

KNOWING WHAT NOT TO DO: FINANCIAL LITERACY AND CONSUMER CREDIT CHOICES*

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Abstract

We analyze whether the frequent use of credit lines is rational or influenced by behavioral traits of households. We consider the special case of Germany where credit lines on current accounts are available to 80% of the population. We document that the excessive usage of costly credit lines is more likely for people who give intuitive but incorrect answers in the Cognitive Reflection Test. Our analysis of a rich sample of household data also provides evidence that a higher level of financial literacy can help to improve consumer credit choices.

JEL-Classification: D12, D14

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1 Introduction

Economic theory assumes that households consume, save or take out loans according to the life-cycle hypothesis (Modigliani and Brumberg, 1954). This normative framework predicts that households borrow in expectation of increasing income and smooth their consumption over time according to their time-consistent preferences. In order to explain empirical observations of households' financial decisions (e.g. Campbell, 2006; Bernheim, Skinner, and Weinberg, 2001), normative theory has been augmented by behavioral aspects. The behavioral life-cycle theory by Shefrin and Thaler (1988) relaxes the assumption about time-consistent preferences. The model formally captures internal conflicts in the decision process caused by rational and emotional aspects of an individual's personality.

Our evidence on credit line usage is consistent with predictions of the behavioral life-cycle model in the sense that impulsively deciding individuals are much more likely to consume on credit. Specifically, we find that very impulsive individuals are about 37 percent more likely to frequently (i.e. more than six times a year or constantly) rely on short-term credit than their reflective counterparts. Since they tend not to engage in rationally reflecting on their decisions, we conclude that impulsive people irrationally decide to overly use short-term debt. Beyond behavioral aspects explaining deviations from normative theory, limited understanding of financial products and the inability to perform financial computations may lead vulnerable households to incur high costs by relying on short-term debt. We find that financial literacy has a mitigating effect which diminishes the effect of lacking reflectiveness.

Germany provides ideal testing conditions for the questions at hand, since a specific form of short-term credit, namely credit lines on current accounts, is broadly available among all population strata.¹ About 80 percent of German households are eligible to use a credit line on their current account so that sample selection is not an important issue. Half of those with access to credit lines use them at least occasionally. Credit lines are a convenient but also costly credit product to smooth consumption in the face of temporary liquidity gaps. The interest rates charged at about 10 to 20 percent p.a. are considered to be expensive.² Credit lines are used without professional consultation and their

¹Note that of the different overdraft programs common in the US (credit lines, linked accounts, automated overdrafts) only overdraft lines of credit are common in Germany. We will focus exclusively on these credits and refer to them as overdraft (lines of) credit, overdraft lines or credit lines interchangeably.

²Although subjective, this judgment is the prevailing view in the political debate in which e.g. the German Federal Ministry of Consumer Protection (BMELV) has appealed to credit institutions to decrease interest charges on credit limits.

size is substantial: They usually amount to a multiple of the consumer’s net monthly income. If individuals without a tendency to reflect and with lacking sophistication are unable to fully conceive the consequences of their debt decision, concerns arise that they will incur significant costs on these credits. Especially if they roll over their outstanding balances from month to month.

We obtain information on credit line usage from the SAVE survey, which is representative for the German population and comprises rich information about financial decisions as well as socio-economic characteristics of more than 2,000 German households. Because of the similarities between German credit lines and credit card accounts our results are also informative for conclusions about credit card usage in countries such as the U.S. where credit cards are more prevalent.³ Moreover, in Germany credit limits are based on current accounts such that their use is independent of the method of payment. Therefore, the specific institutional setup in Germany enables us to unambiguously measure credit decisions rather than a mixture of credit decisions and transaction method choices. This is an advantage compared to the literature on the use of credit cards (e.g. [Klee, 2008](#); [Koulayev, Rysman, Schuh, and Stavins, 2012](#)).

Following the predictions from behavioral life-cycle theory we hypothesize that individual borrowing behavior is influenced by cognitive reflectiveness. The model by [Shefrin and Thaler \(1988\)](#) integrates the conflict of two coexisting selves with mutually inconsistent preferences into the individual’s optimization problem by a dual preference structure. While the far-sighted planner in an individual is concerned with the long term, the pathologically myopic doer prefers to consume right away.⁴ According to the behavioral life-cycle model, impulsive doers do not rationally reflect whether to consume on costly short-term credit and forgo future consumption. In our analysis of individuals’ credit decisions we measure an individual’s tendency to rely on consciously controlled processes rather than automatic first intuitions by their *cognitive reflectiveness*. The distinction of deliberate, sequential thinking as opposed to impulsive fast answers also complies neatly with a dual process framework in the sense of [Stanovich and West \(2000\)](#) about a deliberative and rational System 2 and an impulsive and intuitive System 1.

³Less than 4 percent of all payment cards in Germany are true credit cards according to the statistics of the Statistics on Payments and Securities Trading, Clearing and Settlement in Germany 2008 to 2012 by the Deutsche Bundesbank, which is why an analysis of credit card usage would not yield results representative for a broader population.

⁴Dual processing theory is backed by neuroeconomic evidence that short-term impulsive behavior is associated with the activity of different areas of the brain than long-term planned behavior ([McClure, Laibson, Loewenstein, and Cohen, 2004](#)). It has recently also become a topic in popular scientific discourse thanks to [Kahneman \(2011\)](#) "Thinking, Fast and Slow".

Abstracting from behavioral explanations households may not be able to make optimal decisions due to a lack of *financial literacy*, as put forth by e.g. [Lusardi and Mitchell \(2011\)](#), and therefore be unaware that they hold costly levels of short-term debt. Recently, research on financial literacy has extended its focus from investment decisions⁵ to credit-related issues, such as credit conditions and in particular high cost credit ([Disney and Gathergood, 2013](#); [Lusardi and Mitchell, 2013](#)), credit card usage and over-indebtedness ([Lusardi and Tufano, 2009](#)), the delinquency on (general) debt ([Disney and Gathergood, 2011](#)) and subprime mortgages ([Gerardi, Goette, and Meier, 2010](#)). Recapitulating our result that impulsive consumers are likely to overly rely on credit lines irrationally, we ask whether knowing better would help them - or whether being impulsive dominates better knowledge. Whether financial literacy impacts credit usage decisions beyond a person's tendency to be impulsive or reflective remains an empirical question we investigate. In fact, we find a mitigating effect of financial literacy which diminishes the effect of lacking reflectiveness: according to our evidence, the understanding of financial products and markets leads impulsive individuals to rely on short-term credit as seldom as their less knowledgeable but more reflective peers, i.e. the probability that an impulsive individual frequently uses a credit line is decreased by 23 percent if she is financially literate.

The distinction between behavioral and educational drivers of credit decisions is important as it requires different responses from economic policy: behavioral arguments typically call for tighter regulations of financial activities (e.g. limiting accessibility to loans or the maximum amount to be taken out), which is expected to protect consumers from making adverse decisions. In contrast, evidence in favor of financial literacy as the driver of financial decisions is often taken as a proof that financial education is improving financial decisions ([van Rooij, Lusardi, and Alessie, 2011](#); [Guiso and Jappelli, 2009](#); [Bucher-Koenen and Lusardi, 2011](#)). Hence, the explanatory power of each argument from our analysis may inform political choices between extending regulation or financial education.

Analyzing the interplay of impulsiveness and financial literacy is related to a study by [Gathergood \(2012\)](#). He confirms a relation between lacking self-control, financial illiteracy and more frequent use of quick-access, high-cost credit products such as in-store credit cards, mail order catalogues, home credit and pay-day loans. Compared to these products, we expect impulsive individuals to be much more prone to misuse credit lines - the credit product in our focus - since credit lines can be accessed

⁵Concerning investment decisions a lack of financial literacy is associated with inadequate saving decisions ([Lusardi and Mitchell, 2007](#); [Bucher-Koenen and Lusardi, 2011](#); [van Rooij, Lusardi, and Alessie, 2012](#)), with lower stock market participation ([van Rooij, Lusardi, and Alessie, 2011](#)) and with lower portfolio diversification ([Guiso and Jappelli, 2009](#)).

with even greater ease without consultation, simply by withdrawals from the current account or by cashless payments. Furthermore, credit lines are available to a larger share of the population. Besides, while Gathergood (2012) relies on a self-assessed proxy of self-control, our measure of impulsiveness is derived from an established performance test.

2 Data

We empirically analyze whether short-term credit decisions are driven by an individual's impulsiveness. Comparing usage profiles of impulsive consumers to those of reflective individuals allows us to draw conclusions whether their credit demand is rational. Furthermore, we investigate whether knowing better, i.e. being financially literate, can enhance credit decisions given the personal level of impulsiveness. To do so, we analyze a unique dataset which comprises rich information about financial decisions as well as socio-economic characteristics of German households - the SAVE study conducted regularly until 2010 by the Munich Institute of the Economics of Aging (MEA). The survey is representative for the German population and covers information on demographic and economic characteristics, focusing on savings and old-age provisions. The data is particularly well suited to link individual traits to detailed information about the household balance sheet and socio-demographic characteristics, and has already been used for research on financial literacy by, e.g., Bucher-Koenen and Lusardi (2011), Bucher-Koenen and Ziegelmeyer (forthcoming) and Glaser and Klos (2012).⁶ For the purposes of our analysis, we have to content ourselves with cross sectional data from the survey year 2009 because this questionnaire is the only one including a special module comprising a measure, which differentiates between impulsive personalities and those who tend to reflect more on their decisions. Contrary to earlier studies, we do not rely on imputed values in the SAVE data, neither for descriptive statistics nor for regression results, but instead reconstruct missing values. We decided to apply this approach because missing values mainly stem from our explanatory variables for which it is uncommon to use imputed values.⁷

Concerning consumer credit, we focus on a question from the survey eliciting the usage frequency of

⁶For a detailed description of the design and the results of the survey please refer to Börsch-Supan, Coppola, Essig, Eymann, and Schunk (2009).

⁷Control variables are only very seldom missing if the explanatory variables are provided. In Section 4 we include a robustness test, verifying that our results are not driven by a non-response bias.

overdraft lines of credit on checking accounts (“Dispositionskredite”). As documented by the household survey, about 80 percent of all households in Germany are eligible to use a credit line on their current account. In 2009, 2,176 out of 2,222 respondents (98 percent) indicate whether their checking accounts possess an overdraft line of credit. Of the 1,733 respondents with an available credit line, 97 percent indicate the frequency of consumer credit use. The participants can choose among the four predefined answers “never”, “1 to 3 times a year”, “4 to 6 times a year”, “more often or constantly”. Hence, the variable of interest regarding the usage of overdraft is of categorial nature and censored on both sides (naturally censored by zero on the lower bound and by questionnaire design on the upper bound). The distribution of answers on usage frequency is displayed in Table 1. The largest share of 46.8 percent of respondents indicate to never use overdraft credit, but there is also a considerable fraction of 17 percent who answer that they use overdraft credit more than six times a year or constantly (we will refer to this group as the frequent usage group).

[Insert Table 1 here.]

Since we ask whether individuals rationally decide to use their credit lines, we analyze their rational-thinking skills by the Cognitive Reflection Test (CRT) suggested by [Fredrick \(2005\)](#). The CRT is comprised of three tasks provided in Appendix A.⁸ The tasks are constructed in a way to trigger an intuitive response which comes to mind effortlessly but is incorrect. An individual with higher disposition to reflect is likely to question the intuitive response and eventually to detect the mistake. Because of this reasoning, [Toplak, West, and Stanovich \(2012\)](#) interpret the CRT as a direct measure of rational thought in line with a high correlation between the CRT and a rational-thinking measure. They underline this notion by pointing to the fact that cognitive ability is no guarantee that people will engage in deliberate thinking which is mirrored in the CRT test results of highly select students at MIT, Princeton, and Harvard who also provided the impulsive answers in [Fredrick \(2005\)](#). One advantage of the CRT as a measure of reflectiveness stems from the fact that it is a performance measure and therefore not prone to potential self-reporting biases. Although the CRT has been found to be a potent predictor of performance on a wide sample of tasks from the heuristics-and-biases literature (e.g., [Toplak, West, and Stanovich, 2012](#); [Fredrick, 2005](#); [Cokely and Kelley, 2011](#); [Campitelli, 2010](#); [Oechssler, 2009](#)), the CRT has thus far not been associated with real life financial outcomes. We

⁸The first task the “bat-and-ball puzzle” has been introduced in [Kahneman and Frederick \(2002\)](#) and is also featured in [Kahneman \(2011\)](#), pp. 44-49.

hypothesize that respondents will behave analogically in everyday financial decision making.

The distribution of responses to the questions are reported in Table 2, Panel A. The CRT is successful in that the majority of respondents provide either the impulsive or the correct response (around three quarters in the three questions, or less than 10 percent of incorrect but non-impulsive answers). The questions of the CRT are not difficult in the sense that it is easy to verify, that the answer that comes to mind impulsively is incorrect and the correct solution is understood when explained to subjects. While two out of the three exercises were answered correctly by about 40 percent of respondents in each case, the prominent "bat-and-ball" problem triggered the impulsive wrong answer in two thirds of responses. Nearly one half of the survey participants answer all three questions incorrectly (see Table 2, Panel B). The proportion of respondents answering all questions correctly amounts to only 13.9 percent. On average 1.26 questions are answered correctly.⁹

[Insert Table 2 here.]

We deduct our proxy for financial literacy from a comprehensive module of questions included in the 2009 SAVE survey. These multiple choice questions are a subset of the questions by [van Rooij, Lusardi, and Alessie \(2011\)](#) and provided in Appendix B.¹⁰ The questions aim at evaluating the ability to solve basic mathematical problems occurring in financial markets (interest rate compounding, real vs. nominal quantities), and to comprehend the intuition behind specific financial products. In this way, our measure of financial literacy aggregates information from mathematical and institutional questions. A subset of four questions captures basic financial concepts such as percentage calculus numerical skills as in [Lusardi and Mitchell \(2008\)](#) and [Bucher-Koenen and Lusardi \(2011\)](#). These skills are certainly necessary in context of financial decisions which often involve compounding interest and inflation considerations. Since the questions do not require deep financial-market specific knowledge, we will refer to them as basic financial literacy or numeracy as also suggested by [Lusardi \(2012\)](#). Five advanced questions assess more innate financial concepts regarding knowledge of financial assets'

⁹The distribution of reflectiveness across groups formed according to education, age, and gender is reported in Appendix C, Panel A. The distribution of results compares closest to that of the web-based studies reported in [Fredrick \(2005\)](#). This is plausible, given that the resemblance between our sample and the online participants is probably higher compared to students from Harvard, MIT, Princeton, but also less selective U.S. universities who formed the other test groups.

¹⁰In the survey years 2007 and 2008 a set of three questions was included. Besides the broader scope of the questions, in 2009 the respondents could for the first time actively indicate that they cannot or do not want to answer. This option reduces the probability that individuals try to guess the correct answer and therefore allows for a clearer definition of the proxy for financial literacy. For an extensive literature review on papers measuring financial literacy, please refer to [Fernandes, Lynch Jr., and Netemeyer \(forthcoming\)](#).

characteristics, the stock market, risk-return relationship and diversification. While in context of investment decisions financial literacy is often considered to be an endogenous variable we perceive it unlikely that people can learn about the principles of stock, bond and fund investments from their experience with short-term consumer credit products. We therefore argue the direction of causality to go uniquely from financial literacy to credit usage.

The empirical distribution of responses is reported in Table 3 and the distribution of basic and advanced financial literacy across sub-groups for education, age, and gender is reported in Appendix C, Panels B and C. Table 3 Panel A shows that some basic and advanced financial concepts are conceived better or worse than others. Very broadly speaking, each question is answered correctly by about 50 to 80 percent of respondents. Especially the concepts of interest compounding, when a realistic interest rate for a savings account is assumed (basic question 1), and return volatility of different assets (advanced question 1) are well understood. However, one more difficult advanced question about the relation between interest rate and fixed coupon bonds is answered correctly by only 9.4 percent of respondents. With respect to the advanced questions, respondents indicated much more frequently that they cannot or do not want to answer a question instead of answering incorrectly than for the basic questions. Panel B reports the fractions of respondents who were able to answer a specified number of questions correctly. If the number of correct answers is zero, respondents answered either incorrectly, indicated that they do not know the correct answer or completely refused to answer questions. About 40 percent of respondents answer at least 4 questions correctly. The mean of correct answers is 5. Close to 60 percent of participants indicate at least once that they do not know the correct answer, which is evidence for the importance of providing this answering option.

[Insert Table 3 here.]

The analysis takes into account several demographic characteristics of the respondent and the household as a whole which potentially play a role in the context of overdraft credit usage. According to normative theory household net wealth¹¹, monthly net income, respondent age, as well as family and employment status influence consumers' debt demand. Since life-cycle theory suggests a non-linear relation between credit demand and age we also include squared age (scaled by 100 in order to enhance readability of coefficient estimates). We furthermore include education as a rough proxy for

¹¹We include quartiles of net log wealth in order to reduce noise from imprecise estimates on asset and debt positions. For a more detailed description of assets included and descriptive statistics please refer to Appendix E

general cognitive skills and occupation in order to address the argument, that occupational groups may be assessed differently in banks’ credit worthiness tests. More specifically, respondents indicate whether they are blue- or white-collar workers, civil servants, self-employed, retired or others (e.g. student). The family status is captured by a dummy variable indicating whether the household is a single person or lives together with a partner and we also take into account number of children in the household. Education is measured by respondents’ schooling experience: as in Germany at least a lower secondary education (“Hauptschulabschluss”) is compulsory, we capture higher education by mid-level education (“Mittlere Reife” or equivalent) and A-level education (“(Fach-)Hochschulreife”). We furthermore include respondents’ gender and the self-assessed extent of respondents economics education at school or during an apprenticeship (measured by a seven point Likert scale) which are important control variables in the tests of the impact of financial literacy. We provide a descriptive overview of the usage frequency of overdraft lines of credit across demographic groups in Appendix D. Detailed descriptive statistics of demographic control variables are included in [Bucher-Koenen and Lusardi \(2011\)](#).

3 Empirical Analysis

Our empirical analysis proceeds in several steps. First, we introduce our econometric approach to analyze determinants of consumer credit usage (Section 3.1). Applying this approach, we evaluate our hypothesis that an individual’s tendency to reflect or to decide impulsively will influence short-term credit decisions. We deduct whether credit usage behavior can be judged rational (Section 3.2). In a further step we ask whether knowing better, i.e. being financially literate, can enhance credit decisions given the personal level of impulsiveness (Section 3.3).

3.1 Econometric approach

We take a systematic look at the determinants of the usage frequency of short-term consumer credit, $Creditfreq^*$. First, we focus on the role of cognitive reflection, CRT , and include (depending on the specification) a battery of control variables Φ on the RHS of the equation, i.e.

$$Creditfreq_i^* = \beta CRT_i + \gamma' \Phi_i + \epsilon_i \tag{1}$$

The vector of control variables Φ includes (log) income, wealth quartiles, age, squared age (scaled by 100), gender, family status, dummy variables for the occupational status (white-collar employees being the base group), for the educational status (a lower secondary degree being the base group), respondents' self-assessed extent of economic education, as well as a dummy variable capturing unemployment of the respondent and/or the respondent's spouse. As the data about the usage of consumer credit is of categorical nature (there are four subgroups), $Creditfreq^*$ is not directly observable; hence, we consider Eq. (1) a latent variable model and run ordered probit regressions.

3.2 Reflectivity and consumer credit usage

We hypothesize that individuals without the tendency to reflect may irrationally decide to consume right away instead of waiting for the next paycheck, even though they are aware that overdraft credit is expensive. If this is the case, their credit decisions are driven by their impulsiveness. We analyze this hypothesis by taking Eq. (1) to the SAVE data. The results of our baseline analysis are displayed in Table 4.

In the first row of Table 4 CRT score shows the effect of higher reflectiveness according to [Fredrick \(2005\)](#). The measure counts the number of correct answers to the test.¹² Each time the respondent resisted the impulsive answer and engaged into reflecting on the solution, one point is added to the score. Higher values indicate reflective personalities with a tendency to decide rationally while low scores identify impulsive individuals. We expect the CRT score to be negatively related to overdraft usage frequency.

[Insert Table 4 here.]

The regression results in columns (ii) and (iii) confirm our hypothesis concerning reflectiveness and credit decisions: The CRT score enters the regression with a negative coefficient. I.e. individuals with a tendency to reflect and to decide rationally (with a high CRT score) are likely to use short-term credit facilities seldom. On the contrary, impulsive individuals (with a low CRT score) are likely to use overdraft credit frequently or even permanently. The relation between credit line usage frequency and CRT score is highly significant and robust to adding control variables. This finding not only provides

¹²We require that all three CRT items are answered otherwise the score will turn into a missing value.

evidence that impulsive subjects use credit lines more often, but also that frequent usage of credit lines is an irrational behavior, since the CRT is also directly associated with rational thinking skills (Toplak, West, and Stanovich, 2012). We conclude that frequent usage of credit lines is an irrational behavior. Our results are also in line with Ottaviani and Vandone (2011) who study employees of an international asset management company and provide evidence that impulsiveness is a significant predictor of the probability that an employee holds unsecured debt.

In order to interpret the magnitude of coefficient estimates, the right hand panel of Table 4 presents average marginal effects for the four usage frequency groups. Individuals are more likely to never consume on credit lines when they decide reflectively. Answering correctly to one more question of the CRT makes a person 3.5 percentage points more likely never to rely on overdraft credits. Comparing this figure to the unconditional probability of 46.8 percent proves the economic magnitude of the effect: Being less impulsive in just one case more than average in the CRT makes an individual 7.5 percent less likely to rely on overdraft credit. On the other extreme we see a group of people relying more often than 6 times yearly or constantly on overdraft credit. Being less impulsive in one CRT problem decreases the probability to be in this high usage group by 2.2 percentage points. In relation to the baseline probability of 17.0 percent this equals a decrease of 12.9 percent. In unreported analyses we also calculate predicted probabilities¹³ for the outcome variable when the *CRT score* varies to its extremes: An individual which answers all CRT questions after reflection is 10 percentage points (21 percent) more likely to never use credit lines compared to someone who answers all CRT questions impulsively. For the excessive usage groups results are similar - answering always impulsively increases the probability to be in this group by more than one third (6.3 percent) opposed to a very reflective person.

Further demographic determinants. While the role of reflectiveness remains unaffected when adding demographic characteristics to the RHS, it is interesting to look at these control variables in detail: Comparing columns (i) and (iii) indicates that wealth and age are the most important

¹³E.g., $P[(Creditfreq_i = \text{"Never"})|CRT\ score_i, \Phi_i]$, i.e., the probability of not using short-term credit depending on cognitive reflection and other control variables. Likewise, we are also able to compute $P[(Creditfreq_i = \text{"More often than six times or constantly"})|CRT\ score_i, \Phi_i]$, i.e., the probability of using short-term credit frequently. Predicted probabilities are calculated based on the specification (ii) of the baseline analysis (Table 4), which does not require to determine characteristics with respect to household structure, respondents' occupation or education. This simplification is reasonable since coefficient estimates on the *sCRT score*, log income and age vary modestly between the full specification (column iii) and the reduced specification.

control variables determining credit decisions, which is in line with the assumptions of life-cycle theory. Somewhat surprisingly, household income is not significant in explaining overdraft credit use frequency. Still, it enters with a negative sign which seems reasonable. This finding may be connected to the evidence that household wealth is a very important predictor for short-term credit usage. Although the effect of increasing wealth is non-monotonic, not being in the lowest wealth group significantly reduces the probability to frequently rely on credit lines. Our results provide evidence that a lack of reflectiveness is particularly severe for low-wealth households, since being poor particularly increases the probability to be in the group of frequent users of short-term credit. According to predictions of life-cycle theory, we find a hump shaped pattern in age for the probability to rely on credit: individuals in the period of family or household formation (30-40 years) are most likely to use credit more frequently, whereas this behavior changes markedly for those aged 55 years and older. Furthermore, having children increases the frequency of overdraft credit usage. This argument is plausible in light of unexpected expenses in connection with children. Unexpected expenses are all the more a problem for single parents who cannot balance their budget with their partner internally. The coefficient on the variable indicating whether a person lives in a relationship is not significant, but enters with the hypothesized negative sign. We take into account subjects' occupation for two different aspects: on the one hand banks could prefer certain occupations when granting credit, especially installment credit. Overdraft credit can then work as a substitute for consumer credit. On the other hand, households with irregular income may especially be forced to bridge short-term liquidity shortages by using overdraft credit. However, we find no clear pattern for the relationship between occupational situation and credit line usage when controlling for age and wealth. Alike, neither general education nor self-assessed economics education have significant effects on credit decisions.

3.3 Does knowing better help? The role of financial literacy.

We found short-term credit decisions to be shaped by consumers' reflectiveness or their lack thereof. However, CRT results are also related to general cognitive abilities (Fredrick, 2005). To address this issue, in our baseline analysis we control for general cognitive abilities by including respondents' general education, which had no effect on the explanatory power of *CRT score*. Another measure closely associated with financial decision making and also related to cognitive abilities is financial literacy (Bucher-Koenen and Lusardi, 2011). We therefore ask, whether financial literacy will have a mitigating

effect on the predictive power of the CRT and analyze the interplay between financial literacy and reflectiveness in Table 5. First, we include a crude variable for financial literacy indicating whether the respondent answered at least 7 out of 9 questions correctly (i.e. more than the median number in the sample, which is 6 correct answers) in order to facilitate interpretation. More sophisticated measures which can be deducted from the same set of questions included in the SAVE 2009 survey are presented in robustness section 4.5. The results are qualitatively equivalent.

[Insert Table 5 here.]

The regression of overdraft credit usage frequency on financial literacy and control variables without the inclusion of reflectiveness (column ii) confirms a significant role of financial literacy for credit taking decisions. This finding speaks in favor of the hypothesis that subjects with higher levels of financial literacy better understand financial concepts such as compound interest, and that being aware of high costs of overdraft credit usage leads to a lower usage frequency. This evidence is in line with findings by Disney and Gathergood (2011, 2013), Lusardi and Tufano (2009), and Gerardi, Goette, and Meier (2010) who also confirm a relation between credit decisions and financial literacy. Since we include information on schooling in our control variables we conclude that neither general education nor self-assessed economics education can account for the effect of financial literacy. This result has earlier been advocated by van Rooij, Lusardi, and Alessie (2011) who claim that financial literacy covers concepts different from general knowledge and which is why general education can only imperfectly proxy for financial literacy.

Turning to the question whether a lack of reflectiveness can be mitigated by better knowledge, we simultaneously include both explanatory variables into our estimation model (column iii). We observe that both effects remain statistically significant and the coefficient estimates are only slightly decreased compared to the estimations when only considering one of the two factors (in columns i and ii). The stability of the coefficient estimate confirms that reflectiveness and financial literacy cover different aspects of personal traits and have explanatory power on their own. This finding undermines the role of financial education, since it is ex ante difficult to predict whether impulsive spending can be compensated by better knowledge.

In order to evaluate the economic effect of financial illiteracy we provide average marginal effects for the fully specified model from column (iii) in the right hand panel of Table 5. As before, marginal

effects are displayed for the four usage groups. Considering financial literacy slightly decreases the marginal effect of reflectiveness: If an average individual is more reflective (measured by one more correct answer to the CRT) it is 2.9 percentage points more likely that this person never uses credit lines (this equals a decrease of 6.2 percent compared to the unconditional probability). To the other extreme, impulsive persons (who answer one more question impulsively in the CRT) are 10.6 percent more likely to frequently use short-term credit (this equals an increase by 1.8 percentage points). What is more, the average marginal effect of being financially literate can compensate for a lack of reflectiveness. High financial knowledge increases the likelihood never to rely on short-term credit lines by 5.8 percentage points (or 12.4 percent) while it decreases an individuals' probability to frequently use credit lines by 21.8 percent (or 3.7 percentage points). Mutually analyzing reflectiveness and financial literacy shows that financial literacy can enhance decisions of impulsive consumers who are likely to irrationally use credit lines on their current accounts if they do not possess financial literacy skills. When calculating predicted probabilities (results upon request) we find that this is particularly true for the excessive usage group. Being financially literate decreases the predicted probability to be in this group by 4 percentage points (this equals a decrease of 23 percent compared to the unconditional probability of 17.0 percent). Being very reflective (i.e. only correct answers in the CRT) versus being very impulsive (i.e. always answering intuitive in the CRT) is associated with a decrease in probability by 6.4 percentage points, however, this condition is only seldom fulfilled given that only 13.9 percent of participants manage to resist the intuitive response in all three CRT problems.

4 Robustness

Besides our main analyses we examine which aspect of financial literacy helps more in explaining short-term credit choices: knowledge about financial products and markets or financial numeracy. Furthermore, we ask, whether for another form of unsecured credit, namely consumer installment credit, the same factors are relevant for individuals' credit decisions. As robustness exercises, we demonstrate that the results in the main part are not driven by our measure of reflectiveness, by the simplicity of the measure of financial literacy, by the choice of our econometric approach or by some households that are credit-constrained and have to rely on overdraft credit because they do not have access to consumer credit.

4.1 The role of numeracy

In order to deepen our understanding of the aspects of reflectiveness and financial literacy, we analyze the impact of mathematical skills which enter the CRT as well as the financial literacy test. Although both tests require only modest levels of mathematical aptitude, mathematical skills certainly play a role. Since the SAVE data does not provide a performance measure of mathematical abilities, we proxy for numeracy by relying on the subset of financial literacy questions that evaluate basic mathematical problems occurring in financial markets (the "basic" financial literacy questions).¹⁴ Table 7 presents correlation of the different measures, when defined as score counting the number of correct answers.

[Insert Table 7 here.]

As expected, the correlation analysis shows some positive correlation between the financial literacy measures and the CRT. This is plausible given that both measures are related to individuals' cognitive abilities. Interestingly, the correlation of numeracy (basic financial literacy) and advanced financial literacy is only as high as 0.56 which is further evidence for the moderate overlap between the two measures. The correlation between the self-assessed extent of financial education at school is only slightly positively correlated with the performance measures of financial literacy. The correlation is a little higher for advanced financial literacy compared to basic financial literacy. The fact that self-assessed financial literacy proxies are only mildly correlated with performance based measures underlines the importance of quiz questions for approximating financial literacy.

In the ordered probit regression analysis, we regress overdraft usage frequency groups and define the literacy measures as indicator variables which take a value of 1 if the numbers of correct answers are above the sample median. The "Numeracy" indicator variable marks if a person was able to correctly answer all 4 questions (notice that half of participants were able to correctly calculate at least three exercise which proofs that the questions are very easy). "Advanced literacy" indicates whether at least 4 out of 5 advanced financial literacy questions (pertaining to knowledge about financial products and markets) are answered correctly.

[Insert Table 6 here.]

¹⁴Lusardi (2012) gives a review of numeracy questions included in financial literacy surveys in different countries. The set included in the SAVE survey is representative for these questions.

Separating the effect of numeracy from financial literacy and reflectiveness has no impact on the explanatory power of the two traits. Also, economic significance of impulsiveness is unaffected which is reflected in stable average marginal effects on the right-hand side of Table 6. This finding is little surprising taking into account, that numeracy has already been included before in the aggregate measure of financial literacy. This result is also in line with evidence by [Campitelli \(2010\)](#) and [Koehler \(2010\)](#) that the CRT remains predictive of decision making tasks when controlling for numeracy. While the regression results confirm the explanatory power of reflectiveness and advanced financial literacy for explaining the variation in consumers' credit decisions, numeracy (basic financial literacy) itself is not a significant predictor (column ii). This is in line with evidence provided by [van Rooij, Lusardi, and Alessie \(2011\)](#) who include basic financial literacy as a control variable but focus on advanced financial literacy in context of households' decision to participate in the stock market.¹⁵

The results from the analysis of average marginal effects for the four usage groups confirm our previous findings: a lack of reflectiveness is associated with a higher probability of frequent overdraft usage. But advanced financial literacy has a diminishing effect on the probability for extensive short-term credit demand. For the group of people who never use overdraft credit, deciding impulsively decreases the probability to be in this group by three percentage points. The positive effect of advanced financial literacy is stronger in magnitude such that its positive impact can compensate for impulsive decision making. The same phenomenon can be observed for the frequent usage group. An individual who is impulsive (without the tendency to reflect in the CRT) but possesses advanced financial knowledge has a lower probability to frequently use overdraft credit than a reflective individual lacking advanced financial literacy. We conclude that advanced financial literacy can compensate for lacking reflectiveness. This evidence provides a strong argument in favor of financial education.

4.2 Comparing credit lines to installment credit

So far, we have argued that impulsive people or those with lower financial literacy irrationally use a relatively expensive source of credit. For comparison, we also investigate the determinants of a cheaper, albeit less accessible and less liquid alternative: consumer installment credit. Generally,

¹⁵At first glance, our evidence seems to stand in contradiction to [Gerardi, Goette, and Meier \(2010\)](#) who provide evidence that borrowers' numerical ability predicts subprime mortgage delinquency and default. However, their measure of financial literacy does not include any advanced literacy questions at all, such that a potential impact of advanced financial literacy is omitted in their analysis.

consumer installment credit is comparable to overdraft credit in terms of purchasing goals (SAVE explicitly cites purposes such as buying clothes, electronic devices, cars or vacation trips as examples for what was funded with the loan). We expect that behavioral traits do not shape the process of taking out consumer installment credit for three reasons: (i) while impulsive customers may want to consume more by the means of consumer installment credit, banks' credit counselors can restrict customers' credit demand when the requested level of debt is unsustainable, (ii) requesting consumer installment credit is a much more deliberate decisions which involves paperwork and communication with the bank, compared to financing consumption by overdraft lines of credit, (iii) customers' financial literacy will probably not impact on credit demand but on credit conditions (which we do not observe in our study).

Opposed to credit lines to which nearly 80 percent of respondents have access, there can be groups of people who will not be granted consumer loans by credit providers. I.e. credit access is an issue in the analysis of the demand for installment credit. In order to disentangle credit supply and credit demand we estimate a bivariate probit model with partial observability. This approach is necessary since we can only observe the cases in which a household demanded installment credit and has been granted the credit by the bank. When a household does not hold installment credit we cannot distinguish among the following reasons why: either a bank did not grant a loan because the customer is not creditworthy, or the person did not request a loan (or both). To mitigate this issue, we include information from the SAVE survey, which provides a direct indicator capturing credit demand and constraints: In the survey participants are asked whether in the past five years they were fully or partly denied credit requests, and whether they actually did request a loan. Furthermore, respondents can state whether they refrained from requesting credit for fear of denial. Close to half of the respondents indicate to have requested credit during the five years preceding the survey, while 8 percent did not dare to ask for credit.

Table 8 documents the results of the bivariate probit model. On the household side, income, wealth, age, and family structure will matter for the decision to take out a loan for the same reasons which apply to the decision to use a credit line. Besides, it may matter whether an individual is self-employed because self-employment can demand higher investments finance via credits and we also control for the volume of the credit line granted, since it may work as a substitute. Furthermore, we include information on credit demand as described above. A "Desire for credit" indicates whether an

individual has requested a loan (abstracting from whether it was granted) or refrained from asking for credit for fear of denial. On the side of the bank, we control for customer’s age, assets and outstanding loans (including the volume of overdraft lines of credit),¹⁶ monthly income and rent as well as marital status and number of children because we assume that these variables enter a bank’s credit worthiness evaluation. Whether a customer is self-employed may also matter on the side of the bank because banks will demand regular income streams. We also consider whether the “Bank received [a] request” for credit, which indicates whether the individual has requested a loan.

[Insert Table 8 here.]

The results of the bivariate probit regression confirm our expectations towards the irrelevance of impulsiveness and financial literacy in the demand for consumer installment credit. With respect to socio-demographic characteristics, the results indicate that wealthier households have a lower demand for consumer installment credit and that those with higher income are more likely to have credit outstanding. As for the results on overdraft credit usage, the probability to have installment credit outstanding depends on household age. The same factors also play a role in the decision of the bank to grant credit, with income being the most important determinant. Unsurprisingly, households that requested credit are also more likely to have consumer installment credit outstanding. We also include a probit model as a mini robustness test in column (iii). Comparing the results from our analysis of consumer installment credit to our evidence on credit line usage, we conclude that accessibility and liquidity are features of overdraft lines of credit which are particularly inviting for behavioral biases. It is only in the analysis of credit lines that personal traits play a role.

4.3 Do groups without access to installment credit resort to credit lines?

Credit-constrained people, who do not have access to consumer loans, can be forced to rely on overdraft lines of credit when they experience financing needs. In order to find out whether constraints drive credit line usage we explicitly take into account self-reported credit constraints comparable to the approach in the previous section. We consider an individual to be objectively credit constrained if she has previously been partly or fully denied credit and we distinguish subjectively constrained persons

¹⁶On the bank’s side we do not include total net wealth, since not all items may be observable for the bank, e.g. company pension schemes or loans from family and friends.

who refrained from requesting credit for fear of denial. Furthermore, in Table 9 we exclude groups which are potentially credit constrained because of low or fluctuating incomes: households with at least one unemployed person, and self-employed people.

[Insert Table 9 here.]

According to the results in Table 9 column (ii), access to consumer loans is an important aspect in the overdraft usage decision: households which are or feel credit constrained use overdraft lines of credit significantly more often compared to unconstrained households. In these cases, overdraft credit serves as a substitute for consumer installment credit. Especially respondents fearing credit denial (i.e. they are subjectively constrained) use overdraft credits more frequently, probably for convenience and ease. Excluding potentially credit constrained groups in columns (iii) and (iv), does not impact the relation between reflectiveness and overdraft credit use. The mitigating impact of financial literacy is slightly decreased in significance but nearly unaffected in economic terms.

4.4 An alternative proxy for impulsiveness

In their famous experiments with four-year-old children who were to choose between the immediate reward of one cookie or a delayed gratification of two cookies [Mischel and Peake \(1988\)](#), [Mischel and Rodriguez \(1989\)](#) and [Mischel and Peake \(1990\)](#) demonstrate that individual differences in self-control measured at the pre-school stage predict the same persons' behaviors more than a decade later. Based on this intuition we construct an alternative measure of impulsiveness using information regarding the respondents' childhood behavior (spending or saving their pocket money) to determine whether the adult person will tend to impulsive or reflective behavior. We expect people who spent their pocket money quickly in their childhood to also be impulsive spenders and therefore extensive credit line users in their adulthood. This approach relies on the validity of the assumption that character traits (in particular reflectiveness and impulsiveness) are relatively stable for an individual person. More specific than the influential psychological literature mentioned before, [Moffitta, Arseneault, Belsky, Dickson, Hancox, Harrington, Houts, Poulton, Roberts, Ross, Sears, Thomson, and Caspi \(2011\)](#) present a longitudinal study which demonstrates that self-control in childhood predicts personal finance (among other criteria) at the age of 32. Therefore, our childhood-based measure of impulsiveness is an imperfect, but valid proxy for the impulsiveness of the adult respondent which is not caused by current

spending behavior. It is unrelated to current consumption and saving decisions and hence exogenous to current credit decisions. To the best of our knowledge, this approach to identify determinants of decisions has not been used before.

Concretely, we assess respondents' impulsiveness by considering participants' agreement to the statement "[As a child] I used to spend my pocket money immediately" as the alternative proxy. For this purpose we enrich cross-sectional data from the 2009 SAVE survey with two additional variables from the 2008 questionnaire. Respondents can indicate their agreement to the statement on a scale ranging from 0 ("strongly disagree") to 10 ("agree completely"). High values imply higher impulsiveness. In our regressions we also include respondents' agreement to the statement "As a child I regularly received pocket money". The respondents answer question by indicating higher agreement on an 11 point Likert-Scale (0-10). According to the correlation analysis in Table 7 there is no overlap in our different proxies for impulsiveness. This finding is not very surprising given that they cover very different aspects: While our alternative proxy is a self-assessed measure capturing an individuals' behavior in childhood from which we draw conclusions about current impulsiveness, the Cognitive Reflection Test is a performance based measure eliciting respondents' tendency to reflect and decide rationally and dismiss the intuitive but incorrect answer. The results of the regression analysis in which the CRT is replaced by this new impulsiveness proxy are presented in Table 10.

[Insert Table 10 here.]

Columns (i) and (ii) provide regression results when explanatory variables are of categorical nature whereas columns (iii) and (iv) show results for dummy variable specifications. As hypothesized impulsiveness, which is approximated by immediate spending of pocket money in childhood, is associated positively with overdraft usage frequency. Whether a respondent received pocket money regularly does not impact the results. The results from column (iii) (or column iv) compare closest to evidence presented in Table 5 column (iii) in which financial literacy is also approximated as indicator variable and based on all nine (basic and advanced) financial literacy questions.

From the robustness analysis we can infer that our conclusions drawn so far hold true, when employing a completely different proxy for impulsiveness.

4.5 Alternative measurement of financial literacy

In the following, we document that the results of our study are not driven by the way we define our baseline financial literacy measure. As described above, this measure is derived from nine questions about financial issues contained in the 2009 SAVE survey, which are aggregated into a dummy variable (indicating whether more than the median number of answers were given correctly) or a score measure (counting the number of correct answers). While "I cannot/do not want to answer" is counted as a wrong answer, a missing answer turns the score to missing. In addition to this relatively simple and straightforward measure of financial literacy, we also follow [van Rooij, Lusardi, and Alessie \(2011\)](#) who use an iterated principal factor analysis to construct an index for financial literacy from the quiz questions. When applying factor analysis we assume that financial literacy (which we cannot observe directly) is not mirrored equally well in the answers to the quiz questions. For each question, we construct a dummy variable which indicates the correct answer, such that we obtain 9 items which enter the factor analysis (missing values remain in the coding of the binary variables). Furthermore we construct 9 items indicating whether a respondent decided to admit that he does not know the correct answer.

An indicative principal component analysis leads us to retain two main factors when analyzing all nine financial literacy items. Given the factor loadings from the iterative principal factor analysis of all nine items, we find that one of the factors loads stronger on the basic financial literacy items whereas the other factor loads on the advanced items. We follow the approach by [van Rooij, Lusardi, and Alessie \(2011\)](#) and conduct two separate iterated factor analyses for basic and advanced financial literacy questions. We first only consider items based on correct answers to basic and advanced questions. In a second step we also include "Do not know" answers into the set of items for the iterated principal factor analysis. Details on factor loadings are included in [Appendix F](#).

[Insert Table 11 here.]

Column (i) reproduces the results when measuring financial literacy by dummy variables. In column (ii) basic financial literacy (Numeracy) and advanced literacy are defined as scores. In columns (iii) and (iv) the results for the analysis of financial literacy measures obtained from principal factor analysis are displayed. As expected, the coefficient estimates on different financial literacy proxies are always

negative. While basic financial literacy is not significant in any of the specifications, the coefficient estimates for the advanced financial literacy measures remain significant for the different specifications. We conclude that our results are not driven by the relatively simple approach we employ in our main regressions to measure financial literacy.

4.6 Alternative econometric approaches

As our dependent variable from the SAVE data which observes overdraft credit usage frequency is censored and of categorical nature, ordered probit estimation is the natural choice. However, to make sure that the results on the negative relations between reflectiveness or financial literacy and overdraft credit usage frequency are not due to the ordered probit approach, we also conduct three other regression models, reported in Table 12. Columns (i) and (ii) display the coefficient estimates obtained in an OLS regression. In columns (iii) and (iv) we reduce the information on overdraft usage frequency to a dummy variable indicating whether the credit line has been used at least frequently in the preceding year (i.e. at least 6 times or constantly). Such that we can run probit regressions instead of ordered probit estimations. In columns (v) and (vi) we analyze whether our results are prone to an item non-response bias. For this purpose, we make use of five imputed data sets provided by MEA. While we do not rely on imputed values for our dependent and explanatory variables, we use the imputed values for the control variables. We run ordered probit regressions on all five imputed data sets. The results are obtained by using Rubin’s Method (Rubin, 1987).

[Insert Table 12 here.]

Our results are qualitatively similar to those from the baseline approach reported in Tables 4 and 5. The coefficient estimates of the OLS model are much more straightforward to interpret compared to ordered probit results. At first, the intercept seems very high, considering that the dependent variable can only take on values between 1 (never use overdraft credit) and 4 (more frequently than six times a year or constantly in overdraft use). However, this fact becomes plausible when taking into account that wealth enters the regression negatively. The average respondent age of 55 years further reduces the starting level of the intercept. The OLS regression results once more confirm the compensational effect of advanced financial literacy for a lack of reflectiveness. Statistical significance stays unaffected compared to the ordered probit approach and coefficient estimates are also similar. We also analyze

whether our results are influenced by a non-response bias stemming from the control variables. We can reject this skepticism since the results from repeating our analysis with imputed data are very similar to our estimations when excluding observations with missing data. The value added by the comparably extensive analysis therefore appears to be negligible.

5 Conclusion

We document that frequent credit line usage is most likely observed for people who respond impulsively without reflecting on the tasks in the Cognitive Reflection Test. Since the CRT measures the tendency to decide deliberately and rationally we conclude that extensive use of credit lines is likely to be an irrational behavior. Furthermore, we ask whether there is room for financial education when individuals are impulsive. We provide evidence that individuals use (expensive) credits lines less frequently if they possess financial literacy skills.

Identifying behavioral or educational causes as drivers of credit decisions requires different responses by economic policy: while behavioral arguments typically call for consumer protection by tighter regulations of financial activities (e.g. limiting accessibility to loans or limiting the maximum amount to be taken out), evidence in favor of financial literacy as driver of financial decisions calls for consumer empowerment by means of financial education in order to improve financial decisions ([van Rooij, Lusardi, and Alessie, 2011](#); [Guiso and Jappelli, 2009](#); [Bucher-Koenen and Lusardi, 2011](#)).

We find financial literacy to be a qualification on its own which cannot be substituted by general education or general mathematical abilities. Our findings suggest that financial education programs could substantially improve households' financial decisions. However, evidence collected by [Fernandes, Lynch Jr., and Netemeyer \(forthcoming\)](#) admonishes that the impact of financial hitherto existing education programmes on financial behavior is only modest.

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Table 1: Descriptive statistics on overdraft credit usage

The table shows the distribution of household credit line usage frequency as indicated in the SAVE 2009 survey. We report usage frequency conditional on access to an overdraft line of credit.

| | Frequency | Percent |
|--------------------------|-----------|---------|
| never | 811 | 46.8 |
| 1-3 times p.a. | 438 | 25.3 |
| 4-6 times p.a. | 152 | 8.8 |
| more often or constantly | 295 | 17.0 |
| no answer | 37 | 2.1 |
| Total | 1,733 | 100 |

Table 2: Cognitive Reflection Test by [Fredrick \(2005\)](#)- empirical distribution of answers

Panel A reports the proportion of households providing correct, impulsive incorrect and non-impulsive incorrect answers as well as the proportion of refusals. The questionnaire does not provide the possibility to actively state that one prefers not to answer. Panel B shows which percentages answer correctly (incorrectly/do not answer at all) to a given number of questions, i.e. if no question is answered correctly some of the three questions of the CRT were either not or falsely answered.

| Panel A: Numeracy - percentages of correct, incorrect and missing answers (N= 2,222) | | | | |
|--|---------|-----------|-----------|---------|
| | Correct | Impulsive | Incorrect | Refusal |
| 1) Bat and ball | 19.4 | 66.7 | 3.1 | 10.8 |
| 2) Production time | 40.3 | 32.1 | 11.8 | 15.8 |
| 3) Lily pond | 42.6 | 33.3 | 6.3 | 17.8 |

| Panel B: Summary of responses - percentages of numbers of correct, impulsive and missing answers | | | | |
|--|------|------|------|------|
| | None | 1 | 2 | All |
| Correct | 45.1 | 21.4 | 19.6 | 13.9 |
| Incorrect | 23.9 | 25.5 | 24.6 | 26.3 |
| Refusal | 78.8 | 7.2 | 4.9 | 9.1 |

Table 3: Financial literacy - empirical distribution of answers to nine questions

Panel A reports the proportion of households providing correct and incorrect answers as well as the proportion of "I cannot/do not want to answer" and refusals to answer for each of the nine financial literacy questions. Panel B shows which percentages answer correctly (incorrectly/do not know) to a given number of questions, i.e. if no question is answered correctly the answers were either wrong, do not know or complete refusal or a combination of these possibilities. Means in the Panel B do not add up to nine due to refusals.

| Panel A: Distribution of answers in the financial literacy test (N= 2,222) | | | | | | | | | | | |
|--|---------|-----------|-------------|---------|------|------|------|------|------|-----|------|
| | Correct | Incorrect | Do not know | Refusal | | | | | | | |
| Basic FL questions | | | | | | | | | | | |
| 1) Interest (2%) | 82.8 | 5.3 | 9.1 | 2.8 | | | | | | | |
| 2) Interest (20%) | 63.7 | 23.2 | 10.7 | 2.5 | | | | | | | |
| 3) Inflation | 78.1 | 4.0 | 15.0 | 2.9 | | | | | | | |
| 4) Money illusion | 54.8 | 31.1 | 11.3 | 2.7 | | | | | | | |
| Advanced FL questions | | | | | | | | | | | |
| 1) Return volatility | 70.0 | 9.4 | 17.1 | 3.6 | | | | | | | |
| 2) Stock market | 51.0 | 16.2 | 29.6 | 3.2 | | | | | | | |
| 3) Diversification | 63.7 | 6.4 | 27.5 | 2.4 | | | | | | | |
| 4) Balanced funds | 44.7 | 7.1 | 44.6 | 3.7 | | | | | | | |
| 5) Bond prices | 9.4 | 52.9 | 33.4 | 4.3 | | | | | | | |
| Panel B: Summary of responses - percentages of numbers of correct, incorrect and do not know answers | | | | | | | | | | | |
| | None | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | All | Mean |
| Correct | 8.1 | 3.7 | 5.6 | 8.1 | 10.6 | 10.9 | 15.6 | 16.1 | 17.1 | 4.5 | 5.18 |
| Incorrect | 20.3 | 35.3 | 24.6 | 11.9 | 5.2 | 2.1 | 0.5 | 0.1 | - | - | 1.55 |
| Do not know | 42.0 | 16.0 | 11.2 | 7.5 | 7.5 | 4.7 | 3.0 | 2.5 | 1.6 | 4.0 | 1.98 |

Table 4: Ordered probit regression of overdraft usage frequency on CRT results

This table shows our baseline ordered probit regression of overdraft credit usage frequency on individuals' tendency to reflect (CRT score). Respondents indicate their overdraft credit usage frequency by choosing among four usage frequency intervals: "never", "1 to 3 times a year", "4 to 6 times a year", "more often or constantly". We therefore employ an ordered probit estimation procedure with heteroskedasticity-robust standard errors in all regressions. While in the left hand panel columns (i) to (iii) directly display the probit coefficients, the right hand panel presents average marginal effects for the four usage groups. We identify more impulsive and more reflective personalities by the Cognitive Reflection Test by [Fredrick \(2005\)](#). Counting the correct responses in the CRT yields test scores ranging between 0 (impulsive) to 3 (reflective). When at least one answer to the questions is missing, the score will also be missing. Concerning the occupational control variables, white-collar employment is taken as the base group. Unemployment is included as a dummy variable indicating whether the respondent and/or the spouse is unemployed. Among the educational variables lower secondary education is excluded. Economics education is a self-assessed measure from 0 indicating "no economics education at all" to 7 "very intensive education" in school or other vocational training. Robust standard errors are given in parentheses. Significance levels are indicated as *** 1%-level, ** 5%-level, * 10%-level.

| | Ordered probit results | | | Average marginal effects | | | |
|---------------------|------------------------|----------------------|----------------------|--------------------------|----------------------|----------------------|----------------------|
| | (i) | (ii) | (iii) | "never" | "1-3 times" | "4-6 times" | "more often" |
| CRT score | | -0.088*** (0.032) | -0.098*** (0.033) | 0.035*** (0.012) | -0.006*** (0.002) | -0.006*** (0.002) | -0.022*** (0.008) |
| 2nd wealth quartile | -0.501*** (0.105) | -0.476*** (0.106) | -0.495*** (0.107) | 0.175*** (0.037) | -0.030*** (0.008) | -0.032*** (0.007) | -0.112*** (0.024) |
| 3rd wealth quartile | -0.398*** (0.103) | -0.359*** (0.104) | -0.395*** (0.105) | 0.139*** (0.037) | -0.024*** (0.007) | -0.026*** (0.007) | -0.089*** (0.024) |
| 4th wealth quartile | -0.741*** (0.106) | -0.699*** (0.108) | -0.744*** (0.110) | 0.262*** (0.037) | -0.046*** (0.008) | -0.048*** (0.008) | -0.168*** (0.025) |
| Log income | -0.084 (0.067) | -0.059 (0.068) | -0.078 (0.079) | 0.027 (0.028) | -0.005 (0.005) | -0.005 (0.005) | -0.018 (0.018) |
| Age | 0.051*** (0.019) | 0.048** (0.019) | 0.048** (0.019) | -0.017** (0.007) | 0.003** (0.001) | 0.003** (0.001) | 0.011** (0.004) |
| Age ² | -0.068*** (0.017) | -0.066*** (0.017) | -0.068*** (0.019) | 0.024*** (0.007) | -0.004*** (0.001) | -0.004*** (0.001) | -0.015*** (0.004) |
| Gender (male) | | | 0.098 (0.073) | -0.035 (0.026) | 0.006 (0.005) | 0.006 (0.005) | 0.022 (0.017) |
| Couple | | | -0.036 (0.095) | 0.013 (0.034) | -0.002 (0.006) | -0.002 (0.006) | -0.008 (0.022) |
| Number of children | | | 0.116*** (0.042) | -0.041*** (0.015) | 0.007*** (0.003) | 0.007*** (0.003) | 0.026*** (0.010) |
| Blue-collar worker | | | -0.104 (0.121) | 0.037 (0.043) | -0.006 (0.007) | -0.007 (0.008) | -0.024 (0.027) |
| Civil servant | | | 0.055 (0.161) | -0.020 (0.057) | 0.003 (0.010) | 0.004 (0.010) | 0.013 (0.036) |
| Self-employed | | | 0.302 (0.206) | -0.106 (0.073) | 0.019 (0.013) | 0.020 (0.013) | 0.068 (0.047) |
| Other occupation | | | -0.026 (0.134) | 0.009 (0.047) | -0.002 (0.008) | -0.002 (0.009) | -0.006 (0.030) |
| Retired | | | 0.167 (0.124) | -0.059 (0.044) | 0.010 (0.008) | 0.011 (0.008) | 0.038 (0.028) |
| Unemployed | | | 0.063 (0.185) | -0.022 (0.065) | 0.004 (0.011) | 0.004 (0.012) | 0.014 (0.042) |
| Mid-level education | | | 0.112 (0.089) | -0.039 (0.031) | 0.007 (0.006) | 0.007 (0.006) | 0.025 (0.020) |
| A-level education | | | 0.063 (0.098) | -0.022 (0.034) | 0.004 (0.006) | 0.004 (0.006) | 0.014 (0.022) |
| Economics education | | | -0.033 (0.022) | 0.012 (0.008) | -0.002 (0.001) | -0.002 (0.001) | -0.007 (0.005) |
| μ_1 | -0.498 (0.675) | -0.498 (0.671) | -0.613 (0.718) | | | | |
| μ_2 | 0.233 (0.676) | 0.235 (0.672) | 0.126 (0.718) | | | | |
| μ_3 | 0.589 (0.675) | 0.593 (0.672) | 0.489 (0.718) | | | | |
| N | 1120 | 1120 | 1120 | | | | |
| $PseudoR^2$ | 0.139 | 0.144 | 0.156 | | | | |

Table 5: Ordered probit regression - impact of impulsiveness and financial literacy

In the left hand panel we disentangle the effects of impulsiveness and financial literacy on credit usage. To facilitate interpretation we define "Financial literacy" as dummy variable indicating whether at least seven out of nine financial literacy questions (more than the median number of questions) are answered correctly. For reasons of brevity we only report the coefficients on the most important control variables, although all demographic and educational control variables are included in regression specifications. Robust standard errors are given in parentheses. In the right hand panel we report marginal effects for the full specification from column (iii) for different usage frequencies of credit lines. Significance levels are indicated as *** 1%-level, ** 5%-level, * 10%-level.

| | Ordered probit results | | | Average marginal effects | | | |
|---------------------------------|------------------------|----------------------|----------------------|--------------------------|----------------------|----------------------|----------------------|
| | (i) | (ii) | (iii) | "never" | "1-3 times" | "4-6 times" | "more often" |
| CRT score | -0.098*** (0.033) | | -0.082** (0.034) | 0.029** (0.012) | -0.005** (0.002) | -0.005** (0.002) | -0.018** (0.008) |
| Financial literacy | | -0.208*** (0.076) | -0.165** (0.079) | 0.058** (0.028) | -0.010** (0.005) | -0.011** (0.005) | -0.037** (0.018) |
| 2nd wealth quartile | -0.495*** (0.107) | -0.507*** (0.107) | -0.497*** (0.107) | 0.175*** (0.037) | -0.030*** (0.008) | -0.032*** (0.007) | -0.112*** (0.024) |
| 3rd wealth quartile | -0.395*** (0.105) | -0.410*** (0.104) | -0.384*** (0.105) | 0.135*** (0.037) | -0.023*** (0.007) | -0.025*** (0.007) | -0.087*** (0.024) |
| 4th wealth quartile | -0.744*** (0.110) | -0.749*** (0.110) | -0.725*** (0.110) | 0.255*** (0.037) | -0.044*** (0.008) | -0.047*** (0.008) | -0.163*** (0.025) |
| Log income | -0.078 (0.079) | -0.063 (0.079) | -0.056 (0.079) | 0.020 (0.028) | -0.003 (0.005) | -0.004 (0.005) | -0.013 (0.018) |
| Age | 0.048** (0.019) | 0.049** (0.019) | 0.047** (0.020) | -0.017** (0.007) | 0.003** (0.001) | 0.003** (0.001) | 0.011** (0.004) |
| Age ² | -0.068*** (0.019) | -0.068*** (0.019) | -0.067*** (0.019) | 0.023*** (0.007) | -0.004*** (0.001) | -0.004*** (0.001) | -0.015*** (0.004) |
| Gender (male) | 0.098 (0.073) | 0.109 (0.074) | 0.121 (0.074) | -0.042 (0.026) | 0.007 (0.005) | 0.008 (0.005) | 0.027 (0.017) |
| Couple | -0.036 (0.095) | -0.041 (0.094) | -0.040 (0.095) | 0.014 (0.033) | -0.002 (0.006) | -0.003 (0.006) | -0.009 (0.021) |
| Number of children | 0.116*** (0.042) | 0.108*** (0.042) | 0.112*** (0.042) | -0.039*** (0.015) | 0.007** (0.003) | 0.007*** (0.003) | 0.025*** (0.010) |
| [1em] Occupational demographics | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Educational controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| μ_1 | -0.613 (0.718) | -0.477 (0.721) | -0.520 (0.720) | | | | |
| μ_2 | 0.126 (0.718) | 0.262 (0.721) | 0.222 (0.720) | | | | |
| μ_2 | 0.489 (0.718) | 0.625 (0.721) | 0.586 (0.720) | | | | |
| N | 1120 | 1120 | 1120 | | | | |
| Pseudo R^2 | 0.156 | 0.157 | 0.160 | | | | |

Table 6: Robustness: Ordered probit regression - analyzing components of financial literacy

In the left hand panel we regress credit line usage on a proxy for numeracy (deducted from basic financial literacy items), a measure for advanced financial literacy, and the CRT score in order to consider the impact of financial skills. "Numeracy" pertains to 4 basic financial literacy questions whereas "advanced literacy" covers five advanced financial knowledge questions. Both literacy variables indicate whether more than the median number of questions have been answered correctly (i.e. all of the 4 basic questions and at least 4 out of 5 advanced questions). For reasons of brevity we only report the coefficients on the most important control variables, although all demographic and educational control variables are included in regression specifications. In the right hand panel we report marginal effects for the full specification from column (ii) for different usage frequencies of credit lines. Robust standard errors are given in parentheses. Significance levels are indicated as *** 1%-level, ** 5%-level, * 10%-level.

| | Ordered probit results | | Average marginal effects | | | |
|---------------------------|------------------------|----------------------|--------------------------|----------------------|----------------------|----------------------|
| | (i) | (ii) | "never" | "1-3 times" | "4-6 times" | "more often" |
| CRT score | | -0.083** (0.034) | 0.029** (0.012) | -0.005** (0.002) | -0.005** (0.002) | -0.019** (0.008) |
| Numeracy | -0.065 (0.073) | -0.031 (0.074) | 0.011 (0.026) | -0.002 (0.005) | -0.002 (0.005) | -0.007 (0.017) |
| Advanced literacy | -0.183** (0.077) | -0.155** (0.079) | 0.055** (0.027) | -0.010* (0.005) | -0.010* (0.005) | -0.035** (0.018) |
| 2nd wealth quartile | -0.508*** (0.107) | -0.492*** (0.107) | 0.173*** (0.037) | -0.030*** (0.008) | -0.032*** (0.007) | -0.111*** (0.024) |
| 3rd wealth quartile | -0.398*** (0.105) | -0.374*** (0.106) | 0.131*** (0.037) | -0.023*** (0.007) | -0.024*** (0.007) | -0.084*** (0.024) |
| 4th wealth quartile | -0.741*** (0.109) | -0.717*** (0.110) | 0.252*** (0.037) | -0.044*** (0.008) | -0.046*** (0.008) | -0.162*** (0.025) |
| Log income | -0.058 (0.079) | -0.052 (0.079) | 0.018 (0.028) | -0.003 (0.005) | -0.003 (0.005) | -0.012 (0.018) |
| Age | 0.050** (0.020) | 0.048** (0.020) | -0.017** (0.007) | 0.003** (0.001) | 0.003** (0.001) | 0.011** (0.004) |
| Age ² | -0.069*** (0.019) | -0.068*** (0.019) | 0.024*** (0.007) | -0.004*** (0.001) | -0.004*** (0.001) | -0.015*** (0.004) |
| Gender (male) | 0.108 (0.074) | 0.121 (0.074) | -0.043 (0.026) | 0.007 (0.005) | 0.008 (0.005) | 0.027 (0.017) |
| Couple | -0.043 (0.095) | -0.043 (0.095) | 0.015 (0.033) | -0.003 (0.006) | -0.003 (0.006) | -0.010 (0.021) |
| Number of children | 0.110*** (0.042) | 0.113*** (0.043) | -0.040*** (0.015) | 0.007** (0.003) | 0.007*** (0.003) | 0.026*** (0.010) |
| Occupational demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| Educational controls | Yes | Yes | Yes | Yes | Yes | Yes |
| μ_1 | -0.401 (0.724) | -0.447 (0.724) | | | | |
| μ_2 | 0.337 (0.724) | 0.294 (0.725) | | | | |
| μ_3 | 0.697 (0.725) | 0.655 (0.725) | | | | |
| N | 1118 | 1118 | | | | |
| $Pseudo R^2$ | 0.156 | 0.160 | | | | |

Table 7: Robustness: Correlations of alternative financial literacy proxies and competing explanatory variables

This table shows Pearson correlations between the different proxies for impulsiveness, financial literacy and numeracy. All variables are defined as scores. "PM spending" refers to an alternative measure for impulsiveness introduced in robustness section 4.4.

| | CRT | Full FL | Basic FL | Adv. FL | Economics education |
|---------------------|-------|---------|----------|---------|---------------------|
| Full FL score | 0.41 | | | | |
| Basic FL score | 0.34 | 0.85 | | | |
| Advanced FL score | 0.35 | 0.91 | 0.56 | | |
| Economics education | 0.06 | 0.16 | 0.10 | 0.18 | |
| PM spending | -0.02 | 0.04 | 0.01 | 0.06 | 0.01 |

Table 8: Robustness: Bivariate probit regression of consumer installment credit usage on impulsiveness and financial literacy

In this table we analyze how different household characteristics are related to the prevalence of consumer credit. The dependent variable is the respondents' indication on whether they have any outstanding balances on consumer credit (e.g. car loan, credit for buying clothes or electronic devices). We estimate a bivariate probit regression with partial observability according to the model by Poirier (1980), since we can only observe cases in which a person applied for credit and was granted one. In columns (i) and (ii) we report on the left hand side coefficient estimates for the variables potentially influencing customers' decision to apply for credit whereas on the right hand side we analyze the banks' decision to grant credit. In column (ii) we include the "desire for credit" which is a dummy variable indicating whether a person has asked for credit during the last five years or whether a person did not dare to apply for credit out of fear of being refused. On the side of the bank we include the variable "bank received request" if a person has asked for credit within the last five years. We include a probit model for comparison in column (iii). Robust standard errors are given in parentheses. Significance levels are indicated as *** 1%-level, ** 5%-level, * 10%-level.

| | bivariate probit | | | | probit |
|-------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | (i) | | (ii) | | (iii) |
| | customer | bank | customer | bank | compare (ii) |
| CRT score | -0.001 (0.021) | | 0.002** (0.001) | | -0.034 (0.048) |
| Financial literacy | -0.012 (0.041) | | -0.005*** (0.002) | | -0.156 (0.106) |
| Age | 0.050** (0.023) | 0.049** (0.023) | 0.044* (0.025) | 0.043* (0.025) | 0.034 (0.026) |
| Age ² | -0.070*** (0.023) | -0.070*** (0.023) | -0.057** (0.024) | -0.057** (0.024) | -0.048* (0.025) |
| Couple | 0.058 (0.151) | | 0.028 (0.117) | | 0.022 (0.131) |
| Married | | 0.062 (0.087) | | 0.024 (0.117) | |
| Number of children | -0.043 (0.052) | -0.042 (0.051) | -0.049 (0.056) | -0.041 (0.056) | -0.036 (0.057) |
| Log income | 0.442*** (0.143) | 0.468*** (0.093) | 0.332*** (0.101) | 0.352*** (0.103) | 0.429*** (0.120) |
| Rent | | 0.000 (0.000) | | 0.000*** (0.000) | 0.001*** (0.000) |
| Log wealth | -0.040*** (0.012) | | -0.041*** (0.013) | | |
| Log total assets | | -0.043*** (0.012) | | -0.042*** (0.013) | -0.033** (0.015) |
| Log building soc. loans | | 0.013 (0.008) | | 0.005*** (0.001) | 0.031** (0.015) |
| Log mortgages | | 0.019** (0.008) | | 0.010*** (0.003) | 0.002 (0.011) |
| Log educational loans | | 0.000 (0.002) | | 0.000** (0.000) | -0.038 (0.054) |
| Volume overdraft | 0.002 (0.010) | 0.002 (0.010) | -0.003 (0.011) | -0.003 (0.011) | 0.003 (0.012) |
| Self-employed | 0.038 (0.223) | 0.045 (0.225) | 0.054 (0.215) | 0.051 (0.225) | 0.058 (0.223) |
| Desire for credit | | | 1.346*** (0.123) | | 1.506*** (0.146) |
| Bank received request | | | | 1.338*** (0.124) | |
| μ | -4.768*** (1.069) | -4.679*** (0.762) | -4.932*** (0.875) | -4.699*** (0.861) | -5.360*** (0.937) |
| N | 1223 | 1223 | 1212 | 1212 | 1212 |
| $Pseudo R^2$ | | | | | 0.257 |

Table 9: Robustness: Ordered probit regressions of overdraft usage considering potentially credit-constrained groups

This table shows ordered probit regression results when considering that credit line usage may differ for credit-constrained people without access to installment credit. Column (i) reprints the results from Table 5. In column (ii) we include two dummy variables indicating whether a household is credit-constrained objectively (i.e. was fully or partly denied credit in the past five years) or subjectively (i.e. in the past five years a household did not request credit for fear of denial). In columns (iii) and (iv) we exclude households which may be credit constrained due to their occupation or occupational status and resulting irregular income streams. Robust standard errors are given in parentheses. Significance levels are indicated as *** 1%-level, ** 5%-level, * 10%-level.

| | (i) | (ii) | (iii) | (iv) |
|---------------------------|----------------------|----------------------|----------------------|----------------------|
| CRT score | -0.082** (0.034) | -0.085** (0.035) | -0.086** (0.035) | -0.094*** (0.035) |
| Financial literacy | -0.165** (0.079) | -0.139* (0.080) | -0.160** (0.081) | -0.132* (0.080) |
| 2nd wealth quartile | -0.497*** (0.107) | -0.412*** (0.109) | -0.445*** (0.110) | -0.474*** (0.109) |
| 3rd wealth quartile | -0.384*** (0.105) | -0.297*** (0.107) | -0.372*** (0.110) | -0.368*** (0.107) |
| 4th wealth quartile | -0.725*** (0.110) | -0.619*** (0.112) | -0.701*** (0.113) | -0.711*** (0.113) |
| Log income | -0.056 (0.079) | -0.021 (0.082) | -0.095 (0.087) | -0.081 (0.083) |
| Age | 0.047** (0.020) | 0.052*** (0.020) | 0.056*** (0.020) | 0.054*** (0.020) |
| Age ² | -0.067*** (0.019) | -0.071*** (0.019) | -0.073*** (0.019) | -0.073*** (0.019) |
| Blue-collar worker | -0.121 (0.122) | -0.077 (0.123) | -0.088 (0.127) | -0.118 (0.123) |
| Civil servant | 0.057 (0.160) | 0.087 (0.159) | 0.066 (0.160) | 0.063 (0.160) |
| Self-employed | 0.300 (0.204) | 0.313 (0.210) | 0.403* (0.207) | |
| Retired | 0.157 (0.125) | 0.174 (0.126) | 0.089 (0.127) | 0.156 (0.125) |
| Other occupation | -0.018 (0.134) | -0.028 (0.136) | -0.069 (0.144) | -0.049 (0.135) |
| Unemployed | 0.071 (0.185) | 0.012 (0.190) | | 0.175 (0.187) |
| Obj. constrained | | 0.630*** (0.181) | | |
| Subj. constrained | | 0.900*** (0.208) | | |
| [1em] Household structure | Yes | Yes | Yes | Yes |
| Educational controls | Yes | Yes | Yes | Yes |
| μ_1 | -0.520 (0.720) | -0.031 (0.749) | -0.490 (0.755) | -0.513 (0.740) |
| μ_2 | 0.222 (0.720) | 0.744 (0.749) | 0.270 (0.755) | 0.232 (0.740) |
| μ_3 | 0.586 (0.720) | 1.137 (0.749) | 0.634 (0.755) | 0.601 (0.740) |
| N | 1120 | 1101 | 1069 | 1082 |
| $Pseudo R^2$ | 0.160 | 0.202 | 0.152 | 0.161 |

Table 10: Robustness: Ordered probit regressions of overdraft usage considering an alternative proxy for impulsiveness

In this table we replace the *CRT score* by an alternative proxy for respondents' impulsiveness. We use childhood pocket money (PM) spending behavior as a proxy assuming that quick spending indicates impulsiveness. We include two new variables termed "spent PM quickly" and "received PM regularly". In columns (i) and (ii) the variables span values 0-10 where a value of 10 signals immediate spending and regular pocket money receipt. In columns (iii) and (iv) we define two dummy variables indicating whether the value on the agreement scale is larger than 5. We also consider financial literacy: In columns (i) and (ii) we include the number of correct answers to nine questions whereas in column (iii) and (iv) we consider a dummy which turns to one when more than the median number of questions (at least 7) are answered correctly. Robust standard errors are given in parentheses. Significance levels are indicated as *** 1%-level, ** 5%-level, * 10%-level.

| | Categorical variables | | Indicator variables | |
|------------------------------|-----------------------|----------------------|----------------------|----------------------|
| | (i) | (ii) | (iii) | (iv) |
| Spent PM quickly | 0.048*** (0.012) | 0.053*** (0.013) | 0.232*** (0.085) | 0.227*** (0.086) |
| Received PM regularly | | -0.012 (0.010) | | 0.030 (0.078) |
| Financial literacy | -0.052*** (0.018) | -0.052*** (0.018) | -0.218*** (0.076) | -0.221*** (0.076) |
| 2nd wealth quartile | -0.426*** (0.105) | -0.428*** (0.105) | -0.460*** (0.106) | -0.460*** (0.106) |
| 3rd wealth quartile | -0.360*** (0.105) | -0.358*** (0.105) | -0.385*** (0.103) | -0.386*** (0.103) |
| 4th wealth quartile | -0.626*** (0.112) | -0.626*** (0.112) | -0.659*** (0.110) | -0.659*** (0.110) |
| Log income | -0.076 (0.078) | -0.069 (0.078) | -0.072 (0.079) | -0.074 (0.078) |
| Age | 0.056*** (0.020) | 0.055*** (0.020) | 0.052*** (0.020) | 0.053*** (0.020) |
| Age ² | -0.071*** (0.020) | -0.071*** (0.020) | -0.069*** (0.020) | -0.069*** (0.020) |
| Gender (male) | 0.002 (0.074) | 0.005 (0.074) | 0.025 (0.073) | 0.023 (0.074) |
| Couple | 0.092 (0.096) | 0.083 (0.096) | 0.101 (0.096) | 0.103 (0.096) |
| Number of children | 0.112*** (0.041) | 0.109*** (0.041) | 0.106*** (0.041) | 0.107*** (0.041) |
| Occupational controls | Yes | Yes | Yes | Yes |
| Educational controls | Yes | Yes | Yes | Yes |
| μ_1 | -0.188 (0.736) | -0.225 (0.738) | -0.179 (0.737) | -0.162 (0.739) |
| μ_2 | 0.585 (0.737) | 0.548 (0.739) | 0.590 (0.737) | 0.607 (0.739) |
| μ_3 | 0.920 (0.738) | 0.884 (0.740) | 0.925 (0.738) | 0.942 (0.740) |
| <i>N</i> | 1107 | 1107 | 1107 | 1107 |
| <i>Pseudo R</i> ² | 0.148 | 0.149 | 0.144 | 0.144 |

Table 11: Robustness: Ordered probit regressions of overdraft usage considering alternative measurements of financial literacy

This table reports ordered probit regressions on different proxies for financial literacy which are obtained by applying an iterated principal factor analysis as in [van Rooij, Lusardi, and Alessie \(2011\)](#). Column (i) replicates the results from Table 6 column (ii). Column (ii) displays results when scores are analyzed instead of indicator variables. Columns (iii) and (iv) show the results for two financial literacy indices. The basic financial literacy index is obtained from an iterated principal factor analysis of the four basic financial literacy questions (in column (iv) we also include four items indicating whether a respondent admitted to not know an answer). The advanced financial literacy index is obtained analogically considering the five advanced financial literacy questions. Robust standard errors are given in parentheses. Significance levels are indicated as *** 1%-level, ** 5%-level, * 10%-level.

| | (i) indicator variables | (ii) scores | (iii) indices for FL only correct items | (iv) indices for FL with don't know items |
|-----------------------------|-------------------------|----------------------|--|--|
| CRT score | -0.083** (0.034) | -0.073** (0.036) | -0.080** (0.035) | -0.076** (0.035) |
| Basic financial literacy | -0.031 (0.074) | 0.020 (0.042) | 0.086* (0.049) | 0.032 (0.062) |
| Advanced financial literacy | -0.155** (0.079) | -0.057* (0.031) | -0.092** (0.042) | -0.083* (0.048) |
| 2nd wealth quartile | -0.492*** (0.107) | -0.462*** (0.109) | -0.471*** (0.109) | -0.469*** (0.109) |
| 3rd wealth quartile | -0.374*** (0.106) | -0.385*** (0.109) | -0.397*** (0.110) | -0.391*** (0.109) |
| 4th wealth quartile | -0.717*** (0.110) | -0.705*** (0.115) | -0.717*** (0.115) | -0.713*** (0.115) |
| Log income | -0.052 (0.079) | -0.051 (0.081) | -0.053 (0.082) | -0.053 (0.081) |
| Age | 0.048** (0.020) | 0.044** (0.020) | 0.045** (0.020) | 0.045** (0.020) |
| Age ² | -0.068*** (0.019) | -0.063*** (0.019) | -0.064*** (0.019) | -0.064*** (0.019) |
| Other demographics | Yes | Yes | Yes | Yes |
| Educational controls | Yes | Yes | Yes | Yes |
| μ_1 | -0.447 (0.724) | -0.467 (0.743) | -0.403 (0.746) | -0.395 (0.743) |
| μ_2 | 0.294 (0.725) | 0.281 (0.743) | 0.347 (0.746) | 0.353 (0.743) |
| μ_3 | 0.655 (0.725) | 0.632 (0.743) | 0.697 (0.746) | 0.702 (0.743) |
| N | 1118 | 1054 | 1054 | 1054 |
| $Pseudo R^2$ | 0.160 | 0.149 | 0.151 | 0.149 |

Table 12: Robustness: Applying different regression models

This table reruns the regression from Table 5 column (iii) and Table 6 for different estimation procedures. Columns (i) and (ii) display the coefficient estimates of regressing overdraft credit usage frequency on the full set of explanatory and control variables by an OLS regression with heteroskedasticity-robust standard errors. In columns (iii) and (iv), we do a probit regression of a dummy indicating whether the credit line has been used excessively in the preceding year (i.e. at least 6 times or constantly). In columns (v) and (vi) we analyze whether our results are prone to an item non-response bias. For this purpose, we make use of five imputed data sets provided by MEA. While we do not rely on imputed values for our dependent and explanatory variables, we use the imputed values for the control variables. We run ordered probit regressions on all five imputed data sets. The results are obtained by using Rubin’s Method (Rubin, 1987). Although not fully reported, we employ the complete set of control variables as in Table 5. Robust standard errors are given in parentheses. Significance levels are indicated as *** 1%-level, ** 5%-level, * 10%-level.

| | OLS | | Probit | | mi ordered probit | |
|---------------------------|----------------------|----------------------|----------------------|-------------------------|----------------------|----------------------|
| | (i) | (ii) | (iii) | (iv) | (v) | (vi) |
| CRT score | -0.067** (0.031) | -0.069** (0.031) | -0.084* (0.047) | -0.092** (0.047) | -0.084*** (0.032) | -0.087*** (0.032) |
| Financial literacy | -0.162** (0.071) | | -0.318*** (0.109) | | -0.125* (0.074) | |
| Basic literacy (numeracy) | | -0.024 (0.066) | | -0.110 (0.103) | | 0.003 (0.07) |
| Advanced literacy | | -0.148** (0.069) | | -0.161 (0.109) | | -0.128* (0.073) |
| 2nd wealth quartile | -0.478*** (0.104) | -0.477*** (0.104) | -0.415*** (0.131) | -0.408*** (0.131) | -0.443*** (0.120) | -0.445*** (0.120) |
| 3rd wealth quartile | -0.394*** (0.104) | -0.389*** (0.104) | -0.483*** (0.136) | -0.478*** (0.136) | -0.482*** (0.115) | -0.481*** (0.115) |
| 4th wealth quartile | -0.665*** (0.103) | -0.665*** (0.102) | -0.796*** (0.155) | -0.801*** (0.154) | -0.838*** (0.115) | -0.838*** (0.115) |
| Log income | -0.025 (0.065) | -0.025 (0.065) | -0.033 (0.097) | -0.043 -0.03 (0.097) | -0.028 (0.075) | |
| Age | 0.019 (0.016) | 0.020 (0.016) | 0.034 (0.028) | 0.034 (0.027) | 0.055*** (0.018) | 0.055*** (0.018) |
| Age ² | -0.036** (0.014) | -0.037** (0.014) | -0.056** (0.027) | -0.056** (0.027) | -0.071*** (0.017) | -0.072*** (0.017) |
| Mid-level education | 0.118 (0.081) | 0.121 (0.081) | 0.207* (0.120) | 0.206* (0.119) | 0.121 (0.084) | 0.123 (0.084) |
| A-level education | 0.069 (0.084) | 0.072 (0.084) | 0.189 (0.137) | 0.179 (0.136) | 0.046 (0.094) | 0.048 (0.094) |
| Economics education | -0.027 (0.019) | -0.028 (0.019) | -0.061* (0.032) | -0.065** (0.032) | -0.024 (0.021) | -0.024 (0.021) |
| Household structure | Yes | Yes | Yes | Yes | Yes | Yes |
| Occupational controls | Yes | Yes | Yes | Yes | Yes | Yes |
| α / μ_1 | 2.720*** (0.623) | 2.693*** (0.624) | -0.385 (0.928) | -0.327 (0.921) | -0.114 (0.684) | -0.114 (0.684) |
| μ_2 | | | | | 0.656 (0.684) | 0.656 (0.684) |
| μ_3 | | | | | 1.007 (0.684) | 1.007 (0.684) |
| N | 1118 | 1118 | 1118 | 1118 | 1291 | 1291 |
| $adj./pseudoR^2$ | 0.147 | 0.145 | 0.133 | 0.128 | | |

A Cognitive Reflection Test

This appendix provides the Cognitive Reflection Test introduced by [Fredrick \(2005\)](#) which is translated into German in the 2009 SAVE survey. In the questionnaire the questions of the CRT are captioned "brain teasers" and are provided in fill-in-format. We indicate correct answers in brackets.

1. A bat and a ball cost 110 cents in total. The bat costs 100 cents more than the ball. How much does the ball cost? - Price of the ball: _ _ _ cents (please fill in) [5]
2. If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? - Time required: _ _ _ minutes (please fill in). [5]
3. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? - Duration, until lake is covered half with water lilies: _ _ _ days (please fill in). [47]

B Financial Literacy Questions

This appendix provides a translation of the questions on financial literacy in the 2009 SAVE questionnaire. Correct answers are in bold font. The first four questions displayed here refer to basic financial literacy while the latter five gauge more advanced financial concepts. The order in the SAVE survey deviates from the original questionnaire by [van Rooij, Lusardi, and Alessie \(2011\)](#).

Basic financial literacy questions (financial numeracy):

1. Suppose you own €100 in a savings account. This balance yields interest of 2% per year and you leave it on this account for 5 years. What do you think: What is the deposit account balance after 5 years? - **More than €102**; Exactly €102; Less than €102; Don't know.
2. Suppose you had €100 in a savings account and the interest rate is 20% per year and you leave it on this account for 5 years. What do you think: What is the deposit account balance after 5 years? - **More than €200**; Exactly €200; Less than €200; Don't know.
3. Assuming your savings account yields interest of 1% per year and inflation amounts to 2 % per year. What do you think: Will you be able to buy more, less, or as much as today with your deposit account balance after one year? - More; As much as today; **Less**; Don't know.
4. Suppose that in the year 2012 your income has doubled and prices of all goods have doubled too. How much will you be able to buy with your income in 2012? - More than today; **As much as today**; Less; Don't know.

Advanced financial literacy questions:

1. Which of the following assets exhibits the highest return volatility? - Savings books, bonds, **stocks**, don't know.
2. Which is the main function of the stock market? - The stock market predicts stock earnings; results in an increase in the price of stocks; **The stock market brings people who want to buy stocks together with those who want to sell stocks**; None of the above; Don't know.
3. Is the following statement true or false: An investment in a single stock is less risky than an investment in an equity mutual fund? - True; **False**; Don't know.

4. Which of the following statements is correct? - If you invest in a balanced fund, you cannot withdraw money within the first year of your investment; **Balanced funds invest in several asset classes like stocks and bonds**; Balanced funds guarantee a fixed interest rate which is based on past performance; None of the above statements is correct; Don't know.
5. How does a fixed-coupon bond price react to decreasing interest rates? - **Bond price increases**; Bond price remains constant; Bond price decreases; Don't know.

C Reflectiveness, Basic & Advanced Literacy Across Demographics

Table 13: Appendix: Reflectiveness, Basic and Advanced Literacy Across Demographics

Panel A reports the distribution of the CRT results across different levels of education, different age groups, and gender. Besides the four groups we report for each demographic group the mean value of the *CRT score* as well as the number of individuals in each group. Panels B and C report the same statistics for the basic and advanced financial literacy questions.

| Panel A: CRT score across demographics | | | | | | |
|--|---------------|-------|-------|----------|------|-----|
| Education | Impulsiveness | | | | Mean | N |
| | (low) 0 | 1 | 2 | 3 (high) | | |
| Lower secondary | 12.88 | 25.58 | 32.74 | 28.80 | 1.77 | 559 |
| Mid-level | 19.11 | 30.73 | 27.52 | 22.63 | 1.54 | 654 |
| A-level | 31.78 | 33.09 | 20.26 | 14.87 | 1.18 | 538 |
| Age | | | | | | |
| 21-30 years | 26.09 | 16.52 | 29.57 | 27.83 | 1.59 | 115 |
| 31-40 years | 26.24 | 33.03 | 23.53 | 17.19 | 1.32 | 221 |
| 41-50 years | 21.05 | 31.08 | 27.07 | 20.80 | 1.47 | 399 |
| 51-60 years | 21.68 | 30.64 | 25.72 | 21.97 | 1.48 | 346 |
| 61-70 years | 19.45 | 27.12 | 29.32 | 24.11 | 1.58 | 365 |
| 71 years and older | 16.39 | 33.11 | 26.89 | 23.61 | 1.58 | 305 |
| Gender | | | | | | |
| Female | 24.37 | 32.27 | 25.86 | 17.51 | 1.63 | 877 |
| Male | 17.67 | 27.37 | 28.05 | 26.91 | 1.36 | 874 |

| Panel B: Basic financial literacy (numeracy) across demographics | | | | | | | | |
|--|-----------------------------|-------|-------|-------|----------|----------|------|------|
| | Basic financial literacy | | | | | Mean | N | |
| | (low) 0 | 1 | 2 | 3 | 4 (high) | | | |
| Education | | | | | | | | |
| Lower secondary | 14.19 | 8.54 | 17.61 | 32.33 | 27.33 | 2.50 | 761 | |
| Mid-level | 7.74 | 6.17 | 15.75 | 30.31 | 40.03 | 2.89 | 762 | |
| A-level | 2.68 | 1.85 | 9.90 | 28.86 | 56.71 | 3.35 | 596 | |
| Age | | | | | | | | |
| 21-30 years | 11.38 | 8.94 | 13.01 | 21.95 | 44.72 | 2.80 | 123 | |
| 31-40 years | 6.15 | 5.38 | 18.85 | 23.85 | 45.77 | 2.98 | 260 | |
| 41-50 years | 8.02 | 5.49 | 14.77 | 27.43 | 44.30 | 2.95 | 474 | |
| 51-60 years | 9.44 | 4.84 | 13.56 | 32.93 | 39.23 | 2.88 | 413 | |
| 61-70 years | 4.89 | 5.78 | 16.00 | 36.22 | 37.11 | 2.95 | 450 | |
| 71 years and older | 13.53 | 6.52 | 12.53 | 32.83 | 34.59 | 2.68 | 399 | |
| Gender | | | | | | | | |
| Female | 6.52 | 4.09 | 13.73 | 29.89 | 45.76 | 2.72 | 1092 | |
| Male | 10.62 | 7.42 | 15.75 | 31.32 | 34.89 | 3.04 | 1027 | |
| Panel C: Advanced financial literacy across demographics | | | | | | | | |
| | Advanced financial literacy | | | | | | Mean | N |
| | (low) 0 | 1 | 2 | 3 | 4 | 5 (high) | | |
| Education | | | | | | | | |
| Lower secondary | 28.75 | 16.81 | 16.25 | 19.03 | 16.25 | 2.92 | 1.86 | 720 |
| Mid-level | 14.59 | 12.43 | 16.08 | 24.19 | 27.84 | 4.86 | 2.53 | 740 |
| A-level | 4.93 | 7.99 | 13.27 | 22.62 | 38.10 | 13.10 | 3.20 | 588 |
| Age | | | | | | | | |
| 21-30 years | 18.85 | 17.21 | 14.75 | 16.39 | 30.33 | 2.46 | 2.30 | 122 |
| 31-40 years | 10.89 | 10.12 | 15.95 | 23.74 | 30.74 | 8.56 | 2.79 | 257 |
| 41-50 years | 13.98 | 10.11 | 15.70 | 23.87 | 30.32 | 6.02 | 2.65 | 465 |
| 51-60 years | 17.25 | 11.50 | 15.00 | 22.00 | 29.50 | 4.75 | 2.49 | 400 |
| 61-70 years | 12.79 | 12.56 | 15.35 | 24.42 | 25.58 | 9.30 | 2.65 | 430 |
| 71 years and older | 27.81 | 17.65 | 14.97 | 17.11 | 16.58 | 5.88 | 1.95 | 374 |
| Gender | | | | | | | | |
| Female | 22.82 | 14.39 | 16.86 | 19.60 | 22.54 | 3.79 | 2.16 | 1056 |
| Male | 10.38 | 10.89 | 13.71 | 24.40 | 31.15 | 9.48 | 2.83 | 992 |

D Overdraft Usage Frequency Across Subgroups

Table 14: Appendix: Overdraft usage frequency across subgroups

This table reports usage frequencies of overdraft lines of credit across different demographic characteristics, different levels of impulsiveness as well as basic and advanced financial literacy.

| | 0 (never) | 1-3 times | 4-6 times | more often | N |
|--|-----------|-----------|-----------|------------|-----|
| Education | | | | | |
| Lower secondary | 51.84 | 21.89 | 9.98 | 16.29 | 571 |
| Mid-level | 42.83 | 28.50 | 8.12 | 20.54 | 628 |
| A-level | 49.50 | 26.96 | 8.85 | 14.69 | 497 |
| Age | | | | | |
| 21-30 years | 34.92 | 34.92 | 7.94 | 22.22 | 63 |
| 31-40 years | 31.34 | 26.37 | 12.94 | 29.35 | 201 |
| 41-50 years | 34.29 | 31.15 | 12.04 | 22.51 | 382 |
| 51-60 years | 40.00 | 31.18 | 8.82 | 20.00 | 340 |
| 61-70 years | 58.75 | 22.45 | 7.57 | 11.23 | 383 |
| 71 years and older | 71.56 | 15.90 | 4.89 | 7.65 | 327 |
| Gender | | | | | |
| Female | 45.72 | 26.03 | 8.56 | 19.70 | 853 |
| Male | 49.94 | 25.62 | 9.37 | 15.07 | 843 |
| Net wealth quartiles | | | | | |
| 1 (lowest) | 33.78 | 25.95 | 10.29 | 29.98 | 447 |
| 2 | 50.00 | 24.47 | 6.91 | 18.62 | 376 |
| 3 | 46.45 | 29.10 | 10.27 | 14.18 | 409 |
| 4 (highest) | 60.41 | 24.21 | 8.14 | 7.24 | 442 |
| Net household income quartiles | | | | | |
| 1 (lowest) | 46.15 | 25.52 | 6.29 | 22.03 | 286 |
| 2 | 50.68 | 20.05 | 8.67 | 20.60 | 369 |
| 3 | 45.11 | 27.45 | 11.22 | 16.23 | 419 |
| 4 (highest) | 49.21 | 27.23 | 9.95 | 13.61 | 382 |
| CRT score | | | | | |
| 0 (highly impulsive) | 41.51 | 26.83 | 9.40 | 22.25 | 436 |
| 1 | 50.00 | 24.85 | 7.40 | 17.75 | 338 |
| 2 | 50.56 | 24.30 | 10.61 | 14.53 | 358 |
| 3 (highly reflective) | 54.14 | 25.19 | 9.02 | 11.65 | 266 |
| Basic financial literacy (numeracy) | | | | | |
| 0 (low) | 45.74 | 19.15 | 8.51 | 26.60 | 94 |
| 1 | 51.19 | 20.24 | 11.90 | 16.67 | 84 |
| 2 | 41.63 | 27.04 | 7.73 | 23.61 | 233 |
| 3 | 48.75 | 26.97 | 6.74 | 17.53 | 519 |
| 4 (high) | 48.95 | 26.85 | 10.35 | 13.85 | 715 |
| Advanced financial literacy | | | | | |
| 0 (low) | 42.86 | 28.06 | 5.61 | 23.47 | 196 |
| 1 | 50.53 | 22.87 | 8.51 | 18.09 | 188 |
| 2 | 41.56 | 25.93 | 8.23 | 24.28 | 243 |
| 3 | 47.17 | 24.80 | 10.78 | 17.25 | 371 |
| 4 | 48.81 | 28.94 | 7.78 | 14.47 | 463 |
| 5 (high) | 60.98 | 20.33 | 9.76 | 8.94 | 123 |

E Components of Net Wealth

Table 15: Appendix: Components considered in the calculation of net wealth

The first column reports the number of respondents who provided information on their household balance sheet in the SAVE 2009 questionnaire. We also include the shares of respondents who indicated not to be invested in the respective assets (i.e. have zero value in an asset class). Furthermore, we provide overall mean values in Euros as well as averages for non-zero values. The high value of real estate assets in relation to mortgage balances may be due to households having already paid off lot of their mortgage debts at an average age of 55 years. For the regressions, net wealth is calculated as logarithmic sum of assets minus logarithmic sum of debts. Afterwards, households are sorted into net wealth quartiles. SAVE also contains information about whether the values are reported from documents or respondents' estimates. Median values (available upon request) are similar for both reporting ways.

| Assets | number of observations | share of people not invested | overall mean value (in Euros) | mean value if indebted (in Euros) |
|----------------------------------|------------------------|------------------------------|-------------------------------|-----------------------------------|
| Liquid assets | | | | |
| Savings investments | 1968 | 36% | 13,538 | 21,263 |
| Shares and real estate funds | 2020 | 76% | 6,649 | 27,922 |
| Bonds | 2039 | 91% | 3,333 | 38,614 |
| Other money assets | 2053 | 96% | 1,160 | 31,743 |
| Old age provisions | | | | |
| Whole life insurance | 1820 | 71% | 7,557 | 26,350 |
| Riester pension | 1827 | 86% | 411 | 2,891 |
| Other private pension scheme | 1918 | 92% | 1,030 | 13,168 |
| Life insurance by employer | 1934 | 95% | 1,022 | 19,190 |
| Other pension scheme by employer | 1842 | 92% | 1,290 | 16,847 |
| Real estate assets | | | | |
| Building society investments | 1976 | 67% | 2,634 | 7,945 |
| Market value of flat/house | 2085 | 48% | 109,421 | 208,731 |
| Other real estate assets | 2110 | 87% | 27,855 | 207,686 |
| Debts and mortgages | | | | |
| Building society loans | 2099 | 89% | 3,906 | 34,303 |
| Mortgages | 2065 | 78% | 18,495 | 85,440 |
| Consumer credit | 2067 | 84% | 1,484 | 9,240 |
| Family loans | 1996 | 98% | 285 | 12,367 |
| Other loans | 2066 | 97% | 1,063 | 31,367 |
| Education loans | 2124 | 99% | 60 | 7,472 |

F Constructing Indices for Basic and Advanced Financial Literacy

Table 16: Appendix: Constructing indices for basic and advanced financial literacy

Panel A reports factor loadings and uniqueness criteria when analyzing separately 4 items indicating correct answers to the basic financial literacy questions and 5 items for correct advanced financial literacy questions. Panel B repeats the two separate analyses including dummy variables indicating when a respondent chose to admit not to know the correct answer.

| Panel A: Considering only correct items | | |
|---|-----------------|------------|
| Basic FL questions | Factor loadings | Uniqueness |
| 1) Interest (2%) | 0.7905 | 0.3752 |
| 2) Interest (20%) | 0.6044 | 0.6348 |
| 3) Inflation | 0.6127 | 0.6246 |
| 4) Money illusion | 0.4408 | 0.8057 |
| Advanced FL questions | Factor loadings | Uniqueness |
| 1) Return volatility | 0.6087 | 0.6295 |
| 2) Stock market | 0.6748 | 0.5446 |
| 3) Diversification | 0.7309 | 0.4659 |
| 4) Balanced funds | 0.6478 | 0.5803 |
| 5) Bond prices | 0.2712 | 0.9264 |

| Panel B: Considering correct and don't know items | | | |
|---|---------|-----------------|------------|
| Basic FL questions | | Factor loadings | Uniqueness |
| 1) Interest (2%) | correct | -0.7725 | 0.4033 |
| | d.k. | 0.8644 | 0.2528 |
| 2) Interest (20%) | correct | -0.5178 | 0.7319 |
| | d.k. | 0.8797 | 0.2262 |
| 3) Inflation | correct | -0.7394 | 0.4533 |
| | d.k. | 0.8116 | 0.3413 |
| 4) Money illusion | correct | -0.4262 | 0.8183 |
| | d.k. | 0.7072 | 0.4999 |
| Advanced FL questions | | Factor loadings | Uniqueness |
| 1) Return volatility | correct | -0.6454 | 0.5834 |
| | d.k. | 0.6616 | 0.5623 |
| 2) Stock market | correct | -0.6611 | 0.5630 |
| | d.k. | 0.7682 | 0.4099 |
| 3) Diversification | correct | -0.7517 | 0.4350 |
| | d.k. | 0.8035 | 0.3543 |
| 4) Balanced funds | correct | -0.7046 | 0.5035 |
| | d.k. | 0.7295 | 0.4678 |
| 5) Bond prices | correct | -0.2651 | 0.9297 |
| | d.k. | 0.6569 | 0.5685 |