joo and Grable (2004) do only find a direct effect of financial

knowledge on financial satisfaction but not an effect through financial behavior.

In summary, within the concept of financial capability a link between beneficial financial behaviors and financial outcomes like financial satisfaction has been established. However, the concept still seems to strongly rely on knowledge to explain the behaviors. Evidence presented above suggested that knowledge does not necessarily translate into behavior. This poses the question, which other factors explain financial behaviors and decision making. The outcome of financial satisfaction has been shown to be influenced by several other factors, including demographic factors, income, and financial stressors (Joo & Grable, 2004). Moreover, in the developmental work on financial capability experiences, circumstances and personality, as well as knowledge and understanding, skills, and confidence and attitudes are assumed as predecessors of financial behavior (Kempson et al., 2005). Finally, it has been argued that differences in the use of simple rules are related to differences in financial capability (De Meza et al., 2008). Following this line of thought, financial decision making will next be considered from other perspectives that consider that people may not always use knowledge to determine theri course of action.

Further perspectives on financial decision making

In the context of financial literacy, a comprehensive explanation of individual financial decision making and financial behaviors is lacking. One potential problem of financial literacy is, that it is mainly grounded in rational choice. This means that decisions are assumed to depend on the calculation of expected values or utilities, maximizing welfare in the end (Hastings et al., 2013; Lusardi & Mitchell, 2014; Xiao et al., 2014). However, individuals seem to deviate frequently from norms of rationality from "standard economic theory" (Xiao et al., 2014, p. 418). There are two accounts which suggest that humans might not follow rational calculations in their decisions: behavioral economics and ecological rationality.

Behavioral economics. Behavioral economics (e.g., Belsky & Gilovich, 2010) are is grounded in the famous heuristics and biases program by Tversky and Kahneman (1974). They have shown that individuals rely on a range of heuristics or simple rules, which ignore information. Thy conclude that these rules "are quite useful, but sometimes they lead to severe and systematic

errors" (p. 1124). In line with this finding De Meza et al. (2008) argue that the use of simple rules also plays a role for behaviors involved in financial capabilty. Examples include firstly, that people show a preference for immediate gratification. De Meza and colleagues relate this to the tendency to higher discount-rates for later rewards, leading to inconsistent decisions. Additionally, it is argued that this means, that people may lack self-control to wait for a pleasant outcome that occurs later. They argue that this tendency is related to the accumulation of debt and a lack of retirement saving, as both involve an option of immediate gratification. Secondly, people are overly optimistic and may therefore, for example, fail to save. As a final example, they also note that a tendency for sticking to past choices may be, for instance, related to failing to switch to a better financial product.

Overall, De Meza et al. (2008) attribute financial mistakes to psychological differences, like a lack of self-control, instead of differences in available information or knowledge. They argue that this is related to the use of simple heuristics, which are frequently not rational in today's world. This view sees psychology and simple rules mainly as the source of deficits in financial decision making.

Ecological rationality. The rather pessimistic view of the human decision maker in behavioral economics that using heurisitcs leads to irrationality has been challenged in the framework of *ecological rationality* by Gerd Gigerenzer and his research group (Gigerenzer et al., 1999). Connected to the above, their framework of ecological rationality agrees that the use of heuristics is an explanation of financial decision making. The main difference to the above is, firstly, that within a framework of ecological rationality it is not only considered whether simple rules or strategies lead to systematic errors, but more importantly under which conditions these errors emerge (Gigerenzer et al., 1999). They note that the supposed irrationality of simple rules in the heuristics and biases tradition is strongly grounded in the normative standards of logic and probability theory. Thereby, simple rules are judged relative to these rigid standards without regarding whether the rule may actually be adaptive in the context. In the framework of ecological rationality, in turn, it is also considered under which conditions a certain strategy works well and under which it does not. Contrary to being rational or irrational per se, it is asserted that strategies are adaptive, dependent on the capacities of the individual and the environment one operates in.

This, in turn, also means that the adaptivity of apparently rational behaviors like saving or

avoiding borrowing may also depend on the context. If there is no excess income to be saved from, saving money is likely a bad idea. Relatedly, if an individual is transiently short of money, borrowing may be a good idea, whereas it may be more adaptive to generally cut down on spending when lacking money is a permanent condition. Finally, delaying a reward, as in investing money, may be not necessarily be adaptive. This may be the case when it is uncertain if it will be available in the future or when one knows that she will otherwise forget the reward.

These examples illustrate that considering individual capacities of the decision maker and the environement of financial decisions and behaviors is crucial to judge whther a certain behavior is adaptive to this context. In order to apply the framework of ecological rationality to explain differences in financial decision making competence, firstly individual capacities and personality characteristics that are related to financial decision making and behavior will be considered. Then, features of the environment, which potentially influence financial behavior and decision making, will pointed out. Finally, it will be shown that in the financial context simple strategies are frequently adaptive and successful.

The role of individual capacities and personality. It has been shown above that there are differences in individuals' knowledge and ability to handle their finances successfully, which are predictive of certain financial behaviors and outcomes like financial satisfaction (Hastings et al., 2013; Stolper & Walter, 2017; Xiao et al., 2014). Also more general capacities like intelligence and numeracy have been shown to be related to financial behaviors and outcomes (Stolper & Walter, 2017; Hastings et al., 2013). Hastings et al. (2013) cite some studies which support a role for cognitive ability in financial behavior and decision making. Christelis, Jappelli, and Padula (2010), for instance, find that the cognitive abilities of numeracy (the ability to handle numerical information), verbal fluency, and memory are positively related to holding stocks. Moreover, numeracy has been shown to be related to wealth levels (Banks & Oldfield, 2007). Fernandes et al. (2014) provide evidence on the relationship of numeracy, confidence in investing money, planning long-term, and the willingness to take investment risks to fiancial behaviors. Also Judge, Hurst, and Simon (2009) provide evidence that intelligence is related to income and financial strain. Together, this csuggests that individual capacities should be regarded when investigating financial decision making.

There is, moreover, evidence that other factors influence financial behaviors and individuals' financial circumstances. It has been acknowledged that attitudes and traits likely also play a role in financial decision making and financial behavior. Ali et al. (2015) show, that the attitude towards money influences basic money management practices and financial planning. Moreover, personality traits, like the Big Five, have been shown to be related to financial behaviors. For example, conscientiousness was shown to be related negatively to compulsive buying (Mowen & Spears, 1999), holding assets, saving (Brandstätter, 1996, 2005), and money management (Parrotta & Johnson, 1998). In turn, neuroticism predicted more compulsive buying (Mowen & Spears, 1999) and accumulating debt (Nyhus & Webley, 2001). Extraversion was related to more debts and less assets, agreeableness was also related to more debt, whereas openness was related to both, more debts and assets (Brown & Taylor, 2014). This also connects to the idea that personality may be a predecessor of financial behaviors or financial capability (Kempson et al., 2005).

Furthermore, Dholakia, Tam, Yoon, and Wong (2016) provide evidence on the relevance of a "chronic tendency to save" (p. 140) that they call personal saving orientation. Personal saving orientation has been shown to be related to financial behaviors and outcomes, like financial satisfaction. Personal savings orientation has moreover been shown to moderate the relationship of financial literacy to years of accumulated savings. Finally, Dholakia and colleagues show that letting participants list ways of saving leads to increased savings in a hypothetical scenario among participants low in personal saving orientation. They argue, that their interventio increased personal saving oreintation.

Related to personal saving orientation (Dholakia et al., 2016) the concept of dely of gratification may also be relevant for financial decision making. Delay of gratification is the ability to forego a smaller but immediate reward for a larger but later reward, involving self-control (Reynolds & Schiffbauer, 2005). Obviously, saving or investing involves delay of gratification, as money that might otherwise be spend immediately is set aside to profit from it later. In line with this it has been found that a measure of delay of gratification is related to less financial problems and less borrowing (Hoerger, Quirk, & Weed, 2011).

Together, the above evidence illustrates the importance of considering individual differences,

not only in individual knowledge, but also in personality and attitudes to explain financial decision making and behavior. However, it can be seen that not only the capacity plays a role but also the environment for the behavior or decision.

The role of the environment. The idea to consider the environment in financial decision making is not new. Sherraden and Ansong (2016) consider financial capability as "an individual and structural idea that combines people's ability to act with their opportunity to act" (p. 83). They note that an individuals capacities like, knowledge or cognitive ability, are only valuable if individuals also have access to financial tools like savings accounts. Relatedly, in the context of financial education it has been noted that the timing of interventions may be crucial, as, for example, knowledge about financial products rapidly decays when not used (Fernandes et al., 2014; Alsemgeest, 2015; Xiao & O'Neill, 2016). These ideas are reflective of the idea of ecological rationality, in that they consider the environment, as well as the individual. The focus of the present work is, however, even broader, focussing on the interplay of the general and individual financial situation, individual capacities and the strategies used in this context.

Generally, real world (as opposed to laboratory) environments are often characterized by uncertainty, in which probabilities are unknown, rather than by risk, in which probabilites are known *a priori* (Gigerenzer et al., 1999). This makes real world environments inherently difficult to predict. Accordingly, the financial environment has frequently been characterized as complex and uncertain (Ryan et al., 2011; Stolper & Walter, 2017; Hastings et al., 2013; Lusardi & Mitchell, 2014). Small changes in the conditions of the financial system, together with their interaction with the actions of individual actors can have a large impact and cause events like the financial crisis (Neth, Meder, Kothiyal, & Gigerenzer, 2014). As noted in the introduction, individuals face increasing responsibility in this uncertain and complex financial world. Individuals are faced with complex products like different types of loans, credit cards, or mortgages, between which the have to decide(Lusardi & Mitchell, 2014). Together with general limitations in human capacity (e.g., Cowan, 2010) this environment leads to an information overload which complicates choice (De Meza et al., 2008). In addition to frequent information overload financial decisions frequently have to be made under time pressure (Willis, 2008), highlighting a role of the circumstances of the concrete decision at hand.

In addition to the general financial environment, also the individual's immediate financial and socioeconomic environment, has been shown to play a role for an individuals financial decisions. Prinz, Gründer, Hilgers, Holtemöller, and Vernaleken (2014) find that financial security and funding situation influence risk averse behavior. Moreover, income, social comparison, and, a worsening of one's financial situation (Hsieh, 2003) or experiencing a large drop in income (Xiao et al., 2014) have been found to be negatively related to financial satisfaction and well-being (Joo & Grable, 2004; Ng & Diener, 2014). These factors constitute the financial situation and may also influence, how individuals make decisions, as they may generate pressure to act. For example, a low income may make certain decisions, like taking a loan, more pressing than finding a good investment. These properties specific to the individual decision environment together with the more general properties of the financial environment above serve as part of the background to judge the adaptiveness of strategies.

The adaptiveness of simple rules. In the context of ecological rationality, it has been proposed that individuals have a toolbox of adaptive simple strategies at their disposal, with which they can handle their environment according to their capacity (Gigerenzer & Selten, 2002). This calls for considering the role of simple rules or heuristics in the context of financial decision making (Kozup & Hogarth, 2008). Within research the framework of ecological rationality it has been shown that simple strategies, which ignore information, frequently outperform more complex strategies (Gigerenzer & Gaissmaier, 2011). One prominent example is the recognition heuristic (Goldstein & Gigerenzer, 2002). In an environment in which the criterion value of an object is related to the probability of knowing this object, simply judging that the recognized object has the higher value on the criterion. This has, for instance be shown for stocks by Borges, Goldstein, Ortmann, and Gigerenzer (1999). They find that stocks that are recognised frequently perform better than stocks which are not. This makes a simple strategy to only invest in what you know adaptive (Forbes, Hudson, Skerratt, & Soufian, 2015), especially for those that do not have additonal knowledge at their disposal. This connects to the thought that simple rules may frequently be more adaptive, especially under uncertainty, as it is given in the financial domain (Neth et al., 2014).

Some simple strategies also deal with peculiarities of the environment, like sparse availability

of data (Neth et al., 2014). An example in which a simple strategy manages to outperform a more complex strategy is the simple 1/*N* strategy (DeMiguel, Garlappi, & Uppal, 2009). Thereby, one simply spreads one's investment equally acorss risky and less risky options. DeMiguel and colleagues could show that this seemingly simple strategy outperformed the mean-variance model by Markowitz (1952), as well as its refinements, which allows to maximize profit when for estimated risk. Neth et al. (2014) note that in the context of portfolio choice typically data is rather scarce and therefore more complex model ovefit the present data at the expense of being predictive of future data. Arguably, in this context also knowledge might play a role, as knowing about risk diversification may be a motivation to use the $1/N$ strategy. However, there is no apparent no reason, why knowledge should be necessary for this strategy to be adaptive, as one can arguably use it without understanding why.

Other strategies are more concerned with counteracting limitations in individual capacities. To counteract low levels of financial literacy, Drexler, Fischer, and Schoar (2014), investigated the effectiveness of a heuristics based accounting training for microenterpreneurs in the Domenican Republic. They taught these enterpreneurs, for example, physical rules in handling private money and money dedicated to their enterprise. These rules included physically separating their private money from the money of their business and procedures to transfer money from one place to another without loosing track. They found their heuristics based training to be superior to a standard accounting training in terms of quality of reporting sales and profits, as well as business outcomes. This lends further evidence to the claim that simple rules may sometimes be superior to more complex strategies. This may especially the case when capacities to deal with the respective environment are restricted, as in this case.

An application of considering the context for adaptive strategy choice has been proposed by Shefrin and Nicols (2014). They develop a fast and frugal heuristic to classify credit card holders into different credit card styles according to how much they want to repay, their attitude toward budgeting, and whether they rely on simple strategies for budgeting. The classification heuristic considers these styles and the individual's number of credit cards. Based on this information appropriate online tools for managing the credit cards are suggested. For instance, less savvy consumers,

who show low motivation to manage their credit cards, are suggested to use a simple tool that does much of the management for them. More savvy consumers, who already show good management, in turn, may rely on minimal tools to track their expenses. This is a good example, of a heuristic that regards the individual (credit card styles), as well as its environment (the number of credit cards).

In summary, it has been argued that financial literacy does not regard the finding that people frequently use simple rules in financial decisions (De Meza et al., 2008). This may be a reason that financial literacy is a bad explanation of financial behaviors related to financial capability. In the context of financial capability, simple rules have so far frequently been considered as a source of mistakes (De Meza et al., 2008). Evidence from the framework of ecological rationality suggests, however, that simple rules also may be adaptive (Gigerenzer & Gaissmaier, 2011). Adaptiveness is determined by a fit of the strategy or behavior, to the individual capacities, and the environment it operates in. Therefore, potentially relevant individual variables and properties of the environment have been considered. Finally, examples for the success of simple heuristics in the financial environment have been provided. This sets the stage for a new explanation of financial decision making competence that is centered around the notion of financial wisdom.

Financial wisdom

The proposed concept of *financial wisdom* is based on strategies that are selected in accordance with individual capacities and the environment one is in. Rules and strategies are only adaptive relative to the environment and the individual (Gigerenzer et al., 1999). This makes it necessary for the individual to select an appropriate strategy. This adaptive selection may involve something similar to metacognition (Antonietti, Borsetto, & Iannello, 2016). Antonietti and colleagues noted, that individuals would select one of three processing modes: deliberation, intuition, or heuristic processing. This is related to selecting a strategy accrding to one's individual capacities and the environment one is in. It is proposed, that the adaptive selection and use of simple strategies provides an explanation beyond knowledge to the question why individuals differ in the performance of beneficial behaviors or their financial capability.

With this background, financial wisdom is defined as the repertoire of simple rules, behav-

ioral practices, and attitudes, which individuals use to deal with their financial matters and the ability to adaptively select a strategy, which is appropriate to the decision context. The decision context thereby involves the individual's capacities and personality, as well as the situation in which the decision takes place. In that it also combines "people's ability to act with their opportunity to act" (Sherraden & Ansong, 2016). Therefore, it can be considered closely related to financial capability. Nevertheless, it considers individual capacities that go beyond knwoledge, as it appears to be typically the case in financial capability (e.g., Xiao et al., 2014; Sherraden & Ansong, 2016). The additional idea of financial wisdom, that following adaptive simple rules and behavioral practices is adaptive is in line with findings suggestive that behaviors are a better predictor of financial satisfaction (Joo & Grable, 2004; Xiao et al., 2014).

It is proposed that financial wisdom is a better explanation of how individuals make financial decisions than the previous explanations of financial literacy and financial capabiltiy. Financial wisdom regards that individuals rely on a variety of strategies to deal with their finances, including adaptive simple rules. Research from financial capability suggests that people differ in their adaptive financial behaviors (Xiao et al., 2014; Atkinson et al., 2006). Still, likely knowledge is relevant aspect of financial decision making, as it determines part of an individuals capabilities and available strategies. Above that, financial wisdom is a feature of people that takes into account the situation of the individual as well as its capacity, in addition to the mere financial behaviors.

People likely differ in their repertoire of strategies, as well as their ability to adaptively select among them. Therefore, a measure of financial wisdom should show differences between individuals. To this end, a measure of financial wisdom will be developed. This measure should be able to distinguish between individuals with high and low levels of financial wisdom. To show that the measure actually assesses decison making competence it should furthermore show to be related to outcomes of financial behavior and decison making.

How can we measure financial wisdom?. Financial wisdom is related to the adaptive selection of strategies and rules to deal with one's finances. In previous work by Neth and Galesic (Neth & Galesic, 2012, 2014) the content of financial wisdom has been roughly categorized into monitoring, planning, information search, saving and debt, spending, risk attitude, work ethics, sim-

ple rules, and advice-taking. Items measuring the repertoire of financial wisdom were constructed from guidebooks and "modern educational publications, traditional sayings, as well as advice from religious texts such as the Bible and Talmud" (Neth & Galesic, 2012). These sources have been collected and compiled over time and likely contain a range of advice that applies across different environments and for different people. Therefore, strategies and rules that can potentially be adaptive for a wide range of individuals can be obtained this way. This allows to operationalize financial wisdom as the repertoire of simple strategies, attitudes, and behavioral practices individuals have at their disposal to manage their money successfully.

This repertoire is thought to broadly include a variety of money-related rules, behavioral practices, and attitudes. In three pilot studies Neth and Galesic collected evidence on a set of financial wisdom items and developed a ten-item questionnaire, based on partial correlations with financial outcomes. It consisted of the dimensions long-term planning ("I usually adopt a long-term perspective."), risk-taking ("I take calculated risks"), also including a broader perspective ("Money can't buy happiness"). This questionnaire was shown to be predictive of financial satisfaction and savings beyond financial literacy and numeracy, even, when external factors like previous savings and income were controlled for. This is first evidence for the predictive value of financial wisdom.

One important goal of the present study is to replicate the results on the predictive value of financial wisdom. Additionally, the results will be extended by investigating a set of financial wisdom items to confirm the structure of financial wisdom or to gain additional insights on its underlying dimensions. This comprises investigating the undelying structure of the items which are used to measure financial wisdom. The main goal, thereby, is to show that the simple rules, behavioral practices, and attitudes in financial wisdom have explanatory value in financial behavior and decision making, as well as their consequences. Moreover, construct validity of financial wisdom will be shown by relating it to other constructs and individual capacities.

The main goals of this study can thus be summarized as follows:

1. replicating or refining a measure of financial wisdom based on previous work by Neth and Galesic (2012)

2. exploring the underlying structure of financial wisdom using factor analysis
3. arguing for construct validity as well as predictive validity by establishing relationships to related concepts

To adress the last point, expectations for relationships to other concepts will be formulated in the next part .

How does financial wisdom relate to other concepts?. Financial wisdom comprises simple rules, behavioral practices, and attitudes towards finance. Moreover, in line with ecological rationality (Gigerenzer et al., 1999), financial wisdom is proposed to help individuals to deal adaptively with their finances by selecting among a repertoire of strategies which are suited for the environment at hand. Thus, financial wisdom should be related to other concepts, which are related to strategies or behaviors to adaptively manage ones finances. The relations to other concepts serves to test *nomologic or construct validity*.

Construct validity. A first concept that is likely related to financial wisdom is financial literacy. Adaptively managing one's finances with appropriate behavior is in line with findings from financial capability, which suggests that self-reported behaviors, attitudes, and self-efficacy are predictive of financial outcomes (Atkinson et al., 2006; Xiao et al., 2014; Joo & Grable, 2004). Financial wisdom thereby differs from financial capability in two major aspects: first, financial wisdom is grounded in the idea that people might perform beneficial behaviors in accordance with simple rules or behavioral practices. Financial behaviors, thus, are not necessarily performed because of financial knowledge (De Meza et al., 2008). So, secondly, financial wisdom does not assume that knowledge is necessary for individuals to be financially successful. Therefore, financial literacy is explicitely said not to be the same as financial knowledge.

Financial literacy or knowledge likely still determines part of the individual capacity within a framework of ecological rationality. Therefore, it is assumingly related to the adaptivity of certain strategies in financial wisdom. Financial literacy may, for example, help when an individual has to choose between two savings accounts, in the absence of reliable advice. However, it does not necessarily help to determine whether saving right now is an adaptive choice or not. The relationship

may also be reversed. Financial wisdom may lead to a more comfortable financial situation, which is related to the acqusition of more knowledge. For these reasons, it is assumed that financial literacy is weakly positively related to financial wisdom. This is partially supported by data from the pilot study by Neth and Galesic (2012) in which a measure of financial wisdom and a measure of financial literacy were positively but only marginally significantly correlated. This leads to the following hypothesis:

> Hypothesis 1a: Financial wisdom is weakly positively related to a measure of financial literacy.

Numeracy has also been shown to be positively related to financial knowledge, as well as beneficial financial behaviors (Hastings et al., 2013). Additionally, numeracy may also be related to more general cognitive capacities, which determine the adaptiveness of certain strategies. In line with ecological rationality (Gigerenzer & Gaissmaier, 2011), individuals high in financial wisdom are assumed to offeset disadvatages in cognitive capacities by choosing appropriate simple strategies. For instance, relying on calculation to determine how much to save for retirement may be adaptive for a numerate individual. For a less numerate individual, however, relying on advice instead may be more adaptive. Therefore, numeracy clearly should assess something different from financial wisdom. In line with this,numeracyt has been unrelated to the previous measure of financial wisdom in the data by Neth and Galesic (2014). Therefore, it is assumed that numeracy and our measure of financial wisdom are at most weakly related unrelated.

> Hypothesis 1b: Numeracy is only weakly related to financial wisdom.

Relying on simple strategies, moreover, may be related to enhanced subjective financial capability, which has also been termed as financial self-efficacy (Xiao et al., 2014). Financial self-efficacy has been found to mediate the relationship of financial knowledge on financial behaviors including retirement and emergency saving (Rothwell, Khan, & Cherney, 2016). this suggests that self-efficacy may be an important part in the causal chain of financial decision making and behavior. Simple rules and behaviors in financial wisdom are, by definition, easy to apply and help to adap-

tively deal with the environment at hand. This may lead to a greater sense of subjective financial capability. This leads to the following hypothesis:

> Hypothesis 1c: Financial wisdom is positively related to a measure of subjective financial capability or self-efficacy.

The content of financial wisdom stems from the domains of monitoring, planning, information search, saving and debt, risk attitude, work ethics, simple rules, and advice-taking. Thefore, financial wisdom should additionally be related to a range of concepts, which are related to these domains of financial wisdom. Financial wisdom involves rules, practices, and attitudes towards saving. This puts it close to the concept of personal savings orientation (Dholakia et al., 2016). Personal saving orientation (PSO) is a "chronic tendency to save" (p. 140), involving a mindset that is associated with behavioral practices and habits related to saving money. Conceptual overlap already shows in the measures' items. For example, both measures contain an item which is concerned with saving "money for a rainy day". As saving is a sub-aspect of financial wisdom, a positive relationship of financial wisdom and PSO is expected. However, financial wisdom encompasses other aspects of dealing with money. Thus the concepts should not be redundant and the relationship should not be too close to perfect.

> Hypothesis 1d: Personal savings orientation is positively but not perfectly related to financial wisdom.

Financial wisdom includes not only saving but also monitoring and planning. Strategies for these three aspects of financial wisdom involve taking a long term perspective, which also is related to the ability to delay gratification (Reynolds & Schiffbauer, 2005). Saving involves not spending money right away, whereas planning and monitoring require dedicating time to these actions that might be spend more pleasantly. This is in line with the fact that delay of gratification related to money has been identified as an important dimension in measures of delay of gratification (Hoerger et al., 2011). Hoerger and colleagues measure delay of gratification of money with items like "I cannot be trusted with money" and "I try to spend my money wisely.". This already suggests conceptual

overlap with financial wisdom. Therefore, financial wisdom is expected to be positively related to a measure of delay of gratification. Still, financial wisdom should assess something different than delay of gratification. Financial wisdom includes other aspects, as it is a concept that is different from mere individual capacities. Overall:

> Hypothesis 1e: The ability to delay gratification is positively related to financial wisdom.

Additionally, the aspects of monitoring and planning are likely also related to conscientiousness, as they involve some degree of being organized. Conscientiousness is a personality trait, which includes inhibition and self-control, as in delay of gratification, as well as being aspects of being thorough and structured, like planning and controlling (McCrae & John, 1992). In line with this idea, Donnelly, Iyer, and Howell (2012) find that conscientiousness is positively related to managing one's money. However, financial wisdom should assess something different from conscientiousness, as it is assumed to be more than a personality trait.

> Hypothesis 1f: Conscientiousness is positively related to financial wisdom.

Criterion validity. To argue for *criterion validity*, financial wisdom should also be related to behavioral correlates, as well as actual behaviors. One behavior relevant to financial wisdom is saving, which help to ensure solvency (Joo & Grable, 2004). Individuals high in financial wisdom are assumed to save more, as long as their financial situation allows it. Therefore, on average, the expected money one sets aside in a given month should be predicted by a measure of financial wisdom. This may be influenced by changes in the financial situation. For example, having experienced a large drop in income or holding large amounts of debt may render the situation not sufficiently comfortable to save any money, as paying off debts or adapting a new living standards may be more pressing goals.

This idea is also in line with the finding of a negative influence of relative deprivation on financial satisfaction (Hsieh, 2003). People higher in financial wisdom are now assumed to make more adaptive decisions in these situations, which allow them to save a greater proportion of their

income. Therefore, these influences should be controlled for. It was conjectured that a measure of savings relative to income may be more indicative of differences in saving behavior. Generally, the maximum amount saved is bounded by income. Saving US-$ 100 may be much money for a person with an income of US-$ 800 but not for a person with an income of US-$ 4,000. A relative measure of the proportion saved may make individual behavior more comparable. Still, it is likely, that those with higher incomes likely can also save a greater proportion so that income should still be controlled for in the analyses.

Further, positive relationships of financial literacy to retirement saving and wealth (Van Rooij et al., 2011) and of numeracy to wealth (Banks & Oldfield, 2007) have previously been found. Moreover, the Big-Five personality traits have been linked to saving (Donnelly et al., 2012; Brandstätter, 1996). Also PSO is very likely related to the expected money saved, as saving is its specific domain and it has been shown to be related to hypothetical saving behavior (Dholakia et al., 2016). This also should hold for delay of gratification. Individuals higher in delay of gratification should be more inclined to forgo immediate spending to save more for the future (Reynolds & Schiffbauer, 2005). Arguably, the above are other individual capacities that are related to saving behavior. Financial wisdom is, however, assumed to be a better explanation of saving behavior. To test strictly for the predictive validity of financial wisdom, it should be a predictor beyond PSO, delay of gratification, the Big Five, financial knowledge and numeracy.

> Hypothesis 2: Financial wisdom is predictive of the percentage saved from income beyond financial literacy and numeracy, when influences of personality and the financial situation are controlled for.

To argue more strongly for criterion validity a measure of financial wisdom should also be related to actual behavior in the future. Based on the idea that financially wise individuals also use strategies to plan carefully, it was conjectured that financial wisdom is also related to waiting on an investment task, if this increases the reward. Investing money involves delay of gratification, as waiting promises a larger reward, whereas a smaller reward is continously available (Reynolds & Schiffbauer, 2005). Generally, it has been found that delayed rewards are discounted, meaning

that later rewards are valued less than sooner rewards (da Matta, Gonçalves, & Bizarro, 2012). The finding, that there are differences in how much individuals discount gains is well established (Myerson, Baumann, & Green, 2017). Even, if there are differences between delay discounting and delay of gratification, both processes are likely related (Reynolds & Schiffbauer, 2005).

It was assumed, that financial wisdom would be positively related to the delay of gratification in a task in which individuals had the opportunity to invest money for a certain time to obtain interest. Individuals high in financial wisdom are assumed to use adaptive simple strategies to deal with the financial domain. This should also include strategies to manage and invest one's money. For example, one needs to keep track and plan when to collect the reward. Therefore it was also assumed that financial wisdom is related to waiting time in the investment task beyond the explanatory value of a general measure of delay of gratification. Moreover, relatively easily receiving some extra reward seems to be adaptive at face value. Notably, Green, Myerson, Lichtman, Rosen, and Fry (1996) find that income and age are related to delay discounting. Moreover, following a meta-anlysis females and males differ in their delay discounting (Silverman, 2003). Therefore these characteristics should be controlled in respective analyses among other indicators of the financial situation. To put financial wisdom to a strict test, the relationship should also extend beyond the other individual constructs included in the study.

> Hypothesis 3: Financial wisdom is predictive of the waiting time in an investment task, which needs delay of gratification, when delay of gratification, income, gender, and age are controlled for.

Finally, financial wisdom is assumed to help individuals to successfully shape their financial situation through the selection and application of adaptive simple rules and strategies. To argue for *predictive validity*, differences in financial wisdom should, therefore, be predictive of a global indicator of the financial situation. Such an indicator may be overall satisfaction with the current situation. The idea that simple rules and behavioral practices are predictive of financial satisfaction is in line with findings on financial capability. These findings suggest that certain behaviors, as well as a sense of being able to mange one's finances successfully are predictive of financial satisfaction

(Xiao et al., 2014). Simple rules and behavioral practices might do similarly and additionally support a sense of being capable of managing one's finances successfully within one's environmental possibilities and individual capacities.

However, financial satisfaction has also been explained by a wide variety of other factors. It differs dependent on several demographic and individual characteristics. There is evidence that it is related to income, with higher incomes showing small positive effects on financial satisfaction (Hsieh, 2003). Hsieh (2003) finds that not only actual income has plays a role, but also, whether an individuals' financial situation has worsened ("relative deprivation"), as well as whether the situation is perceived to be better or worse than that of a reference group (e.g., other US Americans, "social comparison"). Moreover, Hsieh (2003) finds an influence of age and health on financial satisfaction. Joo and Grable (2004) find that influences like income, education, number of financially dependent persons, and the number of financial stressors are related to financial satisfaction, mediated by financial behavior solvency, and risk tolerance, as well as the financial stress level. Shim, Barber, Card, Xiao, and Serido (2010) also note influences of socialization and education on financial satisfaction, mediated through knowledge, perceived behavioral control, and financial attitudes. These influences are arguably mostly beyond an individuals direct control through decision making, also being related to individuals behavior. Therefore, a measure which explains variance in financial satisfaction due to superior financial decision making should retain its predictive value, when these influences are controlled for.

There is also evidence that the Big Five traits may be related to financial satisfaction. Conscientiousness is related to being future oriented and managing one's money (Donnelly et al., 2012). It has been found to be positively related to saving (Brandstätter, 1996, 2005). Next, it has also been linked to less compulsive buying (Mowen & Spears, 1999). Finally, conscientiousness has been found to be negatively related to holding unsecured debt (Nyhus & Webley, 2001; Brown & Taylor, 2014). Therefore it may also be positively related to finacial satisfaction through better financial behaviors and less financial stress. Conversely, there is evidence that the other four Big Five personality traits are positively related to holding debt (Brown & Taylor, 2014). Extraversion have, moreover, has been shown to be negatively related to both saving and debt (Nyhus & Webley,

2001). The trait of neuroticism or emotional instability has been found to be related to less savings (Nyhus & Webley, 2001) and compulsive buying (Brougham, Jacobs-Lawson, Hershey, & Trujillo, 2011; Dittmar, 2005; Mowen & Spears, 1999). These may be, in turn, related to financial stress and negatively impact financial satisfaction (Joo & Grable, 2004). This idea is also supported by recent findings, that emotional instability is negatively related to financial satisfaction (K. Davis & Runyan, 2016). For these reasons, the Big Five personality traits should be controlled for in predicting financial satisfaction to show, that financial wisdom has predictive value beyond these established more general concepts.

Next, financial literacy or knowledge is assumed to explain variance in financial decision making behavior (Hastings et al., 2013). Financial knowledge has previously been shown to be related to financial satisfaction (Taft et al., 2013; Shim et al., 2010; Joo & Grable, 2004). However, objective financial knowledge has also been shown to be unrelated (Woodyard & Robb, 2016) or even negatively related (Xiao et al., 2014) to financial satisfaction after controlling for other influences. Findings by Woodyard and Robb (2016) suggest that subjective knowledge may be more predictive of financial satisfaction, as it is more salient. Therefore, both subjective and objective knowledge should be included.

Closely related to financial literacy, numeracy and other cognitive abilites have also been found to be related to beneficial financial behaviors (Hastings et al., 2013). Therefore, it may also be predictive of financial satisfaction. Moreover, numeracy, measured with the Berlin Numeracy Test, has been shown to be related to cognitive abilities like fluid intelligence (Cokely, Galesic, Schulz, Ghazal, & Garcia-Retamero, 2012). Financial wisdom, however, should be a better explanation for a comfortable situation than financial literacy and numeracy. Especially, explanatory value of financial wisdom beyond numeracy can be seen as suggestive of an explanatory value beyond more general concepts like intelligence and working memory. This would also replicate the results by Neth and Galesic (2012). It is therefore proposed that financial wisdom explains financial satisfaction beyond financial literacy and numeracy, after more specific variables of personality and the external influence of the financial situation are controlled for.

Hypothesis 4: Financial wisdom is predictive of financial satisfaction beyond financial

literacy and numeracy, when influences of personality and the financial situation are controlled for.

Methods

Participants

A convenience sample of participants located in the US was recruited through the online platform Amazon Mechanical Turk (MTurk). This allows researchers to rapidly recruit and run large samples. Diversity of age and background as compared to college students has been mentioned as an advantage of samples collected through MTurk (e.g. Mason & Suri, 2012; Gosling, Vazire, Srivastava, & John, 2004). For the present purpose, such an online sample is therefore especially suited, as influences of the work situation and income are of interest, which do not apply to many collge students. Additionally, in order to conduct factor analyses large sample sizes are required (Bühner, 2006).

Landers and Behrend (2015) note that the data obtained from such samples is not generally worse than data obtained from other convenience samples (see Harms & DeSimone, 2015, for a different perspective). Besides higher rejection rates than in traditional lab settings data obtained from such online samples are said to be indistinguishable from other samples (Sprouse, 2011) and that reliability is not negatively affected (Buhrmester, Kwang, & Gosling, 2011). Nevertheless, there are likely differences to traditional samples, for example, in terms of representativeness, and having a large number of participants, who are adept in doing survey (Harms & DeSimone, 2015). Thus, using such samples should be regarded with caution. For the purpose of conducting one of the first tests of a new concept and measure this type of sample is, however, liekly sufficient.

The sample size was determined by a) *a priori* power analysis. b) considerations for the sample size required for explaoratory factor anaylsis. Power analysis was conducted using the free software `g*power` (Faul, Erdfelder, Lang, & Buchner, 2007; Faul, Erdfelder, Buchner, & Lang, 2009). To reliably detect a small incremental effect of financial wisdom ($\Delta R^2 = 0.01$) at a power of $\beta = 0.95$, controlling for the maximum of 30 variables the required sample size is 133. To attenuate potential dropout and to be able to conduct an exploratory factor analysis with a relatively stable

Table 1

Percentages for each category of categorical demographic characteristics for the full sample used, the filtered sample, and excluded participants with χ^2-tests for differences between the filtered sample and excluded participants.

Variable	Full ($N = 199$)	Filtered ($n = 175$)	Excluded ($n = 24$)	χ^2	df	p
Gender				0.41	2	0.814
Female	46.7	47.2	43.5			
Male	52.3	51.7	56.5			
Other	1.0	1.1	0.0			
Marital Status				0.79	3	0.851
Married	30.2	30.7	26.1			
Living with partner	15.6	15.9	13.0			
Single	53.3	52.3	60.9			
Not Say	1.0	1.1	0.0			
Education				2.49	4	0.646
High school degree	29.6	30.7	21.7			
Associates degree	16.1	14.8	26.1			
Bachelors degree	47.7	47.7	47.8			
Masters degree	5.5	5.7	4.3			
PhD or equivalent	1.0	1.1	0.0			
Community size				8.56	4	0.073
Rural (< 3 000 inhabitants)	5.5	6.2	0.0			
Small town (3 000 to 15 000)	14.1	13.1	21.7			
Town (15 000 to 100 000)	30.2	31.2	21.7			
City (100 000 to 1 000 000	38.2	35.8	56.5			
Large city (> 1 000 000)	12.1	13.6	0.0			
Health				1.79	3	0.618
Poor	2.5	2.8	0.0			
Fair	17.1	17.0	17.4			
Good	58.8	59.7	52.2			
excellent	21.6	20.5	30.4			
Having dependent children				0.07	1	0.791
Yes	30.7	31.2	73.9			
No	69.3	0.0	0.0			
Working situation				5.98	8	0.650
Paid employment	62.3	62.5	60.9			
Self employed	22.6	21.6	30.4			
Looking for work	4.5	5.1	0.0			
Not working and not looking for work	0.5	0.6	0.0			
Looking after the home	5.0	5.1	4.3			
Student	3.0	3.4	0.0			
Unable to work	0.5	0.6	0.0			
Other	1.0	0.6	4.3			
Not say	0.5	0.6	0.0			
Experienced drop in income				8.86	1	0.003
Yes	18.6	15.3	56.5			
No	81.4	0.0	0.0			
Received any financial education				0.19	1	0.662
Yes	54.3	55.1	52.2			
No	45.7	0.0	0.0			
Responsibility for financial decisions				8.51	2	0.014
Self	55.8	52.3	82.6			
Self and others	41.2	44.9	13.0			
Others	3.0	2.8	4.3			

Note: χ^2-tests show the difference between the filtered sample and the participants excluded.

solution a total of 200 participants was approached to participate in the study (Bühner, 2006).

A total of 270 participants viewed the survey (due to participants who did not begin or finish the assignment this number exceeds the aim of 200 participants). They were offered US-$ 1.00 as a flat fee upon completion of the survey and could earn up to another US-$ 1.50 based on good performance in the financial literacy and numeracy tasks, as well as attentive responding. It was purposly not incentivized to answer individual questions correctly but passing a threshold. This was done to not punish less numerate or finacially literate participants but still ensure some effort in performance. The average bonus earned was 1.44 US $ (ranging from 0.50 US-$ to 1.50 US-$). In an investment task participants could moreover earn up to another US-$ 2.50 by delaying an otherwise immediate bonus payment of US-$ 0.50. A total of 36 participants was not considered any further, as they did not view the first questionnaire. Another 32 participants were excluded prior to all further analyses, as they did not finish the study and thus were assumed to have revoked their consent to use their data. The data of two of the remaining 202 participants was rejected due to very poor response quality. This was indicated by implausible responses, little variation in responses, several failed attention checks (see below), and an overall duration below 10 minutes.

The remaining 200 participants who finished were paid. However, another participant showed similar response patters as the rejected participants and was excluded from all further analyses. The full sample therefore consisted of 199 participants (93 female, 104 male, 2 “other”). Feitosa, Joseph, and Newman (2015) found that non-English speaking populations are problematic in online samples such as obtained through MTurk. This should not be a problem in the present sample, as all participants indicated English as their native language.

The increased diversity, relative to a student sample, reflects in the present data. Mean age was 34.58 years ($SD = 10.24$, with a range from 19 to 71 years). For categorical demographic characteristics of the sample see Table 1. All participants reported to have at least on kind of educational degree. Around 57.3% reported having any university degree. Roughly half of the participants reported having a Bachelor’s degree (47.7%). A substantial proportion of participants reported being married (30.1%) or living with their partner (15.6%). Participants report to live in different types of communities. Most participants report to live in towns (30.3%) or cities (38.2%)

with 15,000 to 1,000,000 inhabitatnts. Most participants report to be in good health (58.8%). Less than one third reports to have any dependent children (30.7%). Most participants report to be in paid employment (62.3%). A smaller proportion reports to be self employed (22.6%). Substantially smaller proportions report not to be working (15.1% total). About half of the participants reports to have received some financial education (54.3%). Only 3% report to not be involved in financial decisions.

Participants had been asked for their expected income, their expected expenses, and their expected savings or debt for the month of August, which had just begun at the time of the survey (see also Table 4 on pgae 51). The average total income (sum of fixed and variable income) expected for the next month was 3,292 US-$ ($SD = 2,622$, ranging from 100 US-$ to 16,000 US-$, $Md = 2,500$ US-$). Scaling this up to a yearly income by multiplying it with twelve results in a median income of 30,000 US-$. This is substantially smaller than the median household income of 53,889 US-$ reported by the U.S. Bureau of the Census (Guzman, 2017). This may indicate that rather individual personal income, which woul dbe roughly half for all living with a partner, has been assessed in the present study. Average total expected expenses for the next month were 3,292 US-$ ($SD = 2,225$, ranging from 70 US-$ to 9,500 US-$, $Md = 1,700$ US-$), whereas expected amount of money left over was 1,009 US-$ ($SD = 1,322$, ranging from -600 US-$ to 10,000 US-$, $Md = 600$ US-$). Three participants (1.5%) reported to accumulate debt, whereas 16 participants (8.0%) reported to not have any money left over. 78 participants reported to have taken any loans (39.2%). The total average of these loans over all participants was 27,280 US-$ ($SD = 74,789$, ranging from 0 US-$ to 610,000 US-$, $Md = 0$ US-$, among those who took loans: $M = 69,590$, $SD = 106,769$, $Md = 21,250$). Total savings reported were on average 23,900 US-$ ($SD = 71,835$, ranging from 0 US-$ to 650,000 US-$, $Md = 2,500$ US-$). The variance suggests that participants differed substantially in their reported financial situation.

Materials

Financial Wisdom. To measure financial wisdom 47 of the 60 items that have previously been used by (Neth & Galesic, 2012) were used. Items had originally been taken from “different

Table 2
Categories of financial wisdom items and examples items.

Category (Number of items)	Example item
Monitoring (5)	I monitor my income and expenses on a regular basis.
Planning (4)	I have both short-term and long-term financial goals.
Information search (2)	I gather a lot of information on competing products before buying something.
Saving (1)	I increase my savings when I receive a salary increase.
Debt (4)	I try to avoid borrowing money.
Risk attitude (4)	I only invest in financial products that I understand.
Work ethics (2)	If you lack money, work more rather than borrow.
Simple rules (16)	Always keep some money for a rainy day
Advice taking (4)	I follow the advice of independent financial advisors
Self-control (5)	I only buy the things I need.

collections of tips and advice for prudent personal finance management, including a variety of modern educational publications, traditional sayings, as well as advice from religious texts such as the Bible and Talmud". Originally there was a set of 120 items that had been reduced to 60 items by means of content and logical analyses. This item set had further been reduced to a set of 30 items. These items were neither allowed to include obvious aspects of criterion variables, including retirement saving, savings, and financial satisfaction, nor were they allowed to correlate with criterion variables above $r \geq 0.1$ in data from an mTurk sample.

These 30 items were taken as a start. The use of simple financial rules was assumed to be an important part of financial wisdom. Therefore, 15 items, that described clear behavioral rules, but had been previously dismissed were included into the final set of items (e.g., "I only invest in financial products that I understand."). Additionally, two items that had not yet been included after this procedure, were added, as they had been used in the final ten-item scale of financial wisdom, that had been developed based on criterion validity. Example items and rough categories are shown in Table 2 (For a complete list of the items used see Table B1 on page 103 in Appendix B). All 47 statements were rated on the same 7-point Likert scale (ranging from 1: *strongly disagree* to 7: *strongly agree*). This was a difference to the original study, in which items were rated on

different seven-point scales, including the dimensions of frequency or self-decription. For the sake of parsimony, in the present study the same scale was used for all items. One goal was to discover an underlying factor structure in this set of 47 items by means of exploratory factor analysis. Moreover, the number of items should be further reduced by these means.

Financial Literacy. In the present thesis a 13-item measure by Fernandes et al. (2014) was used, which had previously shown good psychometric properties. The measure included items with a clearly identifiable correct answer, like "When an investor spreads his money among different assets, does the risk of losing a lot of money: (i) increase, (ii) decrease, (iii) stay the same, (iv) Don't know, (v) Refuse to answer". The "refuse to answer category" was not emplyoyed in the present study. Correct items were summed to a financial literacy score. The scale showed rather low internal consistency in the present sample ($\alpha = 0.70$), which could not be improved by exclusion of any item.

Subjective financial knowledge and subjective financial capability. Subjective financial knowledge was assessed asking "On a scale from 1 to 7, where 1 means very low and 7 means very high, how would you assess your overall financial knowledge?" on a seven-pont scale (ranging from: 1: *very low knowledge* to 7: *very high knowledge*, Lusardi & Mitchell, 2014; Xiao & O'Neill, 2016). Subjective financial capability or self-efficacy was assessed using agreement on the statement "I am good at dealing with day-to-day financial matters, such as checking accounts, credit and debit cards, and tracking expenses". It was rated on a seven-point scale (ranging from 1:*strongly disagree* to 7: *strongly agree*). This question has previously been included in measures of financial capability, which is arguably related to financial wisdom (Xiao et al., 2014; Xiao & O'Neill, 2016).

Numeracy. To assess numeracy, a modified set of the eight items used in the third study reported in Fernandes et al. (2014) was used. This set was assumed to be suitable, as they had already been used in the context of financial literacy. However, this set included the three items of the cognitive reflection task (CRT; Frederick, 2005). The items of the CRT provoke a certain response, which can be overridden by thinking about it carefully (e.g., "A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost?"; one has to consider that the ball does not cost $0.10, but $0.05, as it is stated that the bat costs $1.00 *more*.). They have frequently been shown to be moderately to strongly related to numeracy (e.g., Obrecht, Chapman,

& Gelman, 2009; Campitelli & Gerrans, 2014; Cokely & Kelley, 2009).

Using confirmatory factor analysis, Weller et al. (2013) found a one factor solution of numeracy and two CRT items to be better suited than a two factor solution to describe their data. However, Thomson and Oppenheimer (2016) showed that familiarity of the items increases the solution rate and thus decreases variance in the measure. They furthermore showed, that CRT results in MTurk populations are altered dependent on familiarity. Therefore, it was decided to replace these items by three similar (isomorphic) items with a different wording, that had previously been used by Mata (2016). The correlations of CRT and numeracy were found to be in the range of $r = .50$ reported by Weller et al. (2013). This suggests that these CRT items assess the same or a similar construct as the original items. Therefore, replacing the old items appears to be reasonable.

Moreover, included the Berlin Numeracy Test was included (BNT, Cokely et al., 2012). The BNT is a four item test, measuring statistical numeracy. It has been found to be especially sensitive to differences in individuals with high numeric ability, including college students, professionals, and computer literate adults (Cokely et al., 2012). Reliability and validity of this test have been tested across several countries (Ghazal, Cokely, & Garcia-Retamero, 2014). It has been suggested, to use the BNT alongside at least one other measure (Cokely et al., 2012). In this context it could be shown that BNT and the items originally proposed by Schwartz, Woloshin, Black, and Welch (1997) yielded good results in an mTurk sample. All items had to be answered in an open response format. Answers which were in line with the correct solution were counted as correct.

To test whether the measures chould be used together to assess numeracy, a confirmatiory factor analysis was conducted. Confirmatory factor analysis suggested that a model with two factors for the measure by Fernandes et al. (2014) and the BNT fit the data better than a model with one factor for all numeracy items [Two factor model: $\chi^2(53) = 106.66$, $p < .001$, CFI $= 0.89$, RMSEA $= 0.071$, SRMR $= 0.065$, $AIC = 1864.23$; one factor model: $\chi^2(54) = 112.81$, $p < .001$, CFI $= 0.88$, RMSEA $= 0.074$, SRMR $= 0.063$, $AIC = 1886.38$]. The model difference was significant following a χ^2-test [$\Delta\chi^2(1) = 6.15$, $p = .013$]. However, in the two factor model both factors were strongly related (the standardized relationship was 0.86). This also reflects in a high correlation of both scores [$r = 0.61$, $t(197) = 10.89$, $p < .001$]. Moreover, a sumscore of both measures provided

a measurement instrument with more variance and less skewness [Fernandes' measure: $SD = 1.83$, $Skewness = -0.73$, measure with BNT: $SD = 2.88$, $Skewness = -0.34$]. Therefore, a sumscore of correctly answered items on the BNT and the measure that had previously been used by Fernandes et al. (2014) was employed to measure numeracy in the present study. This resulted in a numeracy measure with a total of 12 items. Internal consistency of this measure was good [$\alpha = 0.81$].

Personal Saving Orientation (PSO). To be able to compare our measure of financial wisdom to the concept of PSO the measure that had been developed by Dholakia et al. (2016) was included. The measure consists of nine items which are each associated with one of two factors: Five items belong to the factor *Day-to-day action* ("Putting money into personal savings is a habit for me.") and the remaining four items belong *Saving lifestyle* ("Saving money is like a lifestyle, you have to keep at it."). The nine items were all answered on the same seven-point scale (ranging from 1: *strongly disagree* to 7: *strongly agree*). The measure has been shown by the authors to have good psychometric properties. Also including construct and predictive validity. Cronbachs α suggested good internal consistency for the full scale ($\alpha = 0.81$). It could only be slightly improved to $\alpha = 0.83$ by excluding the item "I usually save money without having a specific goal in mind". It was nevertheless retained, for resons of completeness. The *day-to-day action* subscale showed acceptable internal consistency ($\alpha = 0.79$), whereas the *saving lifestyle* subscale showed a rather poor internal consistency ($\alpha = 0.51$). As these subscales were not interpreted in the present study the full scale was used to measure PSO. Both subscales were highly correlated ($r = .62$, $t(197) = 11.06$, $p < .001$).

Delay of Gratification Inventory (DGI-10). To assess the concept of delay of gratification the ten-item version of the Delay of Gratification Inventory (DGI-10) was used (Hoerger et al., 2011). This scale assesses ability to delay gratification in the five dimensions of food ("I have always tried to eat healthy because it pays off in the long run"), physical ("I have given up physical pleasure or comfort to reach my goals"), social ("I try to consider how my actions will affect other people in the long-term"), money ("I try to spend my money wisely"), and achievement ("I have always felt like my hard work would pay off in the end").

Due to time constraints the ten item version of the scale was used instead of the longer 35

item version. The short version had shown acceptable psychometric properties as well (Hoerger et al., 2011). The ten statements included in the scale were all rated on the same 5-point Likert scale (ranging from 1: *strongly disagree* to 7: *strongly agree*). Internal consistency of the scale was acceptable ($\alpha = 0.79$).

Big Five Inventory (BFI-10). To assess the Big-Five personality traits (extraversion, agreeableness, neuroticism, conscientiousness, and openness to experience) a ten-item short version of the Big Five inventory (BFI-10, Rammstedt & John, 2007) was used. The short measure was chosen to decrease the time participants would have to spend with the survey. The BFI-10 has somewhat better psychometric properties than another short measure of the Big Five, the TIPI (Gosling, Rentfrow, & Swann, 2003), which also consists of ten items (Rammstedt & John, 2007). Especially, the five factors have been found to be more clearly seperable in the BFI-10.

The BFI-10 consists of two items for each dimension. The items comprised eleven statements of the form "I see myself as someone who . . . ", e.g., "... does a thorough job." (conscientiousness), "... gets nervous easily" (neuoticism), "... has an active imagination" (openness to experience), "... is outgoing, sociable." (extraversion), "... is generally trusting" (agreeableness). For agreeableness it has been suggested to include a third item to obtain a better validity of the agreeableness scale ("... is considerate and kind to almost everyone."; Rammstedt & John, 2007). As agreeableness was at least of marginal interest to our research question, it was decided to include the additional item. Internal consistency for all traits was low to acceptable ($\alpha_{Conscientiousness} = 0.65$, $\alpha_{Neuroticism} = 0.79$, $\alpha_{Openness} = 0.51$, $\alpha_{Extraversion} = 0.75$, $\alpha_{Agreeableness} = 0.72$).

Measures of financial situation. The measures for the financial situation were chosen according to the measures used in the pilot studies by Neth and Galesic (2012). These items were all adapted versions of items that had been used in larger household surveys like the Household Retirement Survey (HRS, National Institute on Aging, 2004 used, e.g., in Lusardi, Mitchell, & Curto, 2010), the National Longitudinal Survey of Youth (NLSY, Bureau of Labor Statistics, 2006, used e.g., in Lusardi & Mitchell, 2007), and the National Financial Capability Survey (FINRA Investor Education Foundation, 2009, used, e.g., by Xiao et al., 2014). Items were changed so they would take less time to respond. Response categories were collapsed into more general categories where

appropriate. Moreover, filters were removed and participants were onyl asked about themselves and not about other members of the household to reduce the duration for the participants. Additionally, the NLSY survey had been conducted via telephone. Therefore, questions from the NLSY were additionally adapted for online assessment.

Income, expenses, and savings expected for the next month. Questions for income, expenses, and savings were collapsed versions of the questions used household surveys. There, participants were typically asked for single categories like wages, tips, commisions, and income from a business. One goal was also to predict differences between expected and actual values in the second survey (the second part is not reported within the scope of this thesis). Therefore, in the present survey, participants were asked for their expected income and expenses , as well as how much they expected to have left over for saving or how much debt they expeced to accumulate. To shorten questionnaire duration, categories for income and expenses were collapsed into regular (e.g., salary and rent) and variable sources (e.g., gifts and unexpected purchases).

Savings and investments. Moreover participants were asked in which ways they had been saving in the year of 2017 (e.g., at home, in a retirement fund, stocks, or bonds. Then they were asked, how much savings they currently possesed in US-$. This question has been used, for example, in the National Institute on Aging (2004).

Loans. To assess participants' level of debt they were asked what was the total amount of debt they had accumulated in loans until the end of the month prior to the survey. This was also adapted from the NLSY questions (Bureau of Labor Statistics, 2006).

Wealth and assets. Participants' household wealth was also included as a potential control variable. Therefore, they were asked for different categories of wealth including houseownership, owning real estate, a business or farm, a vehicle, and other savings or assets. The categories were adapted from the NLSY (Bureau of Labor Statistics, 2006) and HRS (National Institute on Aging, 2004). These values were summarized to for an indicator of household wealth for each participant.

Financial products. Participants were also asked whether they held certain financial products like savings certificates, treasury bills, stocks, bonds or a mortgage. Categories were adapted from the FINRA study.

Perception of financial situation. To asses how participants perceived their financial situation in comparison to their previous situation and in comparison to others, they were asked for the for their self-reported relative deprivation and social comparison (Hsieh, 2003), as well as, whether they experienced a large drop in income (Xiao et al., 2014). To measure relative deprivation participants were asked, whether their financial situation had been getting better, worse or whether it had stayed the same. Moreover, they were asked, whether they had experienced a large drop in income within the last twelve monts. Finally they were asked "Compared with other US-American families in general, would you say your family income is far below average, below average, average, above average, or far above average". They had to respond on a five-point scale (ranging from 1: *far below average* to 5: *far above average*).

Financial satisfaction. For the sake of brevity, financial satisfaction was measured using a one-item measure. It has been stated that one-item measures lead to similar results compared to multi-item measures of financial satisfaction (Joo & Grable, 2004). One-item measures of financial satisfaction moreover have frequently been used in prior research (Joo & Grable, 2004), especially including research based on data from household surveys (Xiao et al., 2014; Woodyard & Robb, 2016). Following Joo and Grable (2004) and Prawitz et al. (2006), participants were asked "How satisfied are you are with your present financial situation?" on a ten-point scale (ranging from 1: *completely dissatisfied* to 10: *completely satisfied*).

Demographic Variables. For an overview over categorical demographic variables measured see Table 1. Helath was assessed with the question "Would you say your own health, in general, is excellent, good, fair, or poor?" (J. Davis & Smith, 1996, cf. Hsieh, 2003). For financial education participants were asked, whether they had received financial education in high school, college, or in the workplace, or not at all.

Attention Check Questions. It has been suggested to combine different means of assessing insufficient effort responding in online studies (DeSimone, Harms, & DeSimone, 2015). As a part of these means a set of questions that were aimed at helping to identify participants who responded with insufficient effort and attention was included.

In the beginning of the survey an instructional attention check in the style of Oppenheimer,

Meyvis, and Davidenko (2009) was presented. In a lengthy instruction text participants were informed that we are interested in their leisure activities and them paying attention to task instructions. As a sign of reading instructions carefully, they were instructed to not select a leisure activity below. Those who did anyway were prompted to check their entries. This practice has previously been shown to convert participants that respond with insufficient effort into participants that pay sufficient effort. The text from Oppenheimer and colleagues was adapted to the current survey in some places and changed the activities to general leisure activities instead of sports (the text can be requested from the author). Moreover, in the original version participants were required to click on a heading instead of selecting an option or clicking on a continue button. To make the check applicable to the questionnaire software used without additional programming, participants were simply instructed to not select any of the presented alternatives.

Throughout the survey questions that should help to check whether participants were being attentive were included. The questions included five bogus items with clearly idetifiable responses as has been suggested by Meade and Craig (2012). These items were interspersed with the items of the scales used. Two items were directly taken from Meade and Craig (2012, “I am paid biweekly by leprechauns”, “I have never brushed my teeth”). Another two items were adapted from Meade and Craig with their content slightly altered to fit the context of the scales (“I am currently doing an online survey”, “I see myself as someone who has never used a computer before”). A final question was included with the nature of the sample in mind, as all articipants are in fact required to have an Amazon mTurk account (“I have an Amazon mTurk account.”).

Moreover, three instructional manipulation checks were included (Oppenheimer et al., 2009). They were interspersed among the financial literacy, numeracy, and financial situation questions. The first two resembled questions from their respective questionnaires in content and format (Financial literacy: “Attention check: Please do not select any of the alternatives below. (i) He or she owns a part of firm B. (ii) He or she has lent money to firm B. (iii) He or she is liable for firm B’s debts. (iv) None of the above (v) Do not know”; Numeracy: “Imagine that you have US-$ 300 and want to distribute evenly between 3 people. How much money does every person receive? This is an attention check. Please enter “120” below to show that you are paying attention.”). The third ques-

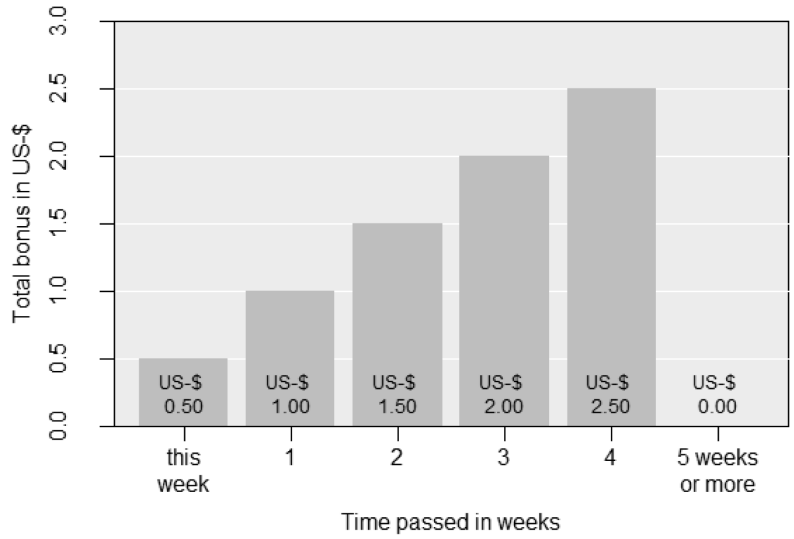

Figure 1. Payment schedule as shown to the participants in the instructions on the investment task.

tion was placed on a transition page and instructed participants to write "I am paying attention" in a textfield at the bottom of the page. Finally, three self-report questions, about whether data should be used were included in after the demographics (Meade & Craig, 2012, On a five point scale from 1: no attention/effort to 5: full attention/effort: "How much effort did you put into responding to the questions in this survey?", "How much attention did you give to the questions in this survey?", "Can we trust your data for scientific research? For example, if you did not attend to or follow all instructions or were intoxicated (etc.), please answer "No""). These questions have been shown to adequately reflect data quality.

Investment task. To be able to make predictions about actual behavior an investment task was included. At the end of the survey participants were informed that they would receive a bonus payment of US-$0.50 in addition to any other bonus payments. They were given the opportunity to "invest" this bonus payment in such a way that they would receive another US-$0.50 for each week they waited after completing the study (i.e., US-$1.00 after one week, US-$1.50 after two weeks). They could invest their payment up to a total of four weeks (resulting in a maximum payment of US-$2.50). They did not receive any bonus payment if they waited for longer than four weeks. They

were presented with Figure 1 of the payoffs to ensure understanding it (for the complete instructions see Figure A1 on page 101 and Figure A2 on page 102 in Appendix A).

An important issue is to ensure trustworthiness of payment (Andersen, Harrison, Lau, & Rutström, 2014). To make sure that participants trusted in that they were actually paid when they claimed their investment, the procedure was made as simple as possible. Moreover, an email adress of the principal investigator was provided for questions and concerns regarding the investment task. To claim their payment they received a link to another survey implemented using the questionnaire software Unipark (`http://www.unipark.com`). The use of this second survey allowed us to conveniently collect their response and check their Amazon worker ID by which we can ensure that the person had actually participated in the corresponding part of the study. In the second survey, participants were again informed about the payment and investment modalities. They could then press a button to communicate their decision to claim their investment or opt to return later. This was done to avoid misunderstandings of the instruction, and to avoid effects of forgetting the payment schedule.

The payment schedule was determined by considerations from the delay discounting literature. First, Coller and Williams (1999) note that study participants may consider alternative options how to invest their money, and therefore not save in the laboratory, as one prefers to invest the money in a better fund. This should not be prevalent in the present task, however, as magnitudes are overall small and alternatives to invest and increase such small amounts are likely scarce. Moreover, individuals have been shown to discount increasing payments over time (e.g., Coller & Williams, 1999). That means that the same payment at a later timepoint is valued less. In this context a magnitude effect has frequently been noted (Johnson & Bickel, 2002). This means that smaller magnitudes are discounted more strongly. In our task, for the above reasons, high interest rates for the investment were chosen, in order to avoid that all individuals would claim their invested bonus payment right away. For this reason and to ensure understandability of the task, non-constant discounting was ignored and a linearly increasing payment schedule was employed.

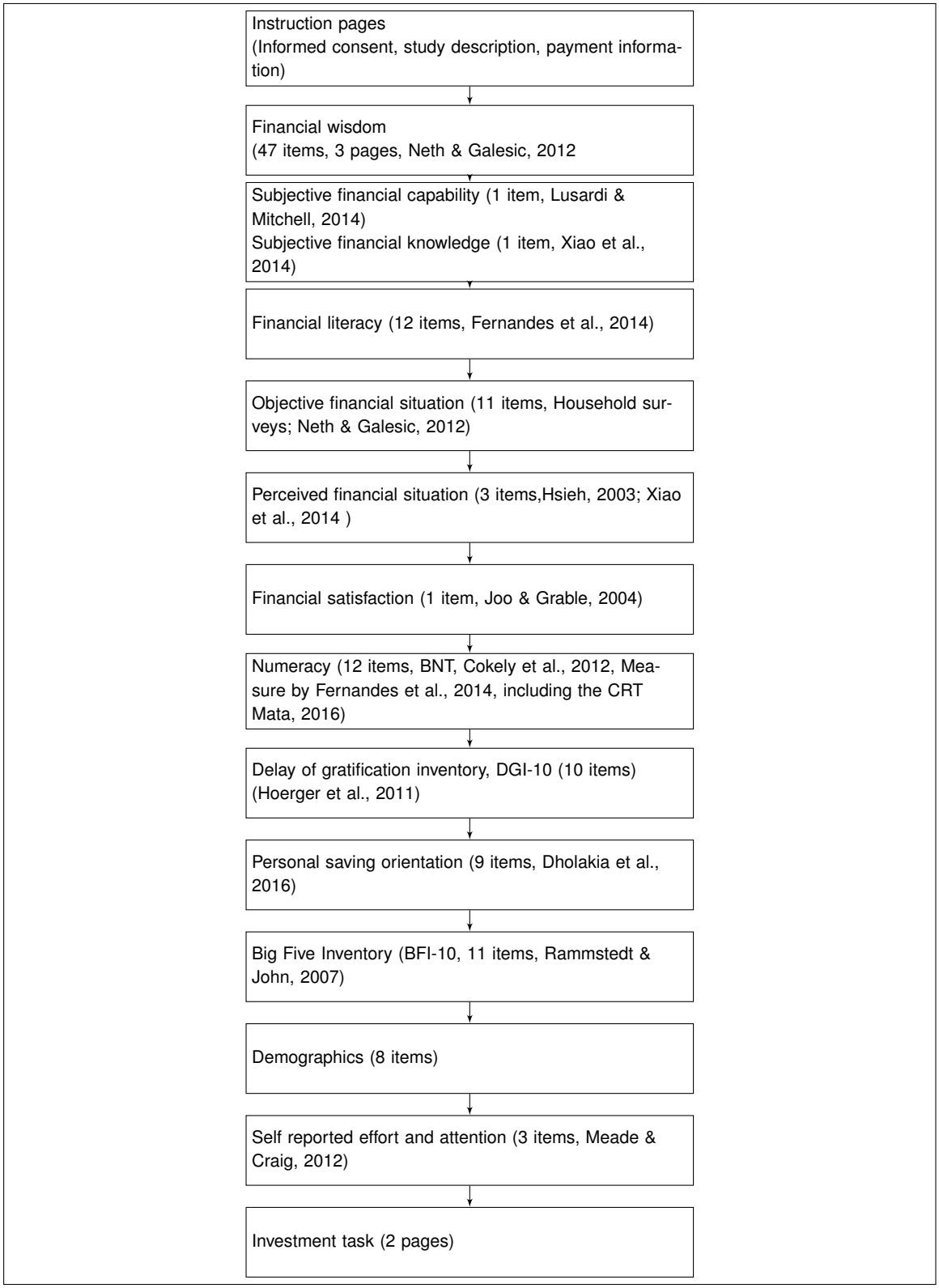

Figure 2. Questionnaires in order of their appearance presented to the participants. The number of items and subscales are given in parentheses. Sources are credited.

Procedure

The survey was implemented using the questionnaire software Unipark (`http://www.unipark.com`). Participants were first informed about the goals of the study and asked to take part only if they were willing to disclose information about their financial situation. They were reminded that participation is voluntary and their responses were handled confidentially. Then they provided informed consent. Afterwards they were given a brief overview over the kinds of questions included in the survey. Following, they were informed about their payment.

The order of questionnaires is given in Figure 2 on page 40. The first questionnaire that was presented was the financial wisdom questionnaire. The 47 questions were distributed into three blocks in order of their item number. The order of the three blocks was the same for each participant. Items were randomized within blocks. On the second and third block each a bogus question was included to assess attentive responding. After that, subjective financial capability and subjective financial knowledge were assessed. This was done before the objective assessment of financial literacy, to avoid potential carryover effects, inasmuch that participants might respond consistently to their financial literacy score.

Then, 16 financial literacy questions were presented (additional questions had been included to allow for comparison to other studies, this has not been done in the scope of this thesis). Participants were informed that they would receive a bonus if they passed the test. What "passing" meant was not further specified to the participants to avoid that participants would correctly respond to the required number and then stop being attentive. On the eight position an instructional manipulation check was included, in which participants were instructed to not select any alternative. After the financial literacy questions, they were asked whether they had used any tools to answer the questions. Then they were informed about their score and whether they received the bonus of US-$ 0.50. The bonus was granted, if a participant had responded correctly to four questions or more.

Next, participants were asked about their financial situation. It has been shown that participants' responses become more careless to the end of the survey (Meade & Craig, 2012). Therefore, this important part was included when participants were still assumed to be attentive, but not in the beginning, as some participants might find these questions intrusive. In the instructions to this

block participants were reminded that their answers are handled confidentially. First, participants were asked, how many adults and children lived in their household to ensure that it is clear what their household is. Second, they were asked for their expected income, their expected expenses, and their expected savings or debt for the month of August. They were reminded, that their expected income minus their expected expenses should equal their expected savings or debt. Third, they were asked about ways they had accumulated savings and the total amount of their total savings. Fourth, they were asked for loans they had taken, and the total debt these result in. Fifth, they were asked whether they had property and assets (housing, business, transportation), as well as the total value of these assets. Sixth, they were asked whether they ever held or currently hold a set of financial products that has been taken from Xiao et al. (2014).

Following the more objective measures of the financial situation, participants were questioned about their subjective evaluation. On a transition page an instructional manipulation check was included. Then they were asked, whether their financial situation has changed, whether they had experienced a large drop in income in the last few years, and whether they perceive their income below or above US-American average. Finally, they answered the question about their financial satisfaction.

After that, participants answered the 12 numeracy questions. After the the CRT and BNT questions they were asked, whether they had seen on e or more of these questions before. As for financial literacy. they were informed that they would receive a bonus for passing the test. Afterwards, they were asked whether they had used any tools to answer the questions. Then they were informed about their score and whether they received the bonus of US-$ 0.50. The bonus was granted, if a participant had responded correctly to more than three questions.

Then, participants were prepared to respond to questions about themselves. These firstly included theDGI-10, followed by the PSO Scale, and the BFI-10. Next, the participants responded to the set of demographics. There, an attention check question was included. Then they indicated their self-reported attention and effort.

Finally, participants were presented with the investment task. After the investment task participants were provided with the opportunity to leave comments and feeback on the survey. Then

they received a random code that they needed to paste back at the mTurk site to verify their participation (Paolacci, Chandler, & Ipeirotis, 2010). On this last page they were also prepared that there might be a second part to this survey and we would contact them in a few weeks. Participants took on average 29 minutes on the whole assignment (duration ranging from 11 minutes to 100 minutes).

Data Analyses

All data were analyzed using the statistical software R (R Core Team, 2016). For data cleaning the functions `psySyn()` and `psyAnt()` from the `careless`-package were used (`https://github.com/mattsigal/careless/blob/master/R/`). To develop the measure of financial wisdom, exploratory factor analyses, were employed, using the function `fa()` with maximum likelihood estimation in the `psych` package (Revelle, 2016). The number of factors was determined using the MAP criterion, determined with the function `nFactors()`, (`psych`) parallel analysis with the function `parallel()` `nFactors`-package (Raiche, 2010), as well as scree plots.

Confirmatory factor analyses were performed using the package `lavaan` (Rosseel, 2012). Cronbach's alphas and correlations were calculated using the `alpha()` function in the `psych` package. To determine construct validity, correlational analyses were performed. *p*-values were adjusted for multiple testing using a Holm correction (Holm, 1979, the standard in the `corr.test()`-function in the `psych`-package). To determine incremental effects of financial wisdom regression and logistic regression analyses were performed. All significance tests were performed on a two-sided α-level of 0.05. Effect sizes for R^2, t-tests and correlations are judged according to Cohen (Cohen, 1988, cf. Leonhart & Lichtenberg, 2009).

Results

Data cleaning

Data quality is an important issue, especially in online studies. It has therefore been recommended to include quality indicators for data screening that capture careless responding (e.g. Meade & Craig, 2012; DeSimone et al., 2015). These indicators may encompass attention check items and indicators of response behavior, as well a response times. It has been recommended to combine

indicators of attention, response time, and consistency (DeSimone et al., 2015). In the present study, attention has been mesured the attention check and bogus questions. The amount spent on the assignment and its pages was assessed through the questionnaire software.

As consistency indicators, psychometric synonyms and antonyms were calculated, as suggested by Meade and Craig (2012). In this item pairs with positive (respectively negative) correlations with $r \geq .60$ in the sample are identified. Then, the correlations on these item pairs are calculated for each participant. This way eight pairs of synonyms (e.g., the PSO-item "Putting money into personal savings is a habit to me" and the financial wisdom item "I increase my savings when I receive a salary increase"), and 2,918 pairs of antonyms were identified. This latter number is unusually high, as the function used does not only pick the most highly correlated items. Still, it should be a valid measure of response consistency.

To follow the suggestion to combine indices, participants were screened for self reported data quality, effort and attention, response times, performance on the attention check questions, as well as general response consistency. Exclusion criteria involved: (a) self reporting that the data should not be used or little effort was put into the survey, as indicated on the self-report questions, (b) a total duration of less than ten minutes (which is only a third of the expected duration of 30 minutes with which the study was advertised), (c) composite criteria of time and attention or response consistency. This means, that participants were excluded if they fulfilled both, a time criterion and a response criterion. The two time criteria were that participants took less than 15 minutes on the overall assignment (which is half of the assumed time for the assignment) or less than two seconds per question on at least two questionnaires (DeSimone et al., 2015). The three response criteria included failing on two or more attention check questions, having a positive indicator on the psychometric antonyms which should be overall negatively correlated, or having not varied their responses on the psychometric synonyms at all. The latter indicates that participants did rarely vary their response option and is thus an indicatior of excess consistency. This resulted in the exclusion of a total of 23 out of 199 participants (11.6%).

The resulting sample consisted of 175 participants (82 female, 91 male, 2 "other"). Participants excluded did not differ significantly from included participants in their distribution of most

demographic variables (see Table 1 on page 1 on page 27). There was a marginally significant difference for size of the community participants lived in ($\chi^2(4) = 9.49$, $p = .050$). Excluded participants were exclusively from cities (54%), small towns (25%), or towns (21%). Moreover, there was a significant difference in being responsible for household finance ($\chi^2(2) = 9.17$, $p = .010$) with more participants being responsible for finances themselves among excluded participants (83%) than among retained participans (52%). This may be the case as the respnse option that oneself alone is responsible for financial decision making was always presented first and therefore may have been chosen more readily selected among careless responders. T-tests on log-transformed expected income, expenses, savings, as well as total savings and loans suggested that the excluded participants did not significantly differ from their retained counterparts (the analyses can be obtained from the author).

It has been suggested to report results for the sample filtered for careless responses as well as for the unfiltered sample (DeSimone et al., 2015). Thus the following results report results for data from the full sample, as well as any deviations within the filtered sample.

Scale development

First, the factor structure of the ten-item financial wisdom scale (FW10) by Neth and Galesic (2014) was tested. Then, the factor structure of the full item set with 47 items was investigated using exploratory factor analysis. Finally, to allow for a more frugal assessment, a short scale from the most highly loading items was developed.

The ten item scale. First, the items from the FW10 were subjected to confirmatory factor analysis in order to test the factor structure that has been found by Neth and Galesic (2014). They based on partial correlations with criterion variables they identified ten items. Following exploratory factor analyses the items showed loadings on the three factors financial planning, risk-taking, and a broader perspective. An analysis of this three-factor structure provided a rather poor fit for both unfiltered data ($\chi^2(33) = 89.62$, $p < .001$, CFI = 0.75, RMSEA = 0.093), and filtered data ($\chi^2(33) = 79.02$, $p < .001$, CFI = 0.76, RMSEA = 0.089). Moreover, items on the risk-taking factor did not load significantly on their factor. Finally, the risk-taking factor did not significantly covary with the

other two factors. These results and the restricted content of the scale called for exploring new ways of measuring financial wisdom.

Exploratory factor analysis on the current data. To get more information on the underlying factor structure of financial wisdom the 47 items were subjected to exploratory factor analysis. The procedure follows suggestions for exploartory factor anaylsis given in Bühner (2006). Both the Bartlett-test for sphericity [$\chi^2(1081) = 4410.87$, $p < .001$], as well as the Kaiser-Meyer-Olkin Measure of sampling adequacy (MSA = 0.84), suggested that the correlation matrix of the items is suited for factor analysis. The significant Bartlett-test showed that the correlation matrix is different from the unit matrix. A MSA larger 0.60 for most items showed the suitability of the single items for factor analysis. This also held for filtered data [Bartlett: $\chi^2(1081) = 3752.87$, $p < .001$; MSA = 0.79].

For full data the MAP criterion, as well as parallel analysis and visual inspection of the Scree-plot suggest to extract five factors from the data. For filtered data the MAP-criterion and parallel analysis suggest to extract six factors, whereas the Scree-plot can also be interpreted as suggesting five factors. For sake of parsimony in factor structure, and due to small differences in the MAP-criterion for five or six factors (both values rounded to 0.12), it was decided to extract five factors from the data.

In the unrotated factor matrix 36 items load on the first factor (37 for filtered data; unrotated matrix can be obtained from the author). This suggests that the items assess a common underlying construct (Bühner, 2006). It was assumed that factors would be correlated, as the domains of financial wisdom are likely related through handling money successfully. Therefore, the oblique promax rotation was applied, allowing for correlations between factors. Factor analysis was performed using maximum likelihood estimation. This estimation method was used, on the one hand, as maximum likelihood estimates population parameters allowing for greater generalizability of the result, on the other hand to allow for testing the factor structure using confirmatory factor analysis in future samples. To check whether the maximum-likelihood method might be appropriate the suggestion by West, Finch, and Curran (1995) cited by Bühner (2006) was followed. No items exceeded a skewness of 2 or a kurtosis of 7, from which maximum likelihood analysis would have

Table 3
Financial wisdom items and factor loadings after promax rotation in unfiltered data and exclusion of seven items.

Item Number	Item	F1	F2	F3	F4	F5
34	I gather a lot of information on competing products before buying something.[b]	0.83				
35	I usually shop around for a good deal before purchasing a product.	0.82				
18	I like to be in control of my financial affairs.[b]	0.70				
22	I frequently check the balance of my main bank account.	0.69				
43	I reduce my spending to pay off debts.[b]	0.66				
19	I monitor my income and expenses on a regular basis.	0.64				
20	I know how much money I have available to spend every month.	0.62				
21	I have both short-term and long-term financial goals.	0.50				
28	I sometimes take pleasure in not buying something.	0.49				
31	I do not mind waiting for a pleasant outcome.	0.42				
29	I do not mind restraining my spending.	0.40				
2	Always keep some money for a rainy day.	0.38	0.35			
38	I only invest in financial products that I understand.	0.34				
27	I only buy the things I need.	0.33				
4	Early bird catches the worm.[b]		0.74			
5	A penny saved is a penny earned.[b]		0.71			
13	The rich man plans for tomorrow, the poor man for today.		0.66			
3	If you look after the pennies, the dollars will look after themselves.		0.63			
8	Out of debt, out of danger.		0.50			
15	If you lack money, work more rather than borrow.[b]		0.49			
11	Always be modest in spending.		0.48			
1	Never spend more than you earn.		0.43	0.36		
12	Always save a part of any money you receive.		0.42			
9	Don't throw good money after bad.		0.36			
30	I frequently spend more than I earn.[a,b]			0.83		
44	I accumulate credit card debt.[a]			0.77		
39	I increase my savings when I receive a salary increase.[b]			0.61		
45	I always pay off my credit card balance as soon as possible.			0.58		
46	I am impulsive and tend to buy things even when I can't really afford them.[a]			0.53		
14	Money is there to be spent.[a]			0.39		
41	I try to avoid borrowing money.[b]			0.35		
25	When deciding how to save or invest my money, I make the same choices as successful investors I know or have heard about.[b]				0.71	
24	When deciding how to save or invest my money, I follow the advice of independent professional financial advisors.				0.67	
26	When deciding how to save or invest my money, I do what most other people are doing.[a,b]			0.35	−0.65	
23	When deciding how to save or invest my money, I make the same choices as my family members or friends did.				0.51	
36	I combine secure and risky investments (e.g., bonds and stocks).				0.45	
47	I take calculated risks.				0.40	
6	It is better to give than to receive.[b]					0.93
10	Give generously to others and you shall receive in return.[b]					0.66
17	Money can't buy happiness.					0.46
	Variance explained by each factor:	0.13	0.10	0.09	0.06	0.05

Note: Only factor loadings greater than 0.3 are displayed for the sake of readability.
F1: Monitoring and managing money, F2: Susceptibility to folk wisdom, F3: Prudent spending and saving, F4: Social influence and risk-taking, F5: Generosity. [a]: item was reverse coded, [b]: item is included in FW-15 shortscale.

been strongly discouraged.

The pattern matrices for filtered and unfiltered data did hardly differ qualitatively. Quantitatively, some factor loadings changed and two factors changed places in terms of variance explained. For full data the five factors explained 41% of the item variance. The model fit was considered acceptable ($\chi^2 = 1374.68$, $p < .001$, $RMSEA = .063$, diagonal fit $= .96$, $TLI = .75$, 6.4% residuals $> .1$). For filtered data 39% of variance was explained, with an acceptable model fit as well ($\chi^2 = 1363.83$, $p < .001$, $RMSEA = .067$, diagonal fit $= .94$, $TLI = .75$, 9.1% residuals $> .1$). However, for both factors the Tucker Lewis Index of factoring reliability (TLI) suggested that the structure might not be highly reliable. However, additional factors resulted in a less meaningful factor structure in both sets.

The pattern matrices for this first step of analysis can be found in Table B1 on page 103 and Table B2 on page 104 in Appendix B. All factors except the fourth factor were moderately to highly correlated ($0.32 < r < 0.59$). For filtered data the first three factors were moderately to highly correlated ($0.38 < r < 0.50$). Factors 2 and 3 were reversed within filtered data in terms of variance explained. The five factors were tentatively named *Monitoring and controlling money*, *Prudent spending and saving*, *Susceptibility to folk wisdom*, *Social influences and risk-taking*, and *Generosity* (see, e.g., Table 3).

Following Kline (1994) in Bühner (2006), only factor loadings greater 0.30 were interpreted. Seven items were excluded from the final scale: (1) "One man's loss is another man's gain.", showed low communalities ($h^2 < 0.25$) in both unfiltered and filtered data. Additionally, the relevance to the concept of financial wisdom was not obvious. (2) and (3) "Improve your education to increase your income." and "I tend to forget when I owe someone money.", showed crossloadings of similar magnitude on two essentially uncorrelated factors. Therefore, these items are not clearly interpretable and were excluded. (4) "I aim to leave an inheritance when I die." was excluded due to loadings below 0.30 in the filtered sample and a low relevance for content validity. (5) "I usually adopt a long-term perspective." showed moderate loadings as well as loadings of similar magnitude on uncorrelateed factors. Moreover, beyond the overall instruction the item is not explicitely concerned with money, which compromises content validity. (6) "If you don't speculate, you won't

accumulate." did not significantly load on any factor, communalities were below $h^2 < 0.07$, and the MSA for the item was below 0.60 in both unfiltered and filtered data. Finally, (7) "I am concerned about my long-term financial future." was excluded due to communalities of $h^2 < 0.15$ in both sets and an MSA below 0.60 in both unfiltered and filtered data. Moreover, the item may have been understood as being worried instead of being considerate about ones financial future, which would make it rather an item mesuring financial stress. Notably, the reverse coded item "When deciding how to save or invest my money, I do what most other people are doing." loaded negatively on the social influences and risk-taking factor, but positively on the control spending factor. The item was retained, as it was still interpretable as an aspect of social influence due to its high loading on the social influences factor.

After exclusion of the items described above, the factor extraction criteria also suggested a five or six factor solutions. For filtered data the MAP criterion suggested a five factor solution, whereas the scree test and parallel analysis suggested six factor solutions. It was adhered to the five factor solution. The unfiltered version of the pattern matrix and variance explained by each factor is presented in Table 3 (for filtered data see Table B3 in Appendix B). Variance explained was 43% for unfiltered and 41% for filtered data. The model fit according to fit indices was acceptable for unfiltered data, even if the χ^2-test was significant ($\chi^2 = 997.48$, $p < .001$, $RMSEA = .066$, diagonal fit $= .97$, $TLI = .81$, 6.4% residuals $> .1$). This also held for filtered data ($\chi^2 = 984.56$, $p < .001$, $RMSEA = .070$, diagonal fit $= .95$, $TLI = .77$, 7.8% residuals $> .1$). Overall, RMSEA, variance explained, fit based on diagonal values and percentage of substantial residuals account for an acceptable fit of the factor structure (Bühner, 2006). As previously, extraction of additional factors did not result in an interpretable factor structure. Assuming additional factors led, factors with only two items loading 0.30 or higher emerged (results can be obtained from the author).

Next, internal consistency of the subscales was checked using Cronbach's alpha. All scales except for the generosity scale showed satisfying to good internal consistency ($\alpha_{Monitoring} = .86$, $\alpha_{Folkwisdom} = .85$, $\alpha_{Spending} = .81$, $\alpha_{SocialandRisk} = .72$, $\alpha_{Generosity} = .69$). For the generosity scale internal consistency could be improved to $\alpha = 0.75$ by excluding the item "Money can't buy happiness.". Therefore, this item was excluded in all further analyses. Indices for the five factors were

formed by taking the mean value of each of the five factors.

To obtain a full financial wisdom scale, the subscale means were averaged into one mean. This was done, as there was no assumption about one dimension being more important than another. Therefore, this procedure was chosen which would result in equally weighted dimensions. Cronbach's alpha suggested good internal consistency for the full scale ($\alpha = .90$). It was even slightly higher than consistencies within the single dimensions. Means and standard deviations for the scales can be found in Table 4 on page 51. The average values of the subscales on the full 39-item financial wisdom measure ranged from 3.15 to 6.38 for potential values from 1 to 7. The average values for the *social influences and risk-taking* dimension were on average lower than the monitoring and control, susceptibility to folk wisdom and spending dimensions.

A short assessment of financial wisdom. To allow for a more frugal assessment a 15-item shortscale for financial wisdom (FW-15) was devised from the items. From each dimension three items (for generosity only the remaining two) were selected according to their factor loadings, as well as their relevance to the concept. All but three items had loadings greater 0.50. The three items "If you lack money, work more rather than borrow.", "I try to avoid borrowing money." and "I combine secure and risky investments (e.g., bonds and stocks).", were selected to retain as many aspects of each dimension as possible. The 15 selected items are marked in Table 3. Internal consistency for the short measure was acceptable ($\alpha = .74$). From these items an index was formed taking the average of the five subscales for each participant. The average values of the subscales forming the FW-15 ranged from 3.40 to 6.53.

Descriptive statistics of the other measures used

Means and standard deviations of independent measures used are given in Table 5. The 13-item financial literacy measure had an average score of 9.86 questions correct, which is close to the maximum of 13. This indicates overall good performance in the present sample. Numeracy scores were also rather high ($M = 7.75$ out of questions correct).

One concern was that numeracy estimates might be influenced by familiarity to the questions posed. A total of 76 participants (38.4%) indicated that they already had seen some of

Table 4
Means, standard deviations, medians, and range for continous variables reported in the analyses for unfiltered data.

Variable	*Mean*	*SD*	*Median*	*Min*	*Max*
FW-39	4.97	0.64	5.0	3.15	6.38
Control	5.63	0.80	5.7	3.00	7.00
Folk wisdom	5.62	0.81	5.7	2.50	7.00
Spending	5.18	1.09	5.3	2.00	7.00
Social and risk	3.79	1.04	3.8	1.00	6.17
Generosity	4.65	1.38	4.5	1.00	7.00
FW-15	5.67	0.79	5.8	3.67	7.00
Financial literacy	9.86	2.29	10.0	1.00	13.00
Subjective knowledge	5.01	1.15	5.0	1.00	7.00
Subjective capability	6.03	1.03	6.0	2.00	7.00
Numeracy	7.71	2.83	8.0	1.00	12.00
PSO	5.13	0.95	5.2	2.56	7.00
Extraversion	3.30	0.59	3.0	2.00	5.00
Agreeableness	3.76	0.91	4.0	1.33	5.00
Conscientiousness	4.12	0.87	4.5	1.50	5.00
Neuroticism	2.51	1.21	2.0	1.00	5.00
Openness	3.90	0.96	4.0	1.00	5.00
DGI-10	3.78	0.59	3.8	2.10	5.00
Financial satisfaction	4.63	2.34	4.0	1.00	10.00
Expected income (in US-$ 1,000)	3.29	2.62	2.50	0.10	16.00
Expected expenses (in US-$ 1,000)	2.23	17.79	17.00	0.70	9.500
Expected savings or debt (in US-$ 1,000)	1.01	13.22	0.60	−0.60	10.00
Proportion expected to save from income	0.30	0.40	0.2	−0.55	5.00
Total savings (in US-$ 1,000)	23.90	71.84	2.50	0.00	650.00
Total wealth (in US-$ 1,000)	115.71	183.67	21.00	184.50	1365.00
Amount of loans (in US-$ 1,000)	27.28	74.79	0.0	0.00	610.00
Age (years)	34.75	10.21	32.0	19.00	71.00
Attention check score	7.81	0.77	8.0	3.00	9.00

Note. $N = 199$

the BNT questions in previous studies, whereas 87 participants (43.9%) indicated that they had seen the CRT questions in previous studies. Two-sample t-tests revealed that (1) the group, who indicated having seen some of the BNT questions before, had a higher score on the BNT ($M_{familiar} = 2.01$, $M_{unfamiliar} = 1.46$, $t(150.49) = 2.90$, $p = .004$, Cohen's $d = 0.43$), (2) the group who indicated having seen some of the CRT questions before, had a higher score on the CRT ($M_{familiar} = 2.02$, $M_{unfamiliar} = 1.68$, $t(189.31) = 2.17$, $p = .031$, Cohen's $d = 0.31$), (3) most importantly, participants who indicated familiarity with the BNT questions had on average a higher numeracy score than participants, who indicated to not have seen one or more of the questions before ($M_{familiar} = 8.58$, $M_{unfamiliar} = 7.21$, $t(157.97) = 3.40$, $p < .001$, Cohen's $d = 0.50$), and (4) this effect was present but considerably smaller and non-significant for familiarity with the CRT ($M_{familiar} = 8.07$, $M_{unfamiliar} = 7.48$, $t(188.54) = 1.48$, $p = .141$, Cohen's $d = 0.21$). The results were similar in significance and magnitude for filtered data. The effect for familiarity to the CRT and the CRT-score failed statistic significance ($M_{familiar} = 2.06$, $M_{unfamiliar} = 1.78$, $t(172.80) = 1.69$, $p = .092$, Cohen's $d = 0.25$). Due to the medium-size effect of familiarity of the BNT on the overall numeracy score, it was decided to control for familiarity of the BNT and its interaction with the numeracy score in subsequent analyses where applicable.

Similar to the FW-39 and FW-15, the mean for the PSO-scale is rather high and standard deviation is rather low. However, the range is somwhat larger, extending from 2.56 to 7.00. The Big-Five show means ranging from 2.51 to 4.12. Except for neuroticism means are greater than the scale center of 3 on the five-point scales. This shows, that the distributions of the Big-Five Dimensions are more or less shifted to the right. This appears to be most evident, for conscientiousness. The mean of self-reported financial satisfaction is below the scale center of 5.5 on the ten-point scale. This may account for rather low financial satisfaction in the sample. Visual inspection of the distribution suggests, that it is slightly bimodald with a peak at the low end (the analysis can be obtained from the author). Correlations of all the variables reported here can be found in Table C1 in Appendix C on page 106.

Table 5
Correlations between independent variables in unfiltered data.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 FW-39	–													
2 Control	**0.73**	–												
3 Folk wisdom	**0.75**	**0.61**	–											
4 Spending	**0.68**	**0.61**	**0.50**	–										
5 Social and risk	**0.43**	0.08	0.11	0.09	–									
6 Generosity	**0.61**	**0.23**	**0.33**	0.07	0.05	–								
7 FW-15	**0.93**	**0.75**	**0.74**	**0.67**	**0.25**	**0.59**	–							
8 Financial literacy	**0.23**	**0.28**	**0.28**	**0.26**	0.08	−0.05	**0.27**	–						
9 Subjective knowledge	**0.42**	**0.38**	**0.24**	**0.35**	0.20	0.18	**0.43**	0.20	–					
10 Subjective capability	**0.35**	**0.52**	**0.28**	**0.46**	−0.06	0.03	**0.42**	**0.27**	**0.42**	–				
11 Numeracy	0.09	0.12	0.05	**0.24**	0.12	−0.18	0.07	**0.61**	0.01	0.16	–			
12 PSO	**0.74**	**0.75**	**0.60**	**0.67**	**0.27**	0.20	**0.72**	**0.23**	**0.39**	**0.46**	0.15	–		
13 Conscientiousness	**0.49**	**0.42**	**0.41**	**0.33**	0.15	**0.29**	**0.50**	0.08	**0.38**	**0.36**	−0.04	**0.41**	–	
14 DGI-10	**0.62**	**0.66**	**0.48**	**0.53**	0.05	**0.32**	**0.63**	0.22	**0.48**	**0.48**	0.04	**0.62**	**0.59**	–

Note: Values that appear in boldface are at least significant at the $p < .050$ level of significance. Significance has been adjusted for multiple testing using a Holm correction (Holm, 1979). FW-39: 39 item financial wisdom scale
FW-15: 15 item financial wisdom shortscale PSO: Personal savings orientation (Dholakia et al., 2016)
DGI-10: 10 item shortscale of the delay of gratification inventory (Hoerger et al., 2011)

Construct validity

Relationships between financial wisdom and other constructs were examined using correlation analyses (see Table 5). All significance values were adjusted for multiple testing using a Holm-correction. In line with expectations, the *39-item financial wisdom measure (FW-39)* was positively and significantly related to financial literacy. For filtered data the relationship to financial literacy was smaller and did not reach significance contrary to expectations ($p_{adj} = 1.00$). This suggests, that participants who scored higher on financial wisdom also responded correctly to more questions on the financial literacy test. However, the relationship remained positive. Moreover, the FW-39 showed the expected positive relationships to subjective financial knowledge, subjective capability, PSO, the conscientiousness scale of the BFI-10, and the DGI-10 (see Table 5). Notably, relationships of the FW-39 to both PSO ($r = .74$) and DGI-10 ($r = 62$) are in the same magnitude as relations among the first three dimensions of financial wisdom ($.68 \leq r \leq .75$). This means, that these constructs are very closely related and likely show high similiarity. Also in line with expectations, the FW-39 was only weakly and non-significantly related to a measure of numeracy in both unfiltered and filtered data.

Interestingly, the relationships of the dimensions of financial wisdom to both the other dimensions of financial wisdom, as well as the presumably related constructs differed. The dimensions of *monitoring and controlling money*, *prudent spendig and saving*, and *susceptibility to folk wisdom* are highly correlated among each other. Except for their relations to generosity and numeracy their relations are rather similar in magnitude. First, spending and borrowing is not significantly related to the generosity dimension. Second, spending and borrowing is the only dimension, which is significantly positively related to the numeracy score. This suggests that those who scored high on spending items, also responded correctly to a greater number of numeracy items.

More notably, the *social influences and risk-taking* dimension is not significantly correlated to any of the other dimensions of financial wisdom (see Table 5). It is also only unsystematically related to other constructs measured. Only a positive relationship to PSO becomes statistically significant. Relationships to subjective financial capability and the DGI-10 even fail to pass the threshold for small effects. Together this indicates that participants who report more agreement to advice and risk-taking are neither reporting higher subjective financial capability, nor a higher ability to delay gratification. This may suggest that the social influences and risk-taking dimension is a unique aspect of financial wisdom or that this dimension measures something different.

The *generosity* dimension exhibits a positive relationship to the monitoring and control dimension, as well as to the folk wisdom dimension. The former relationship to the monitoring and control dimension is, however, non-significant in filtered data ($p_{adj} = 0.94$). Relationships to conscientiousness and the DGI-10 are significantly positive. This suggests that people reporting higher generosity also report to be more structured and thorough, as well as a higher ability to delay gratification. A relationship to PSO fails to reach statistical significance. This suggests that a chronic tendency to save is only spuriously related to being generous. Interestingly, the relationship of generosity to the numeracy score is negative. However, this relationship does not become statistically significant.

For the FW-15, relationships were qualitatively the same as for the FW-39. Both scales were very highly correlated. In summary, some evidence for all hypotheses on construct validity has been found for both, the FW-39 and the FW-15. Problematically, financial wisdom was strongly related

to PSO and the DGI-10 which may suggest that it cannot readily be distiguished from those two concepts. The dimensions of monitoring and control, prudent spending and saving, and folk wisdom exhibit relationships similar to the full scale. Interestingly, the dimensions of social influences and risk and the dimension of generosity show relationships that deviate from the other dimensions. This may mean, that these two dimensions capture inherently different aspects than the other dimensions. As they are considered important parts of financial wisdom they are retained for the analyses in the present study.

Criterion validity

To investigate criterion validity relationships to external criteria were considered. First, it was assumed that financial wisdom would be positively related to financial satisfaction. Second, ist was assumed that financial wisdom would be positively related to the percentage of money saved from income. And finally, financial wisdom was assumed to be related to waiting on the investment task to receive more money.

Relative measures related to saving and spending. To test the hypothesis that financial wisdom is positively related to saving behavior beyond other variables, a stepwise multiple regression analysis on the percentage of money saved from income was conducted. This is similar to the procedure in Neth and Galesic (2012), who did a similar stepwise analysis for the change in savings and financial satisfaction. One participant was excluded for reporting to expect saving 500% of her income. In a first step control variables and personality traits, subjective capacities and numeracy were entered as predictors (see Table 6, Model 1). In the end the numeracy score and its interaction with familiarity of the BNT were entered as well.

Model 1 explained a total of 34% of variance in the percentage of money expected to be saved from income the next month [$R^2 = .340$, $F(17, 180) = 5.47$, $p < .001$]. Age was significantly negatively related to saving, with a one year increase in age being related to a one percent decrease in the proportion expected to save, everything else equal. This may be related to the large age range in the sample, also including older adults who live on pensions and do not save much. Expected income was significantly positively related to the expected percentage of savings with a one log

Table 6
Regression models on proportion of money saved from income for unfiltered data.

Variable	Model 1		Model 2		Model 3		Model 4	
	B	95% CI	B	95% CI	B	95% CI	B	95% CI
Constant	0.22	[−0.07, 0.51]	0.28	[−0.02, 0.59]	0.29	[−0.02, 0.60]	0.29	[−0.03, 0.61]
Age[a]	−0.01***	[−0.01, 0.00]	−0.01***	[−0.01, 0.00]	−0.01***	[−0.01, 0.00]	−0.01***	[−0.01, 0.00]
Expected income[ln]	0.05**	[0.02, 0.09]	0.05**	[0.02, 0.09]	0.05**	[0.02, 0.09]	0.06**	[0.02, 0.09]
Health	−0.03	[−0.07, 0.02]	−0.03	[−0.07, 0.02]	−0.03	[−0.07, 0.02]	−0.02	[−0.07, 0.02]
Recent drop in income	−0.15***	[−0.23, −0.08]	−0.16***	[−0.23, −0.08]	−0.15***	[−0.23, −0.08]	−0.15***	[−0.22, −0.07]
Dependent children	−0.05	[−0.11, 0.01]	−0.05	[−0.11, 0.01]	−0.05	[−0.11, 0.02]	−0.05	[−0.12, 0.01]
Working	−0.02	[−0.10, 0.06]	−0.02	[−0.10, 0.05]	−0.02	[−0.10, 0.06]	−0.03	[−0.11, 0.05]
Agreeableness[a,b]	−0.01	[−0.04, 0.03]	−0.01	[−0.04, 0.03]	−0.01	[−0.05, 0.03]	−0.02	[−0.05, 0.02]
Conscientiousness[a,b]	0.01	[−0.02, 0.04]	0.01	[−0.03, 0.04]	0.01	[−0.03, 0.04]	0.01	[−0.03, 0.04]
Extraversion[a,b]	0.00	[−0.03, 0.03]	0.00	[−0.03, 0.03]	0.00	[−0.03, 0.03]	0.00	[−0.03, 0.03]
Neuroticism[a,b]	−0.03*	[−0.06, 0.00]	−0.03*	[−0.06, 0.00]	−0.03*	[−0.06, 0.00]	−0.03*	[−0.07, 0.00]
DGI-10[a,b]	−0.03	[−0.08, 0.01]	−0.03	[−0.07, 0.01]	−0.03	[−0.07, 0.01]	−0.01	[−0.06, 0.03]
PSO[a,b]	0.06**	[0.02, 0.10]	0.06**	[0.03, 0.10]	0.06**	[0.01, 0.10]		
Subjective knowledge[a,b]	−0.04*	[−0.07, 0.00]	−0.03*	[−0.07, 0.00]	−0.04*	[−0.07, 0.00]	−0.04*	[−0.07, 0.00]
Subjective capability[a,b]	−0.01	[−0.04, 0.02]	−0.01	[−0.04, 0.02]	−0.01	[−0.04, 0.02]	0.00	[−0.03, 0.04]
Numeracy[a]	−0.01*	[−0.03, 0.00]	−0.01	[−0.03, 0.01]	−0.01	[−0.03, 0.01]	−0.01	[−0.02, 0.01]
BNT familiar	0.03	[−0.03, 0.09]	0.03	[−0.03, 0.09]	0.03	[−0.03, 0.09]	0.02	[−0.04, 0.08]
Numeracy[a] $\times$ *BNT* familiar	0.01	[−0.01, 0.03]	0.01	[−0.01, 0.03]	0.01	[−0.01, 0.03]	0.01	[−0.01, 0.03]
Financial literacy			−0.01	[−0.03, 0.01]	−0.01	[−0.03, 0.01]	−0.01	[−0.03, 0.01]
Financial wisdom[a,b]					0.01	[−0.04, 0.05]	0.04*	[0.00, 0.08]
$R^2(adjusted)$	.340 (.278)		.345 (.279)		.346 (.276)		.320 (.252)	
F	5.47		5.25		4.95		4.69	
df	17, 180		18, 179		19, 178		18, 179	
p	$< .001$		$< .001$		$< .001$		$< .001$	
$\Delta R^2(adjusted)$	.340 (.278)		.005 (.001)		.000 (−0.004)		−0.025 (−0.024)	
p of ΔR^2	$< .001$		.252		.802		.010	

Note. $N = 198$ (one person was excluded due to implausible entries), CI = confidence interval.
[a] Predictor was centered on its mean. [b] Predictor was scaled on its standard deviation. [ln] Predictor was transformed using the natural logarithm. $*p < .05$, $**p < .01$, $***p < .01$.

increase being related to a 5% increase in the propoertion expected to save. Having experienced a drop in income in the last year was related to 15% less savings, all else equal. Neuroticism was negatively related to saving, with a one standard deviation increase in neuroticism being associated with a three percent decrease in expected savings. As is to be expected, PSO was found to be positively associated with percentage expected to save, with a one standard deviation increase being related to a 6% increase in expected savings. Somewhat surprisingly, subjective knowledge and numeracy were negatively related to proportion expected to save with a decrease of 4% and 1% respectively. However, the interaction with familiarity of the BNT suggests that this effect might only be present for those not familiar with the BNT. Even if the interaction effect was not significant, it suggests that every additional question on the numeracy test is related to a one percent increase in savings, which offsets the decrease by one percent.

Will the inclusion of financial literacy provide a better model? In fact, including financial literacy in a second step did not significantly improve the model (see Table 6, Model 2: $\Delta R^2 = .005$, $F(18,179) = 5.47$, $p = .252$). This suggests that the objective financial literacy score is not related to the percentage one expects to save from one's income beyond the given set of predictors. Moreover, including financial literacy, the negative effect of numeracy became non-significant.

Against expectations, including financial wisdom did not result in addtional explained variance in the expected percentage saved beyond the set of predictors (see Model 3: $\Delta R^2 = .000$, $F(19,178) = 4.95$, $p = .802$). It was, conjectured that PSO might share substantial variance with financial wisdom and obscure a potential effect. Therefore, PSO was tentatively excluded from the predictors (see Table 6, Model 4).

The resulting model explained less variance than Model 1, 2, and 3, which include PSO ($\Delta R^2_{Model1} = -.020$, $\Delta R^2_{Model2} = -.025$, $\Delta R^2_{Model3} = -.025$, respectively). This suggests that PSO is a better predictor of percentage expected to save than financial wisdom. However, an exploratory comparison of Model 4 to a model equal to Model 2 without PSO (not reported in Table 6) revealed, that financial wisdom significantly explains additional variance in the percentage saved when PSO is not included (Unfiltered data: $\Delta R^2(adjusted) = .015(.012)$, $F(1,179) = 3.95$, $p = .048$). This incremental effect was slightly more pronounced in filtered data ($\Delta R^2(adjusted) = .020(.017)$,

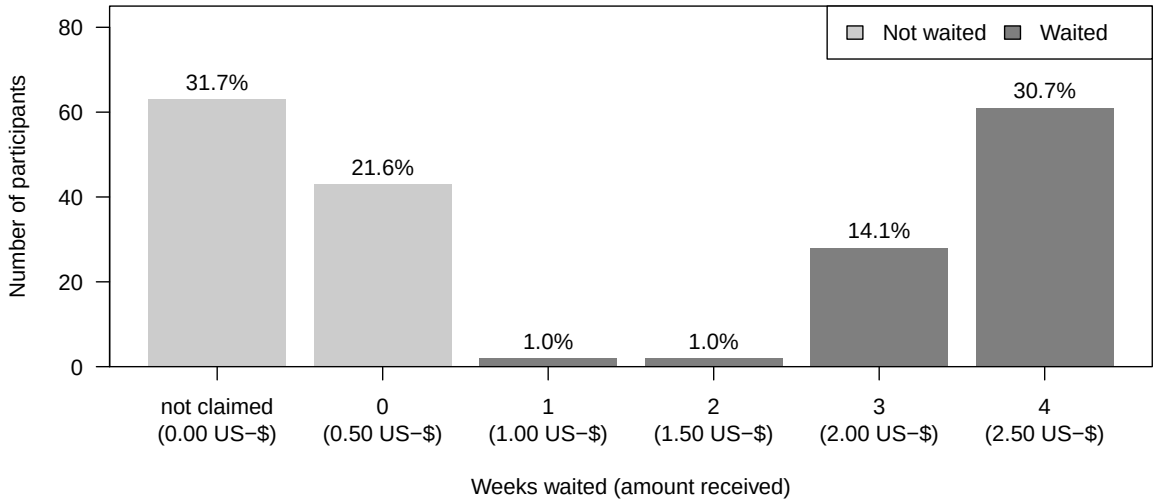

Figure 3. Number of participants by waiting time (amount received). Number of participants not claiming their investment, claiming their investment immediately or waiting for one to four weeks (amount received in parentheses). Bar shadings indicate whether participant was in not-waiting or waiting group in logistic regressions. The percentage for each group is indicated above the bars.

$F(1,156) = 4.55$, $p = .034$). The coefficient for financial wisdom suggests that an increase of one standard deviation in financial wisdom is related to a 4% increase in the percentage of expected savings. This indicates that financial wisdom is positively related to and explains incremental variance in the expected percentage of savings, under the condition that PSO is not also a predictor. This applies also, when the FW-15 is used (Unfiltered data: $\Delta R^2(adjusted) = .026(.024)$, $F(1,179) = 6.99$, $p = .009$).

Relation to the investment task. Individuals differed in their behavior on the investment task. For proportions of participants for each week in unfiltered data see Figure 3. It appears that in filtered data a somewhat greater proportion of participants claimed their investment. In unfiltered data a total of 31.7% of the participants did not claim their investment, as compared to 30.7% in filtered data. The lower proportion of participants claiming their investment in the unfiltered data may be related to effort and attention dedicated to the survey. Moreover, compared to 21.6% in unfiltered data, in filtered data 19.9 % claimed their investment right away. Relatedly, in unfiltered data 30.7% of participants waited until the last week, whereas in filtered data 33.0% did so. This suggests that insufficient effort might be related to performance on the investment task. This also reflects in a marginally significant χ^2-Test on claiming the investment after waiting at least one week

for not bneing vs. being included in the data ($\chi^2(1) = 3.57$, $p = .059$), as well as a correlation of the number of attention checks correctly responded to and the amount of money received ($\tau = 0.13$, $z = 2.02$, $p = .044$). Therefore, results for unfiltered data need to be interpreted with caution.

Waiting time. To test the hypothesis, that financial wisdom is positively related to the waiting time correlational anaylses were performed. As the distribution was clearly not unimodal and ties existed, Kendall's τ was used as a correlation coefficient. Participants who did not claim their investment were coded as the lowest category. It was found that financial wisdom was was marginally significantly related to the amount of money received ($\tau = 0.09$, $z = 1.72$, $p = .085$). This suggests, that participants who scored higher on the measure of financial wisdom also received more money from the investment task. However, this relationship is almost negligibly small. For filtered data this relationship was practically absent ($\tau = 0.02$, $z = 0.21$, $p = .828$). This may be related to people generally waiting more among filtered data, thereby decreasing variance. The results were similar for the FW-15 ($\tau = 0.07$, $z = 1.37$, $p = .168$).

Notably, other measures were also related to both the money earned from and waiting time on the investment task. Higher scores on the financial literacy questionnaire were related to higher amounts of money earned ($\tau = 0.23$, $z = 4.10$, $p < .001$). This also held for higher scores on numeracy ($\tau = 0.25$, $z = 4.52$, $p < .001$). This indicates, that participants higher in financial literacy or numeracy waited for a longer time to claim their investment and also received higher rewards. Higher scores on the DGI-10 were significantly but weakly related to higher amounts of money earned ($\tau = 0.11$, $z = 1.98$, $p = .048$; *n.s.* in filtered data: $\tau = 0.09$, $z = 1.55$, $p = .122$). This suggests that a higher ability to delay gratification was weakly related to receiving a higher reward but not to waiting longer to claim the investment in the present data.

Together these results suggest that financial wisdom may be positively, but only weakly related to the number of weeks waited on the investment task. However, the relationship for other predictors like financial literacy and numeracy is more clear cut. Therefore, the evidence from the present data for the hypothesis that financial wisdom is predictive of the waiting time on the investment task can at best be described as mixed.

Table 7
Logistic regression models on claiming the invested bonus payment in unfiltered data.

Variable	Model 1			Model 2			Model 3		
	B	OR	95% CI	B	OR	95% CI	B	OR	95% CI
Constant	−3.80*	0.02	[0.00, 0.62]	−3.70*	0.02	[0.00, 0.70]	−1.75	0.17	[0.01, 2.43]
Age (years)[a]	−0.05**	0.95	[0.92, 0.98]	−0.05**	0.95	[0.92, 0.99]	−0.03	0.97	[0.94, 1.00]
Expected monthly income	0.18	1.20	[0.83, 1.75]	0.17	1.19	[0.82, 1.74]	0.21	1.24	[0.89, 1.74]
Gender: male	−0.35	0.70	[0.36, 1.34]	−0.35	0.71	[0.37, 1.35]	−0.07	0.93	[0.52, 1.67]
DGI-10[a,b]	0.20	1.22	[0.88, 1.70]	0.14	1.15	[0.76, 1.76]	0.27	1.31	[0.97, 1.78]
Financial literacy	0.24*	1.27	[1.04, 1.56]	0.23*	1.26	[1.03, 1.56]			
Numeracy[a]	0.24*	1.27	[1.06, 1.55]	0.24*	1.27	[1.06, 1.55]			
BNT familiar	0.31	1.36	[0.70, 2.69]	0.32	1.38	[0.70, 2.72]			
Numeracy[a] × BNT familiar	−0.23	0.80	[0.62, 1.02]	−0.23	0.80	[0.62, 1.02]			
Financial wisdom[a,b]				0.09	1.10	[0.71, 1.70]	0.27	1.31	[0.97, 1.78]
χ^2		39.95			40.13			9.53	
df		8			9			4	
p		$< .001$			$< .001$			.014	
Nagelkerke's R^2		.245			.246			.063	
Percent predicted correctly		68.5			68.0			58.4	

Note. $N = 197$ (two participants of sex "other" were excluded), $n_{waited} = 92(53.3\%)$, $n_{notwaited} = 105(46.7\%)$, CI: confidence interval, OR: Odds ratio. χ^2-tests relative to an intercept-only model. [a] Predictor was centered on its mean. [b] Predictor was scaled on its standard deviation. $^*p < .05$, $^{**}p < .01$.

Waiting vs. not waiting. To more strictly test the hypothesis that financial wisdom is related to whether one waits to claim the investment or not, a logistic regression analysis on waiting vs. not claiming and claiming the bonus payment directly was performed (see Table 7). Age, income, and gender were entered as control variables in a first step (not shown in Table 7). For reasons of interpretability age was centered and participants, who had indicated "other" as their gender, were excluded prior to analysis. It is reported whenever their inclusion alters the results in a meaningful way. Additionally, income was log-transformed to accomodate the highly skewed distribution. Plus one was added before to accomodate incomes of zero.

In a second step the DGI-10, the financial literacy score, numeracy, as well as familiarity with the BNT and its interaction with numeracy were entered (Table 7, Model 2). The resulting model differed significantly from an intercept only model [$\chi^2(8) = 39.95$, $p < .001$, Nagelkerke $R^2 = .245$]. It predicted 68.5% of the cases correctly (68.5% for waited and 68.6% for not waited). This is only a negligibly small improvement relative to the baseline of around 50%. Age was a significant predictor. The odds ratio indicated that for each one year increase in age the odds of

waiting decrease by 5%. Both financial literacy and numeracy were significant predictors. For both, the odds ratios suggest that for each additional question, that was answered correctly, the odds of claiming the investment increase by 27%. For numeracy this effect may only hold for those who were not familiar to the BNT questions. The interaction term suggested that among those who already encountered BNT-questions before this study, each additionally correct question would result in a decrease in the odds of 20%. However, this effect is not significant and therefore may not be reliable.

In a third step financial wisdom was entered. It failed to show any incremental effect [ΔNagelkerke $R^2 < .001$, $\chi^2(1) = 0.18$, $p = .671$] beyond the other predictors. It predicted 68.0% of the cases correctly (67.4% for waited and 68.6% for not waited). This is even slightly worse than the first model. The results were similar for filtered data. This suggests that age, numeracy, and financial literacy may be suitable to predict whether a participant will wait. However, overall model fit is rather poor and all odds ratios are below 1.68, and therefore can not even be considered small effects (Chen, Cohen, & Chen, 2010). Moreover, upon visual inspection the residuals appear neither to be homoscedastic nor not patterned. This may hint at a violation of prerequisites. Therefore, these results need to be considered sceptically.

To test, whether financial wisdom has any explanatory power, when other capacities are not regarded, an exploratory model with demographic variables only was fit (see Table 7, Model 3). The model was considerably weaker than the models including DGI-10, financial literacy, and numeracy [Nagelkerke $R^2 = .063$, $\chi^2(4) = 9.53$, $p = .014$; predictive success 58.4%, waited: 48.9%, not waited: 66.7%]. The model also fails to reach statistical significance in filtered data [Nagelkerke $R^2 = .053$, $\chi^2(4) = 7.06$, $p = .133$; predictive success 55.2%, waited: 57.0%, not waited: 53.4%]. This exploratory model suggests that financial literacy has a weak but nonsignificant effect beyond a model with demographic controls [ΔNagelkerke $R^2 = .021$, $\chi^2(1) = 3.17$, $p = .075$]. The effect is also present using the short scale [ΔNagelkerke $R^2 = .018$, $\chi^2(1) = 2.77$, $p = .096$]. The effect is absent in filtered data [ΔNagelkerke $R^2 = .001$, $\chi^2(1) = 1.34$, $p = .247$; shortscale: ΔNagelkerke $R^2 = .003$, $\chi^2(1) = 0.43$, $p = .511$]. These effects were even weaker, when the participants who had indicated “other” were included in analyses.

Finally, a t-test revealed that the group who waited and the group who did not wait or not claim their investment differed in terms of financial wisdom ($M_{waited} = 5.07$, $M_{not\,waited} = 4.89$, $t(196.98) = 2.08$, $p = .039$, Cohen's $d = 0.29$). This small effect suggests, that those who waited to claim their investment had on average higher levels of financial wisdom. The small effect is also present for the short scale ($M_{waited} = 5.23$, $M_{not\,waited} = 5.06$, $t(196.63) = 1.84$, $p = .067$, Cohen's $d = 0.26$). It is, however, not statistically significant and may therefore be not systematic. There are similar but larger effcts for numeracy ($M_{waited} = 8.62$, $M_{not\,waited} = 6.92$, $t(196.91) = 4.49$, $p < .001$, Cohen's $d = 0.63$) and financial literacy ($M_{waited} = 10.61$, $M_{not\,waited} = 9.20$, $t(192.93) = 4.64$, $p < .001$, Cohen's $d = 0.65$). Thus, participants who waited to claim their investment and obtained a higher payment were higher in financial wisdom but also had considerably higher numeracy and financial literacy scores.

Together the results on the investment task suggest at best a minor role of financial wisdom for waiting to claim the investment. This role appears to be absent when demographic characteristics or capacities like the ability to delay gratification, financial literacy, or numeracy are considerd simultaneously. Therefore, evidence for Hypothesis 3 that financial wisdom is related to waiting in an investment task is rather weak and the hypothesis should be rejected for the present data.

Financial satisfaction. Financial wisdom was expected to explain variance in self-reported financial satisfaction beyond demographic variables, as well as personality and capability factors. To test this hypothesis a stepwise linear regression analysis was performed. In the first step demographic characteristics were entered. They included age, education, whether the participant was responsible for finance, and whether he or she was working. Moreover, log-transformed income, social comparison, recent changes in financial situation, expected savings for the next month, and total savings were entered as supposedly positve influences. As financial stressors mortgages, homeownership, and health were entered. These demographic variables together explained 43.5% of variance in the measure of financial satisfaction used [$R^2_{adjusted} = .435$, $F(14, 184) = 11.5$, $p < .001$].

In a second step the Big Five personality traits except for openness were entered, as well as subjective knowledge and capability, PSO and the DGI-10. This resulted in an additional 5.5% of variance explained in financial satisfaction [$\Delta R^2_{adjusted} = .042$, $F(8, 176) = 2.80$, $p = .006$]. Neither

Table 8
Regression models on financial satisfaction for unfiltered data.

Variable	Model 1		Model 2		Model 3		Model 4 (FW-15)	
	B	95% CI	B	95% CI	B	95% CI	B	95% CI
Constant	0.01	[−0.16, 0.17]	0.56	[−0.18, 1.29]	0.66	[−0.09, 1.40]	0.70	[−0.05, 1.45]
Agreeableness[a,b]	−0.02	[−0.17, 0.14]	−0.03	[−0.18, 0.13]	−0.07	[−0.24, 0.09]	−0.07	[−0.24, 0.09]
Conscientiousness[a,b]	0.09	[−0.07, 0.25]	0.09	[−0.07, 0.25]	0.07	[−0.10, 0.23]	0.07	[−0.09, 0.23]
Extraversion[a,b]	0.00	[−0.14, 0.13]	−0.01	[−0.15, 0.12]	−0.02	[−0.15, 0.12]	0.00	[−0.14, 0.13]
Neuroticism[a,b]	−0.20**	[−0.35, −0.06]	−0.20**	[−0.34, −0.06]	−0.21**	[−0.35, −0.07]	−0.22**	[−0.36, −0.07]
DGI-10[a,b]	0.02	[−0.18, 0.22]	0.04	[−0.16, 0.24]	0.02	[−0.18, 0.22]	0.01	[−0.19, 0.21]
PS[a,b]O	0.25**	[0.08, 0.42]	0.25**	[0.08, 0.42]	0.14	[−0.07, 0.35]	0.15	[−0.05, 0.34]
Subjective knowledge[a,b]	0.15	[−0.01, 0.30]	0.16*	[0.01, 0.32]	0.15	[−0.01, 0.30]	0.15	[−0.01, 0.30]
Subjective capability[a,b]	0.00	[−0.16, 0.15]	0.00	[−0.15, 0.16]	0.02	[−0.14, 0.18]	0.00	[−0.15, 0.16]
Numeracy[a]	0.01	[−0.05, 0.07]	0.04	[−0.03, 0.11]	0.04	[−0.03, 0.11]	0.05	[−0.03, 0.12]
BNT familiar	0.02	[−0.26, 0.30]	0.04	[−0.24, 0.32]	0.04	[−0.24, 0.32]	0.02	[−0.25, 0.30]
Numeracy[a] × BNT familiar	−0.04	[−0.13, 0.06]	−0.06	[−0.13, 0.02]	−0.05	[−0.14, 0.05]	−0.05	[−0.14, 0.05]
Financial literacy			−0.05	[−0.14, 0.05]	−0.07	[−0.14, 0.01]	−0.07	[−0.14, 0.00]
Financial wisdom[a,b]					0.20	[−0.01, 0.41]	0.21*	[0.00, 0.41]
$R^2(adjusted)$	.244 (.199)		.253 (.205)		.267 (.215)		.269 (.218)	
F	5.48		5.25		5.18		5.24	
df	11, 187		12, 186		13, 185		13, 185	
p	< .001		< .001		< .001		< .001	
$\Delta R^2(adjusted)$	.244 (.199)		.009 (.005)		.014 (.010)		.002 (.002)	
p of ΔR^2	< .001		.133		.065		–	

Note. $N = 199$, CI: confidence interval. BNT familiar: dummy coded, whether participant indicated to have seen the BNT before. The outcome financial satisfaction was scaled and centered to allow for a straightforward interpretation as zero being the mean and an increase of one being one SD. [a] Predictor was centered on the mean. [b] Predictor was scaled. $*p < .05$, $**p < .01$, $***p < .01$.

adding numeracy and its interaction with familiarity to the BNT [$\Delta R^2 =< -.003$, $F(3,173) = 0.62$, $p = .749$], nor adding financial literacy [$\Delta R^2 = .000$, $F(1,172) = 1.09$, $p = .297$)] resulted in a significant increase in explained variance. Against expectations, entering financial wisdom in the last step of analysis did also not yield any incremental effect [$\Delta R^2 = -.003$, $F(1,171) = 0.06$, $p = .814$].

Visual inspection of residual plots, variance inflation factors, and detection of outliers suggested that prerequisites were met to an acceptable degree. Therefore, it can be concluded that the measure of financial wisdom failed this rather strict test of criterion validity. To gain further insight into the relation of financial wisdom to financial satisfaction additional regression analyses were performed.

Additional analyses. First, it was expected that financial wisdom has explanatory power in financial satisfaction beyond other factors related to personality and individual capacities. Therefore, a second stepwise regression analysis was performed. In a first step personality traits, subjective financial knowledge, subjective financial capability, and numeracy were entered as predictors (see Table 8, Model 1). This model explained 24.4% of variance in financial satisfaction [$R^2 = .244$, $F(11, 187) = 5.48$, $p < .001$]. Neuroticism and PSO were significant predictors in this model. Regression coefficients suggested that an increase of one standard deviation in neuroticism is related to a decrease of 0.20 standard deviations in financial satisfaction, when everything else is held constant. Similarly, an increase of one standard deviation in PSO is related to an increase of 0.25 standard deviations in financial satisfaction, when everything else is held constant.

In a second step financial literacy was added. It did not show a significant incremental effect beyond the set of predictors [$\Delta R^2 = .009$, $F(1) =$, $p = .133$]. In this model subjective knowledge became a significant predictor in addition to neuroticism and PSO. The coefficient suggested that a one standard deviation increase in subjective knowledge was related to a 0.16 standard deviation increase in financial satisfaction. This effect was slightly more pronounced in filtered data (see TableC2 on page 107 in Appendix C). This indicates, that individuals who feel more knowledgeable are also more financially satisfied.

In a third step financial wisdom was entered into the regression model. Adding financial wisdom explained an additional 1.4% of variance. This effect of financial wisdom was marginally significant [$\Delta R^2 = .014$, $F(1) = 5.18$, $p = .065$]. In filtered data this effect becomes statistically significant [$\Delta R^2 = .019$, $F(1) =$, $p = .042$]. The coefficient suggests that a one standard deviation increase in financial wisdom is related to an increase of 0.20 standard deviations in financial satisfaction, when everything else is held constant (0.22 in filtered data). As this effect is only significant in filtered data, it should be interpreted with caution.

In both models PSO becomes a non-significant predictor with a smaller magnitude. This may be because of the high degree of shared variance between financial wisdom and PSO (see Table 5 on page 5). In unfiltered data, subjective financial knowledge ceases to be statistically significant. However, the effect remains. Interestingly, answering one additional financial literacy

question is related to a decrease of 0.07 standard deviations in financial satisfaction, everything else costant. This effect does, however, not become statistically significant and may thus be unreliable. Additionally, effects for numeracy are negligibly small.

All results are similar for the FW-15 (see Model 4 in Table 8 on page 63 and Table C2 in Appendix C on age 107). The shortscale was also significantly positively related to financial satisfaction. This effect is significantly different from zero in unfiltered data ($B = 0.21$, $t(1) = 2.01$, $p < .046$), as well as in filtered data ($B = 0.23$, $t(1) = 2.19$, $p < .030$). This is further evidence that financial wisdom is predictive of financial satisfaction. Neither visual inspection of residual plots nor the Durbin-Watson statistic for autocorrelated errors did reveal violated prerequsites.

These exploratory results are in line with the hypothesis that financial wisdom and financial satisfaction are positively related. This effect extended beyond other concepts describing the indiviudal. However, the measure of financial wisdom failed the more strict test including a wisde range of variables describing an individuals situation. This renders the overall evidence for the relationship of financial wisdom and financial satisfaction as mixed.

Discussion

The present study was concerned with the role of financial wisdom for financial decision making and the financial situation of individuals. In a framework of ecological rationality, financial wisdom denotes the repertoire of simple strategies, attitudes and behavioral practices and the competence to adaptively select among these according to the environment. It was expected that a newly developed measure of the repertoire part of financial wisdom would be related to other concepts that capture behavioral strategies, as well as to capacities for financial decision making. Moreover, it was predicted that financial wisdom would be related to financial outcomes and behaviors. The measure comprised the mutually related underlying dimensions of *monitoring and controling* finances, *susceptibility to folk wisdom*, *prudent spending and saving*, *social influence and risk-taking*, and *generosity*.

In line with expectations of construct validity, a financial wisdom measure was shown to be related to personality traits and attitudes, as well as indicators of subjective competence to make

financial decisions. However, the relations to PSO and delay of gratification were very large casting doubt on discriminant validity. Additionally, financial wisdom was also moderately related to financial knowledge, but not or only weakly to individual capacities reflected by numeracy. Evidence, moreover, suggests that financial wisdom is positively related to financial satisfaction, which may be an indicator of succesful financial decision making. There is also weak evidence that financial wisdom is related to actual saving behavior. This relationship, however, was less clear. Finally, evidence for a relationship of financial wisdom to investment behavior involving the delay of gratification indicates that financial wisdom may not be related to investment behavior in an experimental setting. Together the evidence suggests a potential role of financial wisdom for financial decision making that also goes beyond financial literacy.

In the following, firstly, the scale development and the dimensions of the scale will be considered more closely. Then the relationships of the financial wisdom measure and its dimensions to other concepts will be discussed in the light of construct validity. Then, relationships to a correlate of saving behavior, and behavior on an experimental investment task will be examined more closely to argue for criterion validity. Finally, the relationship to financial satisfaction will be discussed, and it will be argued for the role of financial wisdom in financial decision making.

Scale development and dimensions of financial wisdom

Dimension s of financial wisdom. Exploratory factor analysis suggested that the content of financial wisdom can be grouped into five dimensions. These dimensions included *monitoring and controling* one's finances and *prudent spending and saving* money, as well as *susceptibility to folk wisdom*, using *social influences and risk-taking*, and attitudes towards *generosity*. Four of the dimensions were found to be closely related to each other. This was also indicated by most items loading on one factor without rotation. However, the factor underlying social influence was only weakly related to the other factors. This suggests, that it might assess an aspect of financial wisdom that is not related to the other aspects. Overall, this is evidence for some multidimensionality of financial wisdom.

This is in line with findings by Neth and Galesic (2014), who found three factors for a ten-

item short measure of financial wisdom, that had been labelled *financial planning*, *risk-taking*, and *broader perspective*. Evidence for this factor structure was rather weak in the present data. Especially the risk-taking were not significantly related to the factor from the previous study. Therefore, dimensions of financial wisdom were investigated again from a factor analytic perspectve.

The final items in this study were selected based on their loadings on the factor as well as based on their assumed importance for the content validity of the measure. Moreover, it was tried to retain as many diverse aspects of simple strategies and behavioral practices, as possible. Therefore, the social influence and risk-taking factor was also included in the measure of financial wisdom, despite its lack of a correlation to the other factors. The resulting measure still showed good internal consistency, which is indicative that all items assess an underlying construct. To allow for a more frugal assement a short scale with three items per dimension was created. Internal consistency of this short measure was still acceptable. This serves as first evidence that the construct may also be assessed using a smaller item set. This may also indicate that some practices are more indicative of financial wisdom than others. These included for example being in control of one's finances, "Early bird catches the worm", "I frequently spend more than I earn" (reverse coded), "It is better to give than to receive.". These are all simple rules, behaviors or attitudes, whcih appear to be indicative of financial wisdom.

Interestingly, the dimensions found can be related to the dimensions of financial capability found by Atkinson et al. (2006). These dimensions included managing money (including making ends meets and keeping track), planning ahead, choosing products, and staying informed. The dimensions of making ends meets and keeping track bear resemblance of the factors named controlling spending and monitoring and controlling here. However, the monitoring and controlling factor also included aspects of searching information, as included in the choosing products dimension of Atkinson and colleagues, as well as aspects of planning ahead. This shows that the factors of financial wisdom identified empirically in the present study do differ from the theoretically identified factors of financial capability. Nevertheless, both constructs comprise closely related aspects. This accounts for a close relationship of financial wisdom and financial capability.

Limitations of the present measure. Beyond financial capability, the main new ideas in financial wisdom were the use of simple rules and adaptive selection among strategies to deal with money. However, the present measure did only regard the former of both aspects explicitely. The other may be implicit in the interplay and the relationships of the dimensions of financial wisdom and concepts that capture individual and environment. Also in other regards, the present measure of financial wisdom may not yet be optimal. It has been found that the measure does not cover the full possible range. Moreover, the average score of financial wisdom was relatively high and general variance was low. This suggests that individuals are principally high in financial wisdom. This is a good sign inasmuch that individuals at least seem to report assumingly beneficial simple rules, behavioral practices and attitudes. On the other hand, the high levels of financial wisdom may be an indicator that not the full range of financial wisdom is captured in the present study.

This restriction of range may be due to the sample, which was comprised of workers on Amazon's mTurk. These workers must at least monitor their balance within their mTurk account. This may be related to them adhering to a greater range of financial practices, as they are generally aware of the importance of keeping an eye on their money. At worst, the small variance and range may be due to the selection items. It may be an indicator that an insufficient number of underlying dimensions was captured by the item set. Alternatively, the restricted range may be related to the general social desirability of the statements participants had to agree or disagree with. For example, avoiding to borrow or to spend more than one earns may be very general practices most people believe they should agree with. This property of the items should be regarded in future research aiming at the measurement of financial wisdom.

Moreover, the social influences and risk-taking dimension appears to include two different aspects. Either, the relation of social influences or advice and risk-taking may be caused by advice frequently suggesting to take risk. This suggests that, this factor is artificial in nature. It might, however, also suggest that following others and risk-taking are dimensions that are intrinsically related to each other. Generally, following others may be adaptive for those taking risk or vice versa. Future research may try to clarify this by expanding the item set used in this study.

Besides these issues, content and dimensional structure of the present financial wisdom mea-

sure appear to reasonably capture an underlying cosntruct of financial wisdom. The rules and practices used, were related among each other, accounting that they asses an underlying construct of financial wisdom. This construct is sematically related to financial capability, but goes beyond it, as it regards simple rules. Nevertheless, it remains to be cautioned that currently only a repertoire of simple rules, behavioral practices, and attitudes is assessed and apparently differences among individuals are rather low. Arguably, these simple rules are adaptive for many individuals and across environments, so that the measure can still provide evidence on the usefulness of financial wisdom.

Construct validity of financial wisdom

Correlational evidence suggests relatively good construct validity of financial wisdom. However, a distinction from PSO and delay of gratification may be difficult. A possible explanation is that these concepts are part of financial wisdom. Additionally, intersting relationships for the dimensions of financial wisdom were found. About the dimensions of financial wisdom no *a priori* hypotheses had been stated.

Other personality characteristics.

Personal saving orientation. As expected, the measure of financial wisdom was shown to be most strongly related to other personal characteristics related to dealing with money. This included PSO, delay of gratification, and the Big-Five trait of conscientiousness. PSO is a mindset that is associated with behavioral practices and habits related to saving money, also inluding attitudes (Dholakia et al., 2016). Financial wisdom also comprises simple rules, behavioral practices, and attitudes concerned with saving. In fact, both concepts show considerable overlap. As expected, PSO and financial wisdom were found to be strongly related. This is likely the case as, for example, monitoring one's income and expenses and avoiding to overspend are also related to saving money. This idea is further supported by the finding that the correlations with the monitoring and the prudent spending and saving factor are largest. In turn, the correlation of PSO with the social influences and risk dimension is weaker. Advice and risk may be related to saving money in some cases but not in others. Finally, the generosity dimension has not been found to be substantially related to PSO. This suggests that being generous may be independent of whether one saves or not.

Counter discriminant validity the corelation was very large. This casts some doubt on whether financial wisdom is a concept that differs from PSO. Items in financial wisdom may not be sufficiently differ from items related to saving. Another possible explanation for the high correlation is that participants may overall have been in an environment in which it is simulataneously adaptive to adhere to both saving practices of PSO, as well as to some of the larger set of practices included in financial wisdom. For example, a stable financial situation with sufficient income allows to save money and avoid the accumulation of debt. Such a situation may reflect in the present sample through most people reporting good health, being employed and obtaining an income, as well as few participants reporting negative changes in their financial situation. In another sample with a less table situation saving may be less adaptive, and therefore be less strongly related to PSO. Moreover, conceptually, financial wisdom is broader, also including strategies other than saving and saving-related money mangement practices. For example, advice-taking or risk-taking. This may be reflected in the weaker relationship of PSO and the social influence and risk-taking dimension. In fact, it may be the other way round: that PSO is contained in financial wisdom. Future work may help to refine the measure of financial wisdom and clarify this issue.

Delay of gratification inventory. Next, financial wisdom was shown as hypothesized to be positively related to delay of gratification. This suggests, that certain strategies involve the ability to forego an immediate reward for a later but potentially greater reward (Reynolds & Schiffbauer, 2005). Examples in the financial domain include saving and investing money, sustainable spending behavior, as well as planning. This is also reflected in the items from the money domain of the DGI-10: “I can be trusted with money” and “I try to spend my money wisely”. This already suggests a role for financial wisdom in delay of gratification. In line with this reasoning, the dimensions of monitoring finance and controlling spending were strongly related to delay of gratification. Interestingly, also generosity was related to delay of gratification. This may reflect that being generous may involve giving up immediate money to receive a material or immaterial reward in return. This is directly reflected in the generosity item “Give generously to others and you shall receive in return.”. Moreover, it may reflect the social dimension of delay of gratificaion (Hoerger et al., 2011).

Notably, the relationships of financial wisdom to PSO and delay of gratification was always

larger than the relationships within financial wisdom. This may be seen as evidence that both measures of personal saving orientation and delay of gratification can be considered, in fact, part of financial wisdom. Both deal with behavioral practices and attitudes, which are relevant in the financial domain. Additionally, delay of gratification may, in turn, also rely on simple rules, like following defaults, including for example, delaying to buy things that one cannot afford currently. Importantly, both PSO and delay of gratification, may be only useful dependent on the environment. Saving is not always feasible and sometimes it may be adptive to not delay gratification. For example claiming a reward immediately instead of waiting for a larger outcome may help to avoid forgetting to claim it at all. The high correlations suggest that the aspects of both concepts are already regarded in the present measure of financial wisdom. The differential relationships of the financial wisdom dimensions to PSO and delay of gratification provide some empirical evidence that the financial wisdom concept is broader than its single dimensions

Conscientiousness. The personality trait of conscientiousness was also shown to be positively related to financial wisdom. This suggests that financial wisdom involves some aspects that are related to being structured and thorough. This also reflects in the finding that the monitoring and the prudent spending and saving dimension of financial wisdom show the strongest relationships to conscientiousness. Arguably, the non-substantial relationship of social influence and risk-taking to conscientiousness underscores this idea, as structured behavior is not necessarily related to seeking help or taking risk. Interestingly, the generosity dimension was shown to be positively related to conscientiousness. This may relate to a moderate correlation of conscientiousness and agreeableness in the sample, as agreeableness includes a dimension of generosity (see Table C1 in Appendix C on page 106).

Relation to subjective capacities.

Subjective capability. As expected, financial wisdom was also shown to be related to measures of subjective financial decision making competence. These included subjective financial capability and subjective knowledge. The positive relationship to subjective financial capability suggests that following successful simple rules and behavioral practices is related to a heightened sense of being capable to handle one's finances (Xiao et al., 2014). This holds especially for the monitoring and

spending dimensions. These two dimensions might be most strongly related to feeling in control of one's finances. The positive relationship to the folk wisdom dimension suggests that following the simple rules of folk wisdom may serve to enhance a sense of being in control of one's finance. This can be seen as evidence for the relevance of simple financial rules to increase subjective financial capability or self-efficacy. Financial self-efficacy in turn has been shown to be related to financial satisfaction (Xiao et al., 2014) and, relatedly, perceived control over behavior has also been shown to be related to beneficial financial behavior (Shim et al., 2010). This may be one link how financial wisdom relates to financial outcomes that should be investigated in future investigations.

The social influence and risk, as well as the generosity dimension were not substantially related to subjective financial capability. The relationship of subjective financial capability to social influences and risk is negative in direction. This may indicate that those who do not feel in control of their finances rely more strongly on others to deal with their finances. This tendency may be seen as evidence for the adaptiveness of financially wise behavior. However, this relationship is weak and not systematic in the present data, suggesting that this may be but one explanation of the relationship of social influence to financial capability. Moreover, the causality may also go from social influences and risk-taking to subjective financial capability. Individuals who rely or have to rely on others may feel less capable, in turn. Finally, the absence of a relationship between generosity and subjective financial capability suggests that the generous do not necessarily feel more capable.

Subjective financial knowledge. Hypothesis on the relationship of financial wisdom to financial knowledge was hypothesized. The positive relationship of financial wisdom to subjective financial knowledge may, however, be explained similarly to the relationship to subjective financial capability. This positive relationship is present and substantial across the domains of finacial wisdom. Individuals who are high in financial wisdom may consider which rules and strategies they know to deal with their finances. However, this relationship is also open to an alternative explanation. It may also be the case that individuals high in financial wisdom feel that their knowledge is sufficient to deal with their everyday finances within their financial environment. Finally, it may also be the case that subjectively knowlegeable individuals perform more beneficial behaviors, which then reflect in higher financial wisdom. However, all three explanations would predict a pos-

itive relationship as it was found in the present study. Future studies might address this question by testing more sophisticated models that include mediations between factors.

Relation to objective capacities.

Financial literacy. Financial wisdom was also found to be related to financial literacy measured by objective financial knowledge.In line with expectation, this relationship was considerably weaker for most dimensions than the relationships to other personality characteristics and subjective capacities. This can be considered as evidence for discriminant validity. Financial wisdom seems to clearly assess something different beyond financial literacy or knowledge.

It further suggests that financially more knowledgeable individuals report engaging in more financially wise behaviors, like planning. This is in line with findings that financial literacy is related to financial planning and money management practices (Ali et al., 2015). The low to moderate relationship suggests, that financial literacy explains less variance in these behaviors than other constructs, like, for instance, conscientiousness or subjective capability. This is also in line with the finding by Fernandes et al. (2014) who have shown that certain personality traits and attitudes are more predictive of financial behaviors than financial knowledge.

Relationships of the social influences and risk-taking dimension and the generosity dimension to financial literacy also appear reasonable. Financial knowledge does not necessarily correspond to following financial advice or taking risk. Neither, is there an apparent reason that it should be related to generosity.

Numeracy. Also partially in line with expectations, evidence for a relationship of financial wisdom to numeracy was rather weak. Previous research suggested that numeracy might be related to more general cognitive abilities like fluid intelligence (Cokely et al., 2012). Therefore, this can be seen as evidence that financial wisdom assesses something different from more general cognitive abilities.

However, the relationships to numeracy differ across dimensions of financial wisdom. It appears that controlling one's spending is related to numeric ability. In fact, numeracy may be involved in performing calculations helpful to determine, whether something can be afforded to avoid overspending. Notably, the relationship of numeracy to social influences and risk-taking is

negative. Although it fails to reach statistical significance, this may indicate that individuals with worse numeracy are more likely to rely on external sources to deal with their money. This is in line that individuals choose their strategies according to their capacities. Due to the mixed nature of this factor, it may however also be the case that—more alarmingly—less numerate individuals also take more risks. A future measure of financial wisdom should separate the two parts of this dimensions more clearly to shed light on this issue. The mixed results on numeracy indicate that more general individual capacities are related to some strategies and behaviors included in financial wisdom but not necessarily to others.

All of the above relationships are rather weak. Together with evidence on a positive relationship of financial wisdom to financial literacy this suggests that individual capacities specific to finance are related to financial wisdom but not more general capacities or cognitive abilities like numeracy.

Summary of construct validity. Together all of the relationships mentioned above can be seen as first evidence for both congruent and discriminant validity of the construct of financial wisdom. Relationships were generally in line with expectations. One major problem are the strong relationships to personal saving orientation and delay of gratification. They call for a refinement of the financial wisdom measure that maybe encompassess both explicitely as aspects of it.

Moreover, the different relationships of the dimensions of financial wisdom indicate that the social influence and risk-taking dimension, as well as the generosity dimension differ from the three other dimensions of financial wisdom. However, these two dimensions appear to increse the breadth of financial wisdom. Interestingly, individuals lower in numeracy report taking more advice. This is in line with ecological rationality, which suggests that individuals should select strategies according to their individual capacities.

Therefore, it is reasonable to summarize the dimensions of financial wisdom into one measure. Deficits in strategies of one dimension may be compensated by strategies from another domain, which is more adaptive for a given individual in a given environment. The complete repertoire of strategies an individual uses should therefore still be related to individual financial decision making competence. Overall, relationships among financial wisdom, its dimensions and other constructs

still suggest an acceptable degree of construct validity within the constraint that the present measure of financial wisdom may be confused with PSO or delay of gratification.

Criterion validity of financial wisdom

Relation to saving behavior. Financial wisdom was shown to be positively related to the proportion of money participants expected to save from their income in the month following the study. However, this was not the case when the more specific concept of personal saving orientation was included as a predictor. As shown above, the relevant strategies in financial wisdom overlap considerably with the behaviors and attitudes in PSO. The relevant variance in the proportion saved was apparently captured better by the more specific concept of PSO. This suggests, that PSO may be a better predictor for saving behavior than financial wisdom.

Importantly, when PSO was not included, financial wisdom could be shown to be related to more saving beyond properties of individuals' financial environment, general personality traits, the ability to delay gratification, and individual capacities. A relationship beyond the strong predictor of experiencing a recent drop in income suggests that financial wisdom is related to saving behavior beyond single aspects of the financial situation. This replicates the relation of financial wisdom to change in household savings found by Neth and Galesic (2012) and extends this finding beyond other control variables.

Individual capacities included subjective and objective financial knowledge, as well as subjective financial capability, and numeracy. The relationship beyond numeracy suggests that financial wisdom is an importatnt predictor beyond individual capacities. Previous relations of numeracy to general cognitive abilities like fluid intelligence (Cokely et al., 2012) additionally suggest that financial wisdom may be relevant beyond cognitive abilities in general. The findings moreover suggest, that financial wisdom is a better predictor of how much is saved than financial literacy. This is in line with the idea that financial literacy is not necessarily related to financial behaviors, when other influences are controlled for (Fernandes et al., 2014). This can be considered as evidence that relying on simple rules and behavioral practices is more important to explain financial behaviors than financial literacy. However, it remains to be cautioned, that another explanation may be that

an effect of financial literacy on saving behavior is mediated through the self-reported behaviors in financial wisdom. What accounts against this explanation is that financial wisdom does not have any explanatory value before financial wisdom is considered. Future research might clarify this question by performing mediation analyses controlling for other influences of the individual and the environment.

Both for objective financial literacy, as well as for subjective financial knowledge there is no evidence for a substantial role for how much is saved. This finding is at odds with previous findings which suggest that financial literacy and knowledge are related to saving and wealth accumulation (Behrman, Mitchell, Soo, & Brava, 2012; Van Rooij et al., 2012; Lusardi & Mitchell, 2011). It may be the case that these studies failed to consider influences of the environment or the individual that play an important role to predict financial behavior above financial literacy. Thereby, this casts doubt on financial literacy being a valid explanation for financial behavior. Overall, this underscores the value of considering financial decision making in a framework of ecological rationality, as environmental and individual factors are considered.

In summary, the evidence suggests that financial wisdom is related to saving behavior, measured by the proportion participants expected to save from their income in the month following the study. The effect goes beyond environmental factors, more general personality traits, and individual capabilities, including financial literacy. This can be considered as evidence for criterion validity of the concept. This conclusion is somewhat compromised by the lack of an effect beyond PSO. As a potential explanation it has been suggested that both concepts overlap in their relevant aspects, and the concept more specific to saving is better suited to predict saving behavior.

Relation to an experimental investment task. To address the issue of causality, participants' behavior on an investment task with real rewards was investigated. Relating financial wisdom to actual behavior in the future allows to exclude reverse causality. It was conjectured that higher fincial wisdom is related to waiting longer to collect an investment that grows over time to obtain a higher reward.

The evidence for an influence of financial wisdom on the waiting behavior is, however, extremely weak. Individuals, who waited for their investment to grow were found to be higher in

financial wisdom, than those who forgot to claim their investment or claimed it right away. However, the effect of financial wisdom could not be shown when other predictors including age, income, delay of gratification, financial literacy and numeracy were controlled for. Moreover, financial wisdom was not substantially related to the time waited on the investment task. It showed a weak but non-systematic relationship to the amount received from the investment task, which may simply reflect the difference in waiting or not waiting.

The results suggest that age, financial literacy and numeracy are most strongly related to waiting behavior. Both effects were weak (Chen et al., 2010), suggesting an increase of the odds of waiting of slightly above 25% for both financial literacy and numeracy. The presence of an effect of financial literacy is in line with previous research suggesting a role of financial literacy for financial saving and investment behavior (e.g., Van Rooij et al., 2011). Beyond studies using survey data this effect is therefore likely not subject to reverse causality, as financial literacy. However, the general behavioral tendency to wait might still increase financial literacy. Nevertheless, this is less plausible, as delay of gratification has been controlled for.

Evidence, moreover, suggests that the effect of numeracy may only be present for those unfamiliar to the questions of the BNT. Even if the corresponding interaction effect does not systematically differ from zero. As numeracy has been shown to be related to more general cognitive abilities the result shows a role of cognitive capacity in financial decision making that exists clearly among those who were not familiar with part of the numeracy test before.

In addition the results on numeracy and age suggest, that younger participants with higher numeracy were more likely to wait to claim their investment. This connects to the finding that a decline in numeracy and cognitive ability in age may be related to financial decision making (Gamble et al., 2015). However, it has been shown that age differences in performance of psychometric tasks may not be related to cognitive decline but rather demands of memory search (Ramscar, Hendrix, Shaoul, Milin, & Baayen, 2014). Therefore, it might be the case that older mTurk workers differ from their younger conterparts. A speculative example might be the importance of bonus payment: some older workers might participate just for fun and therfore do not care about bonus payments that require waiting.

Interestingly, relationships of a measure of delay of gratificaition to the investment task were mixed. A weak relationship of delay of gratification was not substantial anymore, if financial literacy and numeracy are considered as well. This is surprising, as the task clearly includes delay of gratification, meaning foregoing an immediate payment in favor of a later and larger payment, while the original payment is still available (Reynolds & Schiffbauer, 2005). The absence of a clear relationship casts some doubt on the criterion validity of the shortscale of the DGI. A potential reason may be that the more domain specific measure of financial literacy is a better predictor than the general ability to delay gratification in this case. Another reason may be worse psychometric properties of the DGI-10 relative to the full scale (Hoerger et al., 2011), precluding to find an effect that would have been found with the full money shortscale of the measure.

Generally, the absent relationships of financial wisdom and dely of gratificaiotn may hint at difficulties in predicting behavior on the investment task at hand. Firstly, potential resons for waiting or not waiting are diverse. Not claiming the investment may have been related to forgetting. However, it may also be caused by not caring about a negligibly small payment. A correlation with the attention check score in unfiltered data suggests that careless responding may, in fact have been related to not claiming the investment. This is related to literature on delay discounting suggests that smaller payments lose more value over time than larger payments (Johnson & Bickel, 2002). A reason for claiming the investment immediately may be a lack of trust, that the investment can be claimed later. Another reason may be adaptively claiming the investment immediately, to avoid forgetting it. These properties introduce a lot of noise that complicates prediction of the behavioral outcome.

This idea also reflects in a rather poor fit for all logistic regression models. Finally, the external validity of the task for actual investment behavior may be low as payments were small and absolute amounts were shown to the participants whereas in reality “returns are typically stated in terms of interest rates” (Coller & Williams, 1999, p. 108) given in percentages. Therefore, results might not translate into real life investment behavior. In fact, stating the interest as percentages might increase an effect of numeracy. Beyond limitations of external validity, the investment task serves to fill a gap in research on financial literacy which has seldomly considered actual behavioral

evidence but mostly relied on data from large household surveys (see Stolper & Walter, 2017; Hastings et al., 2013; Lusardi & Mitchell, 2014 for reviews on a larget number of studies).

Taken together, the results indicate that both, financial knowledge and cognitive capacities appear to play a role for financial decision making. This is in line with research suggesting that financial knowledge in the form of education is relevant after cognitive abilities are controlled for (Lusardi et al., 2010). Unlike in previous studies, the explanatory value of knowledge and numeracy cannot be attributed to reverse causality due to the design. Still, there may be other influences like attention and diligence that are related to both the numeracy and financial literacy measures and the behavior on the investment task. The role of financial wisdom and simple strategies, however, is less clear. Results account for a role of individual capacities for financial decision making beyond simple strategies. Overall, the results show only weak evidence, that financial wisdom is related to actual behavior. Future research, might improve on the task by excluding alternative explanations, in order clarify whether this was due to the task used or whether the measure of financial wisdom does not accurately relate to behavior. Moreover, hypotheses on relationships of specific dimensions of financial wisdom might be tested.

The role of financial wisdom in financial decision making. To argue for the relevance of financial wisdom in financial decison making, it should not only be related to behaviors and their correlates. Financial wisdom should also be predictive of more global indicators of adaptive financial decision making. It was assumed that one way in which adaptive financial decision making manifests is financial well-being, including the subjective evaluation of one's financial situation. This expectation is in line with the finding that the effect of financial behaviors on financial satisfaction is mediated through the financial stress level, which is also influenced by situational characteristics like solvency (Joo & Grable, 2004). Financial wisdom should lead to a better financial situation through dealing with one's finances using adaptive behavioral practices and rules. Adaptive means, that one's strategies to deal with money match to one's capacities and the environment one is in. Adaptive strategy use, in turn, is proposed to frequently lead to at least acceptable outcomes in a given context. A so shaped acceptable financial situation was assumed to correspond to financial satisfaction.

For this reason a positive relationship of financial wisdom to financial satisfaction was expected. This relationship was assumed to be positive for all individuals in a given context, shaped by the individual capcities and the financial situation (Gigerenzer et al., 1999). Therefore the relationship should also extend beyond other personal characteristics and capacities, as well as properties of the financial situation. Against the latter expectation, the financial wisdom measure failed a strict test controlling for both situational characteristics and characteristics of the individual.

There are at least two explanations for the described pattern of results. First, the current financial wisdom measure does not explicitely capture the aspect of adaptive strategy selection. Therefore, it may fail to show the relationship to fiancial satisfaction that is grounded in selecting strategies adaptive to the fiancial situation. Second, there are external influences on the financial situation that may simply defy control by adaptive financial decision making and nonetheless influence financial satisfaction. Candidates are health (Hsieh, 2003) and other financial stressors that may impact financial satisfaction (Joo & Grable, 2004). For those who are subject to such influences, selecting adaptive strategies may not lead to substantial improvements in the financial situation. Other influences may the not be offset by financial wisdom. This may account for an interaction of external influencess and financial wisdom that should be investigated in future research.

Therefore, the above results compromise the importance of financial wisdom for financial satisfaction. It does, however, not necessarily compromise the relevance of financial wisdom for financial decision making. Further analyses suggested that financial wisdom is positively related to financial satisfaction, beyond other personal characteristics and capacities like personal saving orientation, financial literacy, and numeracy. This is evidence that financial wisdom may be an individual characteristic related to individual financial well-being. Statistical significance but not magnitude of the financial wisdom effect depended on filtering the data, for the 39-item measure. Therefore, responding with insufficient effort is likely not an explanation for the finding that financial wisdom is related to financial satisfaction. Therefore, the results can be considered as evidence, that financial wisdom is a better predictor for financial satisfaction than other concepts related to financial decision making, including financial literacy, numeracy, and PSO.

These findings are in line with findings on financial capability, which suggest that financial

behaviors are more important than objective financial knowledge (Xiao et al., 2014). The financial wisdom measure comprises financial behaviors. The present data suggest that financial literacy is not substantially related to financial satisfaction when financial behavior and other influences are controlled for. Also in line with Xiao and colleagues, there is also a hint at a negative effect of financial literacy on financial satisfaction in the present data. They suggest that low levels of financial satisfaction and high levels of financial knowledge may have been the reason for this negative effect. This may also be the case in the present data. Like in previous research on mTurkers (Farrell, Grenier, & Leiby, 2017) financial literacy in the sample was rather high. However, the effect may also connect to the claim that in previous research variables that explain relationships of financial literacy to financial behaviors and outcomes better have been ommitted (Fernandes et al., 2014).

The non-substantial relationship of financial literacy on financial satisfaction may also be indicative of a potential mediation effect. In previous research it has been found that financial planning mediates the effect from financial knowledge on financial satisfaction (Ali et al., 2015). However, data would be more suggestive of a mediation, if financial literacy had been a substantial predictor of financial satisfaction before financial wisdom was entered. Overall, this casts doubt on the importance of financial literacy for financial satisfaction when financial behaviors like in financial wisdom are controlled for. Therefore, it also casts doubt on the role of financial literacy for successful financial decision making.

Moreover, the relationship of financial wisdom and financial satisfaction also extended beyond numeracy. Numeracy was not substantially related to financial satisfaction beyond other individual characteristics. This suggests two things: first, numeracy does not appear to be a better predictor of financial satisfaction than other aspects of the personality. Second, it suggests that financial wisdom is a better explanation of financial satisfaction than numeracy. As previous findings indicate that numeracy is substantially related to more general cognitive abilities like fluid intelligence (Cokely et al., 2012), the finding may also be indicative that financial wisdom has explanatory power in outcomes of successful financial decision making beyond general cognitive ability.

Overall, the present data can be seen as evidence that financial wisdom, measured by a reper-

toire of simple rules, behavioral practices, and attitudes is predictive of successful financial decision making. This is suggestive, that the measure of financial wisdom actually measures financial decision making competence. Moreover, the results suggest that financial wisdom is a better explanation of financial satisfaction than financial literacy. This is a hint that financial wisdom may be more important than financial literacy for dealing successfully with finances.

However, there remain some unresolved questions. First, an element of reverse causality may be likely for financial wisdom. The repertoire of strategies at one's disposal may vary with the situation. Individuals, with a more favorable situation may need a greater variety of strategies to deal with their finances and thus are likely to score higher on financial wisdom. Secondly, it is also important to note, that financial wisdom and financial capability have not been directly compared in this study. Even if both concepts are similar in their content, behaviors included differ. Future research might compare a measure of financial wisdom to a measure of financial capability. Certainly, the effect of financial wisdom on financial satisfaction awaits replication, as well as arguments for a causal role through, for example, a longitudinal design. Finally, other potential indicators of adaptive financial decision making beside financial satisfaction should be considered consolidate and extend the promising evidence that financial wisdom is related to good financial decision making.

Limitations and future directions

The results presented above suggest that strategies and attitudes asssessed in financial wisdom may play a role in financial decision making. Nevertheless, the results of the present study are subject to some limitations that should be adressed in future research. The limitations include both limitations related to the measure used to assess financial wisdom well as related to the the sample, data quality, and the study design.

Financial wisdom. Firstly, it needs to be mentioned that the current factor structure of financial wisdom was determined solely by means of exploratory factor analysis. This was mainly done, as the sample size was considered too small for crossvalidating the structure by means of confirmatory factor analysis. Analyses of the data quality suggest that overall data quality may have been low, so that splitting the sample likely would have resulted in an increase in the proportion of

noise. Next, the fit of the model suggests that the factor structure may not be fully reliable. Therefore, all presented results on financial wisdom remain necessarily preliminary in nature. Future research should, thus, aim to confirm the current factor structure using confirmatory factor analyses. This may help to refine the measure of the repertoire of financially wise strategies.

Additionally, the high correlation to PSO taps into the question whether the content of financial wisdom was accurately and comprehensively assessed. Financial wisdom is not meant to be exclusively concerned with saving and also includes strategies that deal with other issues. These are currently mainly reflected in the dimensions of social influences and risk-taking, as well as generosity. Relatedly, the present measure of financial wisdom assesses only the repertoire of simple rules, behavioral strategies, and related attitudes, an individual can select from. the present financial wisdom measure does not explicitely include the aspect of adaptive strategy selection in its items. It is therefore not entirely clear whether the measure comprehansively assesses the concept of financial wisdom. Together this renders the interpretaion of all of the above results on the financial wisdom measure as only preliminary evidence for the role of financial wisdom.

Generally, future research may tackle some of the present limitations by refining the set of items used to assess financial wisdom in this study. To also capture strategy selection, items that capture the interplay between repertoire of strategies and selecting the appropriate strategies more explicitely should be included. This will result in a more full measure of financial wisdom that goes beyond a mere repertoire of attitudes and strategies. Moreover, in this context it may be fruitful to refine the measure by including further items to include more clearly delineated dimensions that apply to different situations. These dimensions may, among others, include strategies for saving, borrowing, and risk-taking. Financial wisdom is based on the framework of ecological rationality. This suggests that these strategies should be reported dependent on an individual's current financial situation. So should an individual with a low income (e.g., a student or unemployed person) report using less strategies for saving, whereas an individual with at least some excess income should report more of these strategies.

Finally, a more general problem with measuring financial wisdom is to judge whether a strategy is actually adaptive in a given decision context. To the end of judging decision making success,

appropriate norms should be established (Baron, 2004). In the present study financial satisfaction was used as a norm of successful financial behavior and decision making. However, financial satisfaction also reflects many external aspects of the financial situation, like income, which act as boundaries to financial satisfaction. Financial satisfaction may therefore not be attainable for everyone, even when following adaptive strategies to deal with money. This observation may call for searching alternative norms in future research.

Another fruitful avenue is to investigate concrete simple strategies or heuristics to adaptively deal with one's daily finance. This may include simple rules to decide when to save or when to take advice and the selection of appropriate strategies. Therefore metacognition should be considered as an aspect of financial wisdom (Antonietti et al., 2016). The investigated strategies may, for instance, also include concrete behavioral rules to adaptively deal with complexity, like only buying financial products one understands (Forbes et al., 2015). Together the approaches delineated above may help to further shed light on the role of financial wisdom in financial decision making.

Sample and data quality. Especially in online samples, data quality is an important concern (Meade & Craig, 2012). The exclusion of roughly thrity partipants following rather lenient filter criteria showed, that careless or inattentive responses might also be an issue in the present data. Results further suggest that careless responding may have been systematically related to characterisitcs of the participants. Compared to the retained participants a greater proportion of excluded participants reported having experienced a drop in income. Moreover, a greater proportion of excluded participants reported not being responsible for financial decisions in the household or at least not being responsible alone. Both findings may be related to individuals being less inclined or able to give reasonable responses. A drop in income may make it unpleasant for participants to consider money-issues and not being responsible may render them with a lack of information on household related financial topics.

These differences might have influenced the results. Results however, did not substantially differ for the full data set and the dataset with some participants excluded. This mitigates but does not fully dispel concern that results might be influenced by poor data quality and inattentiveness. The filtering was done in line with suggestions to combine different indicators (Meade & Craig,

2012). However, there is no gold-standard for which indicators indicators shold be used (DeSimone et al., 2015). Therefore, the set of indicators may not have been optimal. Overall, the negligible differences in filtered and unfiltered data serve to underscore the robustness of the present results. Future research shoudl aim to implement similar tasks in larger household surveys in order to clarify the role of financial wisdom and simple rules for decison mkaing competence.

Study design. The explanatory power of financial wisdom beyond numeracy, suggests a role of financial wisdom that goes beyond cognitive capacities. Nevertheless, future research should also directly investigate whether financial wisdom retains explanatory power beyond individual capacities like intelligence and working memory. Individuals high in financial wisdom should be able to adaptively select from their repertoire of strategies according to their cognitive capacities. People with lower cognitive capacities, for example, are expected to use strategies, which do not exceed their capacities, to adaptively deal with their finance.

As mentioned above, reverse causality of financial wisdom cannot be precluded on emprical grounds. This is especially important, as the mainly cross sectional design of the present study precludes statements about causality. Only the behavior on the investment task fulfills the necessary condition for causality that the behaviors are seperated from the outcome in time (e.g., Schnell, Hill, & Esser, 2011). However, the evidence of the relationship of financial wisdom and behavior on the experimental investment task suggested that other factors are more important. Thus, statements about causal influences of financial wisdom can currently only be made on theoretical grounds. To tackle this issue it is planned to contact the participants of the present study for a follow-up. The goal is to predict changes in financial satisfaction and the occurence of financial events that may be caused by non-adaptive decision making. This design also allows to test construct validity of financial wisdom related to other constructs, like for example general frugality (Lastovicka, Bettencourt, Hughner, & Kuntze, 1999). Moreover, the retest reliability of the financial wisdom measures may be tested to assess stability of the characteristic.

Finally, the present study involved several statistical tests. This may lead to an increased probability of falsely rejecting the null-hypothesis. Therefore, all of the results presented await replication by future studies to test whether they are reliable.

Implications

Due to the limitations above, strong conclusions about the implications of financial wisdom for policy and interventions cannot yet be drawn. Nevertheless, in line with previous findings, the present research suggests that self reported simple rules, attitudes, and behavioral practices are relevant for financial decision making. (Xiao et al., 2014; Drexler et al., 2014; Dholakia et al., 2016). This is evidence, that educating individuals in using simple rules and performing certain behaviors may help them to make better financial decisions.

There is also some evidence that financial literacy is related to actual investment behavior. Although it cannot be excluded that the investment task was rather artificial and my not translate into real world behavior, this can be considered as evidence that financial knowledge is realted to the performance of certain financial behaviors. Financial literacy was, however, not shown to be related to saving behavior and the more global indicator of financial satisfaction. The pattern of results for financial wisdom was reversed: evidence has been shown that financial wisdom is related to both saving behavior and financial satisfaction. More generally, these results indicate that individual differences beyond financial literacy, conceived of as financial knowledge, need to be considered. Especially financial wisdom appears to be a promising candidate.

The lacking relationship of financial literacy to saving behavior and especially financial satisfaction also accounts against relying too strongly on financial literacy. Instead, the evidence suggests that simple rules and behavioral practices may be a better explanation for these type of outcomes. In line with previous criticism this suggests that successful financial decision makers do not necessarily need to rely financial knowledge (Willis, 2008).

Financial decision making is assumed to be important for financial well-being and for society as a whole (Hilgert et al., 2003; Ali et al., 2015). Therefore, policymakers are interested in how individuals can be aided in making better financial decisions (Kozup & Hogarth, 2008; Stolper & Walter, 2017). In general, approaches to aiding individuals in their environment can be summarized into two categories: boosting and nudging (for a review see Hertwig & Grüne-Yanoff, 2017). Boosting has the goal of developing individuals' competence to make successful choices on their own (Hertwig & Grüne-Yanoff, 2017).

Financial literacy has been frequently prescribed as a remdy to bad financial decision making behavior. This would be considered as boosting, as individuals are given additional competence. If financial literacy, however, fails to show an impact on relevant beaviros and decision outcomes, it may be the wrong competence to be increased. The results of the present study suggest that an alternative approach may be increasing financial wisdom instead.

Generally, financial education has been criticized for being too costly (Willis, 2008). Broadly teaching financial literacy may indeed not be a good idea (Alsemgeest, 2015). This is also related to the finding that effects of interventions on finacial literacy decay rapidly (Fernandes et al., 2014). Rather individuals should be educated according to the needs of their current situation (Xiao & O'Neill, 2016). Is increasing financial wisdom then a viable option at all or are other alternatives better suited?

In fact the above thoughts and the present results on financial wisdom might be combined in the context of ecological rationality. First, the results suggest that financial literacy education may be not sufficiently effective. In addition to the cost of such interventions, boosting financial literacy does not seem to be a viable alternative. However, teaching an individual simple rules and behavioral practices needed to handle the current situation may inform simple interventions that reach individuals in a "teachable moment" (Xiao & O'Neill, 2016, p. 720), when it is likely that they retain the new behaviors and strategies. These interventions may potentially be designed to be relativley inexpensive due to their simplicity. Finally, the teaching of rules and behaviors may still be complemented with nudges, changing the environment so that financial wisdom that individuals rely on works best (Hertwig & Grüne-Yanoff, 2017).

As an important next step, successful simple rules and related contexts should be identified. Studies by Drexler et al. (2014), who tested simple rules for accounting among microenterpreneurs in the Dominican Republic or Shefrin and Nicols (2014), who helped individuals identify financial management tools appropriate for their personality and situation may serve as a model for these rules. Further research on financial wisdom may help to design efficient policy interventions in the context of ecological rationality. These interventions may ultimately help to improve financial decision making, aid individuals to deal with increased responsibility in the complex and uncertain

world of finance.

Conclusion

The present study applied the framework of ecological rationality in order to understand financial decision making competence. In this framework, a measure of financial wisdom, the repertoire of attitudes, behavioral practices, and simple rules to deal adaptively with money, was contributed. Evidence was presented that people who rely on these strategies and simple rules are more satisfied with their financial situation and expect to save a greater proportion of their income. The effects of behavioral practices and simple rules extend beyond the frequently advertised remedy of financial literacy. Apparently, building knowledge may neither be a necessary nor an optimal way of improving financial decision making competence. Instead, behaviors and simple strategies should be regarded more strongly. The present concept and measure of financial wisdom provide a first attempt to include simple rules into the explanation of differences in financial decision making competence. Even if this measure—in its present form—does not yet include the aspect of adaptively selecting among strategies, the present results are encouraging that relying on simple rules and strategies is related to superior decision outcomes.

Obviously, the quest for understanding individual financial decision making competence is not over yet. The present measure of financial wisdom is but a small first step into a new direction. The underlying framework of ecological rationality provides a promising avenue to continue, in order to deepen our comprehension of financial decision making and individual financial decision making competence. One major goal is to investigate which simple rules and strategies help to adaptively deal with the complex financial environment. Another goal is to find out, how people adaptively select among these strategies. This might ultimately inform the design of simple interventions, that help to boost individual financial decision making competence, helping individuals to deal with increased responsibility in a complex and uncertain environment, and ultimately increasing financial well-being.

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List of Tables

Appendix A

Instructions investment task

Investment game

Thank you! You are **almost done** with this survey.

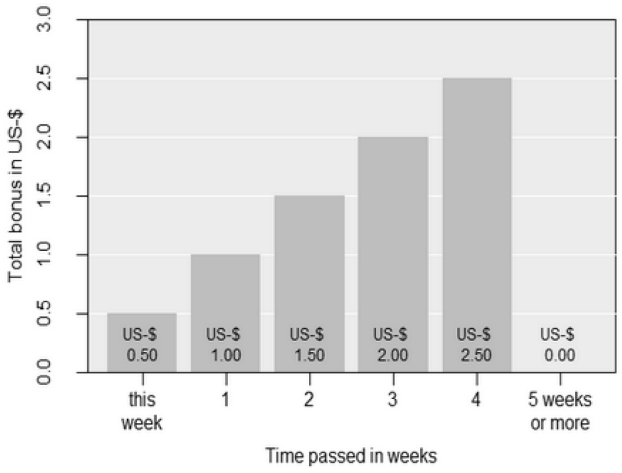
We now award you a **bonus of US-$0.50** that is **independent** of any other bonus payments and the flat fee of US-$1.00 you earned by completing this study.

We want to offer you the **unique opportunity to invest** this bonus with us.

What does this mean?

You can **claim this bonus anytime** (how this is done will be explained below).

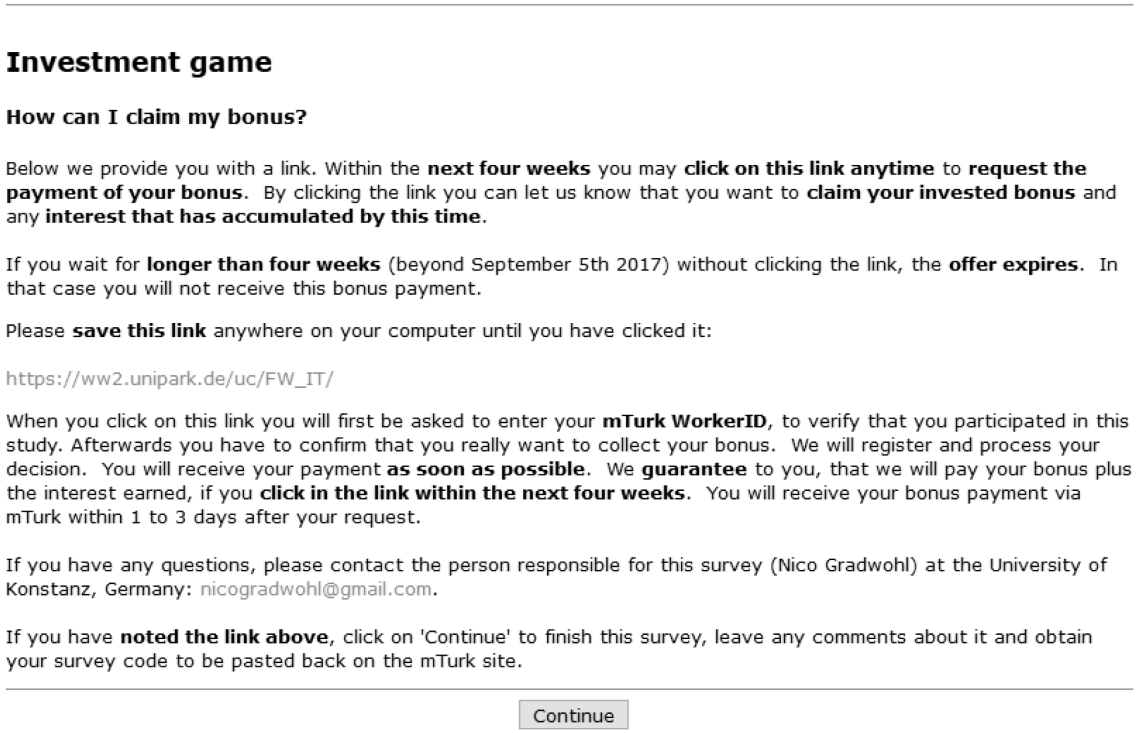
If you **claim your bonus immediately**, you will receive a payment of **US-$0.50**. For a **maximum of four weeks** you can **invest this bonus by delaying its payment**. For **every week you wait** your **bonus increases** by a **simple interest of US-$0.50**. However, if you **do not claim** your investment **within five weeks** (until September 5th), you **forego** this bonus payment. The following figure shows the total value of your bonus from any period of time (from now to five weeks or more):



Thus, **now** or in the **first week** from now (**until August 7th**) you receive **US-$ 0.50**. As soon as at least **one week** has passed (from **August 8th** onwards) you receive a total bonus of **US-$ 1.00**. As soon as at least **two weeks** have passed (from **August 15th** onwards) you receive a total bonus of **US-$ 1.50**, and so on. If you **wait until August 30th** and claim your bonus **before September 5th** you will receive the **maximum bonus payment of US-$ 2.50**. If you wait for **more than four weeks** (beyond **September 5th**) you **forgo your payment** and will **not receive any bonus**.

Click on 'Continue' to learn, **how** you can **collect** your bonus.

Figure A1. Instruction for the investment task showing the payment schedule for the invested bonus payment.



Investment game

How can I claim my bonus?

Below we provide you with a link. Within the **next four weeks** you may **click on this link anytime** to **request the payment of your bonus**. By clicking the link you can let us know that you want to **claim your invested bonus** and any **interest that has accumulated by this time**.

If you wait for **longer than four weeks** (beyond September 5th 2017) without clicking the link, the **offer expires**. In that case you will not receive this bonus payment.

Please **save this link** anywhere on your computer until you have clicked it:

https://ww2.unipark.de/uc/FW_IT/

When you click on this link you will first be asked to enter your **mTurk WorkerID**, to verify that you participated in this study. Afterwards you have to confirm that you really want to collect your bonus. We will register and process your decision. You will receive your payment **as soon as possible**. We **guarantee** to you, that we will pay your bonus plus the interest earned, if you **click in the link within the next four weeks**. You will receive your bonus payment via mTurk within 1 to 3 days after your request.

If you have any questions, please contact the person responsible for this survey (Nico Gradwohl) at the University of Konstanz, Germany: nicogradwohl@gmail.com.

If you have **noted the link above**, click on 'Continue' to finish this survey, leave any comments about it and obtain your survey code to be pasted back on the mTurk site.

Continue

Figure A2. Instruction for the investment task (continued) showing the instructions for claiming the invested bonus payment.

Appendix B

Scale development

Table B1

Financial wisdom items and factor loadings after promax rotation and before exclusions in unfiltered data.

Item Number	Item	F1	F2	F3	F4	F5
34	I gather a lot of information on competing products before buying something.	0.77				
35	I usually shop around for a good deal before purchasing a product.	0.75				
18	I like to be in control of my financial affairs.	0.74				
43	I reduce my spending to pay off debts.	0.66				
22	I frequently check the balance of my main bank account.	0.66				
19	I monitor my income and expenses on a regular basis.	0.60				
20	I know how much money I have available to spend every month.	0.60				
21	I have both short-term and long-term financial goals.	0.54				
28	I sometimes take pleasure in not buying something.	0.48				0.34
31	I do not mind waiting for a pleasant outcome.	0.43				
29	I do not mind restraining my spending.	0.40				
40	I am concerned about my long-term financial future.	0.39				
33	I usually adopt a long-term perspective.	0.39			0.32	
2	Always keep some money for a rainy day.	0.38		0.34		
38	I only invest in financial products that I understand.	0.34				
27	I only buy the things I need.					
30	I frequently spend more than I earn.		0.84			
44	I accumulate credit card debt.		0.81			
39	I increase my savings when I receive a salary increase.		0.63			
45	I always pay off my credit card balance as soon as possible.		0.60			
46	I am impulsive and tend to buy things even when I can't really afford them.		0.54			
14	Money is there to be spent.		0.43			
41	I try to avoid borrowing money.		0.40			
4	Early bird catches the worm.			0.71		
5	A penny saved is a penny earned.			0.64		
13	The rich man plans for tomorrow, the poor man for today.			0.62		
3	If you look after the pennies, the dollars will look after themselves.			0.57		
7	One man's loss is another man's gain.			0.49		
15	If you lack money, work more rather than borrow.			0.45		
11	Always be modest in spending.			0.45		
8	Out of debt, out of danger.			0.44		
1	Never spend more than you earn.		0.39	0.41		
16	Improve your education to increase your income.			0.40	0.35	
12	Always save a part of any money you receive.	0.30		0.39		
9	Don't throw good money after bad.			0.37		
37	If you don't speculate, you won't accumulate.					
25	When deciding how to save or invest my money, I make the same choices as successful investors I know or have heard about.				0.68	
24	When deciding how to save or invest my money, I follow the advice of independent professional financial advisors.				0.67	
26	When deciding how to save or invest my money, I do what most other people are doing.		0.37		−0.66	
23	When deciding how to save or invest my money, I make the same choices as my family members or friends did.				0.49	
36	I combine secure and risky investments (e.g., bonds and stocks).				0.47	
47	I take calculated risks.				0.44	
42	I tend to forget when I owe someone money.	0.35			−0.36	
6	It is better to give than to receive.					0.98
10	Give generously to others and you shall receive in return.					0.71
17	Money can't buy happiness.					0.55
32	I aim to leave an inheritance when I die.					0.31

Table B2

Financial wisdom items and factor loadings after promax rotation and before item exclusions in filtered data.

Item Number	Item	F1	F2	F3	F4	F5
43	I reduce my spending to pay off debts.	0.73				
18	I like to be in control of my financial affairs.	0.67				
34	I gather a lot of information on competing products before buying something.	0.62				
35	I usually shop around for a good deal before purchasing a product.	0.62				
20	I know how much money I have available to spend every month.	0.61				
28	I sometimes take pleasure in not buying something.	0.61				0.37
22	I frequently check the balance of my main bank account.	0.58				
19	I monitor my income and expenses on a regular basis.	0.58				
21	I have both short-term and long-term financial goals.	0.56			0.33	
33	I usually adopt a long-term perspective.	0.47			0.41	
27	I only buy the things I need.	0.47				
29	I do not mind restraining my spending.	0.46				
31	I do not mind waiting for a pleasant outcome.	0.42				
38	I only invest in financial products that I understand.	0.37				
2	Always keep some money for a rainy day.	0.32	0.3			
4	Early bird catches the worm.		0.74			
5	A penny saved is a penny earned.		0.70			
13	The rich man plans for tomorrow, the poor man for today.		0.6			
3	If you look after the pennies, the dollars will look after themselves.		0.56			
7	One man's loss is another man's gain.		0.56			
15	If you lack money, work more rather than borrow.		0.51			
8	Out of debt, out of danger.		0.43			
11	Always be modest in spending.		0.41			
16	Improve your education to increase your income.		0.36		0.34	
12	Always save a part of any money you receive.		0.35			
9	Don't throw good money after bad.		0.34			
37	If you don't speculate, you won't accumulate.					
30	I frequently spend more than I earn.			0.78		
44	I accumulate credit card debt.			0.77		
39	I increase my savings when I receive a salary increase.			0.53	0.32	
46	I am impulsive and tend to buy things even when I can't really afford them.	0.34		0.50		
45	I always pay off my credit card balance as soon as possible.			0.48		
41	I try to avoid borrowing money.			0.48		
1	Never spend more than you earn.		0.40	0.43		
14	Money is there to be spent.			0.31		
40	I am concerned about my long-term financial future.					
25	When deciding how to save or invest my money, I make the same choices as successful investors I know or have heard about.				0.69	
24	When deciding how to save or invest my money, I follow the advice of independent professional financial advisors.				0.62	
26	When deciding how to save or invest my money, I do what most other people are doing.				−0.61	
36	I combine secure and risky investments (e.g., bonds and stocks).				0.54	
47	I take calculated risks.				0.52	
23	When deciding how to save or invest my money, I make the same choices as my family members or friends did.				0.38	
42	I tend to forget when I owe someone money.	0.34			−0.36	
32	I aim to leave an inheritance when I die.					
6	It is better to give than to receive.					0.96
10	Give generously to others and you shall receive in return.					0.67
17	Money can't buy happiness.					0.51

Table B3

Financial wisdom items and factor loadings after promax rotation in filtered data after exclusion of seven items.

Item Number	Item	F1	F2	F3	F4	F5
43	I reduce my spending to pay off debts.[b]	0.71				
34	I gather a lot of information on competing products before buying something.[b]	0.68				
35	I usually shop around for a good deal before purchasing a product.	0.67				
22	I frequently check the balance of my main bank account.	0.63				
18	I like to be in control of my financial affairs.[b]	0.61				
28	I sometimes take pleasure in not buying something.	0.6				0.32
20	I know how much money I have available to spend every month.	0.59				
19	I monitor my income and expenses on a regular basis.	0.56				
27	I only buy the things I need.	0.48				
21	I have both short-term and long-term financial goals.	0.47				
29	I do not mind restraining my spending.	0.44				
31	I do not mind waiting for a pleasant outcome.	0.39				
38	I only invest in financial products that I understand.	0.35				
2	Always keep some money for a rainy day.					
4	Early bird catches the worm.[b]		0.76			
5	A penny saved is a penny earned.[b]		0.75			
13	The rich man plans for tomorrow, the poor man for today.		0.64			
3	If you look after the pennies, the dollars will look after themselves.		0.62			
15	If you lack money, work more rather than borrow.[b]		0.55			
8	Out of debt, out of danger.		0.46			
11	Always be modest in spending.		0.43			
12	Always save a part of any money you receive.		0.36			
9	Don't throw good money after bad.		0.32			
14	Money is there to be spent.[a]		0.32			
30	I frequently spend more than I earn.[a,b]			0.85		
44	I accumulate credit card debt.			0.78		
39	I increase my savings when I receive a salary increase.[b]			0.55		
46	I am impulsive and tend to buy things even when I can't really afford them.			0.54		
45	I always pay off my credit card balance as soon as possible.			0.5		
41	I try to avoid borrowing money.[b]			0.49		
1	Never spend more than you earn.		0.4	0.44		
25	When deciding how to save or invest my money, I make the same choices as successful investors I know or have heard about.[b]				0.73	
24	When deciding how to save or invest my money, I follow the advice of independent professional financial advisors.				0.64	
26	When deciding how to save or invest my money, I do what most other people are doing.[a,b]				−0.6	
36	I combine secure and risky investments (e.g., bonds and stocks).				0.53	
47	I take calculated risks.				0.5	
23	When deciding how to save or invest my money, I make the same choices as my family members or friends did.				0.4	
6	It is better to give than to receive.[b]					0.94
10	Give generously to others and you shall receive in return.[b]					0.64
17	Money can't buy happiness.					0.45
	Variance explained by each factor:	0.12	0.09	0.09	0.06	0.05

Note: F1: Monitoring and managing money, F2: Susceptibility to folk wisdom, F3: Control spending, F4: Social influence and risk, F5: Generosity.
[a]: Item reverse coded. [b]: item included in FW-15 shortscale.

Appendix C

Additional results

Table C1

Correlations between variables used in analyses for unfiltered data.

	Variable	1	2	3	4	5	6	7	8	9	10
1	FW-39	–									
2	Control	**0.73**	–								
3	Folk wisdom	**0.75**	**0.61**	–							
4	Spending	**0.68**	**0.61**	**0.50**	–						
5	Social and risk	**0.43**	0.08	0.11	0.09	–					
6	Generosity	**0.61**	0.23	**0.33**	0.07	0.05	–				
7	FW-15	**0.93**	**0.75**	**0.74**	**0.67**	0.25	**0.59**	–			
8	Financial literacy	0.23	**0.28**	**0.28**	0.26	0.08	−0.05	**0.27**	–		
9	Subjective knowledge	**0.42**	**0.38**	0.24	**0.35**	0.20	0.18	**0.43**	0.20	–	
10	Subjective capability	**0.35**	**0.52**	**0.28**	**0.46**	−0.06	0.03	**0.42**	**0.27**	**0.42**	–
11	Numeracy	0.09	0.12	0.05	0.24	0.12	−0.18	0.07	**0.61**	0.01	0.16
12	PSO	**0.74**	**0.75**	**0.60**	**0.67**	**0.27**	0.20	**0.72**	0.23	**0.39**	**0.46**
13	Extraversion	0.11	0.01	0.05	−0.08	0.20	0.14	0.02	−0.22	0.07	−0.07
14	Agreeableness	**0.49**	**0.35**	**0.36**	0.20	0.10	**0.50**	**0.46**	−0.08	0.26	0.20
15	Conscientiousness	**0.49**	**0.42**	**0.41**	**0.33**	0.15	**0.29**	**0.50**	0.08	**0.38**	**0.36**
16	Neuroticism	−0.25	−0.15	−0.11	−0.25	−0.17	−0.10	−0.21	0.00	**-0.32**	−0.13
17	Openness	0.08	0.09	0.03	−0.03	0.06	0.08	0.04	0.08	−0.02	0.08
18	DGI-10	**0.62**	**0.66**	**0.48**	**0.53**	0.05	**0.32**	**0.63**	0.22	**0.48**	**0.48**
19	Financial satisfaction	**0.40**	0.25	0.22	**0.39**	0.23	0.18	**0.39**	0.03	**0.34**	0.24
20	*ln*(Expected income)	0.21	0.15	0.16	0.06	0.25	0.06	0.23	0.17	0.23	0.12
21	*ln*(Expected expenses)	0.14	0.11	0.16	0.00	0.20	0.02	0.15	0.23	0.24	0.14
22	*ln*(Expected savings or debt)	0.21	0.13	0.11	0.12	0.21	0.09	0.24	0.05	0.13	0.06
23	Proportion expected to save	0.11	−0.02	0.02	0.07	0.16	0.07	0.06	−0.13	0.00	−0.01
24	*ln*(Total savings)	0.18	0.13	0.13	0.13	0.17	0.03	0.20	0.17	0.15	0.11
25	Total wealth	0.19	0.12	0.14	0.16	0.14	0.07	0.21	0.13	0.09	0.14
26	Amount of loans	0.18	0.18	0.19	0.07	0.06	0.09	0.19	0.15	0.20	0.17
27	Experienced drop in income	−0.26	−0.17	−0.12	−0.26	−0.14	−0.14	−0.23	−0.21	−0.23	−0.16
28	Age (years)	−0.09	−0.01	−0.03	−0.18	−0.03	−0.02	−0.03	0.20	0.04	0.14
29	Attention check score	**0.27**	**0.37**	**0.37**	0.21	−0.13	0.12	**0.32**	**0.39**	0.04	**0.30**

	Variable	11	12	13	14	15	16	17	18	19	20
11	Numeracy	–									
12	PSO	0.15	–								
13	Extraversion	−0.24	0.05	–							
14	Agreeableness	−0.14	**0.33**	**0.27**	–						
15	Conscientiousness	−0.04	**0.41**	0.06	**0.43**	–					
16	Neuroticism	0.06	−0.21	−0.20	**-0.41**	**-0.31**	–				
17	Openness	0.02	0.11	0.08	0.08	0.08	−0.06	–			
18	DGI-10	0.04	**0.62**	0.06	**0.48**	**0.59**	**-0.37**	0.18	–		
19	Financial satisfaction	0.02	**0.39**	0.07	0.23	**0.31**	**-0.33**	0.03	**0.35**	–	
20	*ln*(Expected income)	0.03	0.18	−0.04	0.07	0.13	−0.07	−0.04	0.15	0.23	–
21	*ln*(Expected expenses)	0.08	0.13	−0.01	0.02	0.07	0.00	−0.09	0.09	0.10	**0.86**
22	*ln*(Expected savings or debt)	−0.05	0.18	−0.05	0.09	0.15	−0.13	0.05	0.17	**0.34**	**0.77**
23	Proportion expected to save	−0.12	0.12	0.09	0.03	0.06	−0.12	0.05	0.03	**0.32**	0.03
24	*ln*(Total savings)	0.13	0.17	−0.05	−0.02	0.07	−0.11	0.09	0.12	0.21	**0.34**
25	Total wealth	0.02	0.13	−0.10	0.14	0.13	−0.11	−0.04	0.16	0.16	**0.55**
26	Amount of loans	0.04	0.18	0.00	0.08	0.06	0.01	−0.04	0.09	0.02	**0.47**
27	Experienced drop in income	−0.21	−0.17	−0.01	−0.16	−0.13	0.21	0.02	−0.23	**-0.41**	−0.19
28	Age (years)	0.08	−0.09	0.04	0.00	0.11	−0.03	−0.08	0.00	−0.18	0.06
29	Attention check score	0.24	0.25	−0.13	0.10	0.22	0.01	0.12	**0.28**	−0.02	−0.05

	Variable	21	22	23	24	25	26	27	28	29
21	*ln*(Expected expenses)	–								
22	*ln*(Expected savings or debt)	**0.35**	–							
23	Proportion expected to save	−0.16	**0.31**	–						
24	*ln*(Total savings)	**0.29**	**0.28**	0.08	–					
25	Total wealth	**0.39**	**0.52**	0.08	**0.34**	–				
26	Amount of loans	**0.54**	0.22	−0.03	**0.36**	**0.35**	–			
27	Experienced drop in income	−0.11	−0.24	−0.20	−0.13	−0.20	−0.08	–		
28	Age (years)	0.17	−0.11	−0.20	0.15	−0.03	0.05	0.04	–	
29	Attention check score	−0.01	−0.08	0.01	0.04	0.07	0.06	−0.24	0.12	–

Note: Values that appear in boldface are at least significant at the $p < 0.05$ *level of significance.*

Table C2
Regression models on financial satisfaction for filtered data.

Variable	Model 1		Model 2		Model 3		Model 4 (FW-15)	
	B	95% CI	B	95% CI	B	95% CI	B	95% CI
Constant	0.02	[−0.16, 0.20]	0.63	[−0.24, 1.49]	0.74	[−0.12, 1.60]	0.79	[−0.08, 1.66]
Agreeableness[a,b]	−0.05	[−0.22, 0.11]	−0.07	[−0.23, 0.10]	−0.12	[−0.29, 0.05]	−0.11	[−0.28, 0.06]
Conscientiousness[a,b]	0.07	[−0.10, 0.25]	0.07	[−0.10, 0.24]	0.04	[−0.13, 0.21]	0.04	[−0.13, 0.21]
Extraversion[a,b]	0.03	[−0.12, 0.18]	0.01	[−0.13, 0.16]	0.00	[−0.14, 0.15]	0.02	[−0.12, 0.17]
Neuroticism[a,b]	−0.19*	[−0.34, −0.03]	−0.19*	[−0.34, −0.03]	−0.20*	[−0.35, −0.05]	−0.21**	[−0.36, −0.05]
DGI-10[a,b]	−0.02	[−0.22, 0.19]	0.00	[−0.20, 0.21]	−0.01	[−0.22, 0.19]	−0.02	[−0.22, 0.18]
PSO[a,b]	0.26**	[0.08, 0.43]	0.25**	[0.08, 0.43]	0.13	[−0.08, 0.34]	0.14	[−0.07, 0.34]
Subjective knowledge[a,b]	0.19*	[0.02, 0.36]	0.22*	[0.05, 0.40]	0.20*	[0.03, 0.38]	0.20*	[0.02, 0.37]
Subjective capability[a,b]	0.02	[−0.14, 0.18]	0.02	[−0.14, 0.18]	0.04	[−0.12, 0.20]	0.03	[−0.13, 0.19]
Numeracy[a]	0.00	[−0.07, 0.07]	0.03	[−0.05, 0.11]	0.03	[−0.05, 0.11]	0.04	[−0.04, 0.12]
BNT familiar	−0.04	[−0.33, 0.25]	−0.03	[−0.32, 0.26]	−0.01	[−0.30, 0.27]	−0.03	[−0.31, 0.26]
Numeracy × BNT familiar	0.00	[−0.10, 0.11]	0.00	[−0.11, 0.10]	0.00	[−0.11, 0.10]	−0.01	[−0.11, 0.10]
Financial literacy			−0.06	[−0.14, 0.02]	−0.07	[−0.16, 0.01]	−0.08	[−0.16, 0.01]
Financial wisdom[a,b]					0.22*	[0.01, 0.43]	0.23*	[0.02, 0.43]
$R^2(adjusted)$	.251 (.201)		.260 (.206)		.279 (.221)		.281 (.224)	
F	4.99		4.77		4.82		4.88	
df	11, 164		12, 163		13, 162		13, 162	
p	< .001		< .001		< .001		< .001	
$\Delta R^2(adjusted)$	.251 (.201)		.009 (.005)		.019 (.015)		.003 (.003)	
p of ΔR^2	< .001		.154		.042		–	

Note. $N = 176$, CI = confidence interval. The outcome financial satisfaction was scaled and centered to allow for a straightforward interpretation as zero being the mean and an increase of one being one SD. [a] Predictor was centered on the mean. [b] Predictor was scaled. [ln] Predictor was transformed using the natural logarithm. $^*p < .05$, $^{**}p < .01$, $^{***}p < .001$.