

Understanding the Determinants of Financial Outcomes and Choices: The Role of Noncognitive Abilities

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Abstract

We explore how financial distress and choices are affected by noncognitive abilities. Our measures stem from research in psychology and economics. In a representative panel of households, we find that people in the bottom decile of noncognitive abilities are five times more likely to experience financial distress compared to those in the top decile. Relatedly, individuals with lower noncognitive abilities make financial choices that increase their likelihood of distress: They are less likely to plan for retirement and save, and more likely to buy impulsively and to have unsecured debt. Causality is shown using childhood trauma as an instrument.

Keywords: Noncognitive abilities, financial distress, financial choices, saving, unsecured debt, behavioral finance, psychology and economics

JEL classification: D10; D14; G02

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Economists have accumulated abundant evidence indicating that noncognitive abilities—besides cognitive skills—matter for a large set of economic behaviors.¹ Recent research shows that noncognitive abilities have implications for labor income (Heckman, Stixrud, and Urzua (2006); Lindqvist and Vestman (2011)), health-related behavior (Heckman, Humphries, and Veramendi (2017)), educational attainment (Cunha, Heckman, and Schennach (2010)), and firm policies (Gow, Kaplan, Larcker, and Zakolyukina (2016)). Yet, in financial economics, there is relatively little empirical evidence on the role that noncognitive abilities play in influencing households’ financial decisions and their exposure to financial distress.

A better understanding of the determinants of financial fragility is of critical importance. According to a survey conducted by the Federal Reserve Board, almost half of U.S. households are at risk of financial distress: An unexpected expense of \$400 would prompt many individuals to borrow money, sell something, or simply not pay at all (Federal Reserve Board (2016)). Traditional economic theories, however, have a hard time explaining the observed heterogeneity in financial choices and outcomes. In this paper, we provide evidence linking noncognitive abilities to a broad array of financial choices and, in particular, to the likelihood of financial distress.

The measurement of noncognitive abilities presents a challenge in itself. Heckman, Pinto, and Savelyev (2013) state that the most influential taxonomy for measuring noncognitive abilities is a framework developed in psychology that is commonly referred to as the big five personality traits. Following that framework, we obtain measures of emotional stability and conscientiousness—two of the five traits—using the 20 standard survey questions developed in the seminal paper by

¹The term *noncognitive abilities* is rather standard in the literature; however, some clarification regarding our terminology is in order. As highlighted by Borghans, Duckworth, Heckman, and Ter Weel (2008), the term *noncognitive* is often juxtaposed with *cognitive*. However, it should not be interpreted as referring to traits devoid of cognition. Alternative names for noncognitive abilities are *soft abilities*, *personality traits*, and *character skills*. See Almlund, Duckworth, Heckman, and Kautz (2011) for a review of the literature.

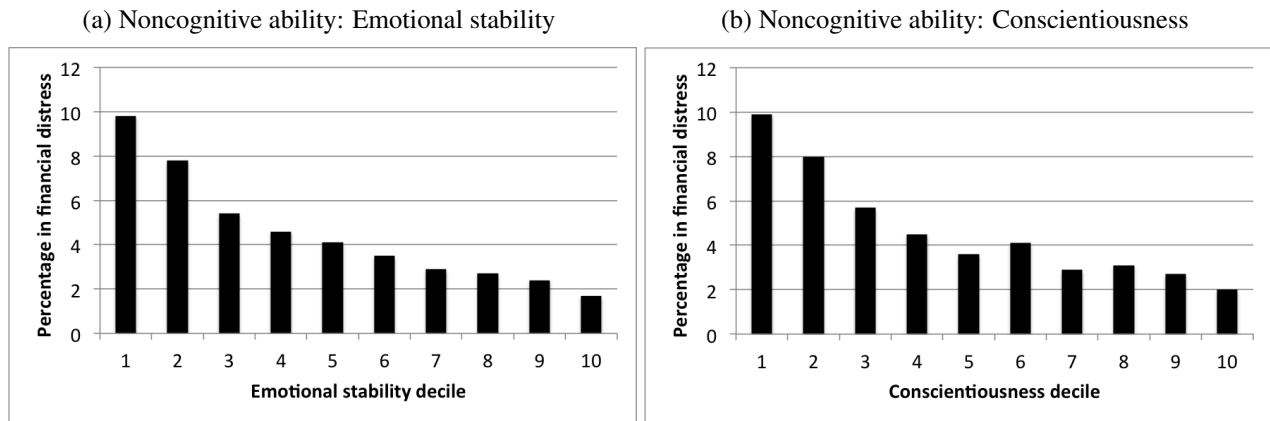
Goldberg (1992).² Emotional stability refers to a person’s ability to remain calm when faced with pressure or stress and to not be easily inclined to anxiety or act impulsively. Conscientiousness describes the tendency to be organized, practical, dependable, and self-disciplined.

We obtain the information needed to construct these measures and a rich set of variables of interest and controls from the Longitudinal Internet Studies for the Social Sciences (LISS). This panel comprises a representative sample of more than 7,000 individuals in the Netherlands who were regularly surveyed from 2008 to 2015.

As first evidence, Figure 1 illustrates the unconditional relation between noncognitive abilities and financial distress in our sample, motivating a thorough analysis. In the graphs, financial distress is defined as being delinquent on payment obligations (we consider several alternative definitions in the analysis). People in the lowest decile of noncognitive abilities have an almost 10% probability of being in financial distress, compared to less than 2% for those in the highest decile.

Figure 1: Financial distress by decile of noncognitive ability

Percentage of households in financial distress per decile of emotional stability and conscientiousness. Financial distress is measured as being delinquent on mortgage payments, rent payments, utility bills, or other bills.



²In our analysis, we focus on the two traits that have consistently been shown to relate to economic variables. We include the other three traits as controls (we find them to have no effects in most analyses). The literature on noncognitive abilities is described in more detail in Section I.A.

The estimated effect remains sizeable and statistically significant when accounting for a large number of likely covariates. In our baseline specification, we include controls for household income, employment status, financial wealth, health status, education, numeracy, financial literacy, risk aversion (inferred by lottery choices and self-reported), ambiguity aversion, trust, optimism, the other three personality traits (agreeableness, extraversion, and openness), gender, home ownership, the presence of children living in the home, living with a partner, residency in a rural area, and age. We find that a one standard deviation increase in emotional stability results in a 0.5 percentage point decrease in the probability of financial distress (12.1% relative to the baseline rate of 4.4%), while a one standard deviation increase in conscientiousness results in a 0.8 percentage point decrease in the probability of financial distress (19.0% relative to the same baseline).

Furthermore, we find that noncognitive abilities influence financial choices. Namely, people with lower abilities are less likely to plan for retirement and save, and have a higher propensity to buy impulsively and to have unsecured debt.³ While low savings and holding unsecured debt are not unambiguously bad financial choices, poor decisions in these domains do intuitively contribute to the likelihood of ending up in financial distress, thereby providing a plausible rationale for our previous results.

We also offer some evidence on the economic mechanisms governing these findings, building on the theoretical frameworks proposed by [Heckman, Stixrud, and Urzua \(2006\)](#) and [Borghans, Duckworth, Heckman, and Ter Weel \(2008\)](#). Analyzing the time a person dedicates to financial administration, we are able to link low noncognitive abilities to higher cost of effort and lower productivity of effort toward financial decision making. The evidence that we put forward in this

³This last result seems particularly important in light of the recent rise in the number of personal bankruptcies induced by unsecured borrowing (e.g., [Carrell and Zinman \(2014\)](#); [Skiba and Tobacman \(2015\)](#)).

regard is, however, only suggestive.

To provide further support for our main findings, we perform three additional sets of tests. First, to mitigate potential reverse causality concerns, we regress financial distress on lagged noncognitive abilities (e.g., we show that noncognitive abilities measured in 2008 predict financial distress in 2014). Second, to mitigate issues related to omitted variables or measurement error, we instrument emotional stability in adulthood using childhood trauma. The rationale behind this test is that traumatic experiences during childhood contribute to shape emotional stability but are arguably exogenous to financial outcomes in adulthood. Third, we show that our main results hold for a cross section of American households using the Understanding America Study (UAS). Overall, the empirical evidence supports a causal interpretation of our findings and mitigates concerns about our results being country specific.

Our paper makes a number of contributions to the literature. First, our study is closely related to the empirical literature exploring the determinants of financial outcomes and decisions.⁴ A growing number of papers focus specifically on the influence of cognitive abilities.⁵ In this paper, we focus instead on noncognitive abilities. We show that these abilities are particularly relevant to financial choices and possibly explain more of the variation in financial distress than cognitive abilities do.

⁴For instance, previous papers argue that financial choices are influenced by trust (Guiso, Sapienza, and Zingales (2008)), optimism (Puri and Robinson (2007)), ambiguity attitudes (Dimmock, Kouwenberg, Mitchell, and Peijnenburg (2016)), political preferences (Kaustia and Torstila (2011)), and health status (Rosen and Wu (2004)). Furthermore, recent research shows that important sources of personal bankruptcy are health shocks (Gross and Notowidigdo (2011)) and employment shocks (Elul, Souleles, Chomsisengphet, Glennon, and Hunt (2010)).

⁵Grinblatt, Keloharju, and Linnainmaa (2011) relate cognitive abilities to stock market participation, diversification, and Sharpe ratios and Grinblatt, Ikäheimo, Keloharju, and Knüpfer (2015) show that high-IQ investors avoid funds with high management fees. Furthermore, Agarwal and Mazumder (2013) analyze the effect of cognitive abilities on the propensity to make financial mistakes regarding the optimal usage of credit cards and home equity loan applications. Both Grinblatt, Keloharju, and Linnainmaa (2011) and Agarwal and Mazumder (2013) obtain their measures for cognitive ability from military test scores. Furthermore, there is a vast literature emphasizing the importance of financial literacy for households' financial choices (e.g., Lusardi and Mitchell (2008); Lusardi and Mitchell (2014); van Rooij, Lusardi, and Alessie (2011)).

Our research builds on preliminary evidence from the literature in psychology that links personality traits to financial behaviors (e.g., [Davey and George \(2010\)](#); [Xu, Beller, Roberts, and Brown \(2015\)](#)) and relates to a few recent studies in economics. Namely, [Kuhnen and Melzer \(2017\)](#), in a contemporaneous paper, examine the influence of the self-efficacy of young adults on their financial delinquency behavior⁶ and [Rustichini, DeYoung, Anderson, and Burks \(2014\)](#) map survey questions onto the big five traits and show a relation with the credit scores of trucker trainees. In contrast to those papers, we study a much richer set of financial choices in a representative sample, we are able to distinguish between alternative explanations, and we are the first to provide suggestive evidence for the underlying economic mechanism linking noncognitive abilities to financial choices.

Our paper also contributes to a growing literature on genetics and financial choices. A recent series of papers documents the importance of genes in explaining heterogeneity in financial behaviors (e.g., [Cesarini, Johannesson, Lichtenstein, Sandewall, and Wallace \(2010\)](#); [Cronqvist and Siegel \(2014\)](#); [Cronqvist and Siegel \(2015\)](#); [Cronqvist, Previtro, Siegel, and White \(2016\)](#)). By documenting the relation between financial choices and noncognitive abilities, which are largely genetically determined, we provide a likely connection between genetic heritage and financial choices.

Our findings have policy implications. While it is difficult to alter noncognitive abilities after childhood, noncognitive abilities can be nurtured at an early stage of life. Several programs, such as the influential Perry Preschool Project, show that not only cognitive abilities can and should be developed in classrooms, but even more so noncognitive abilities (e.g., [Chetty, Friedman, Hilger,](#)

⁶We run a similar analysis to that conducted by [Kuhnen and Melzer \(2017\)](#) by using a closely related measure of self-efficacy (locus of control) and we find similar results. Interestingly, when we include our measures of emotional stability and conscientiousness, self-efficacy becomes insignificant. This is possibly because self-efficacy is usually considered a part of conscientiousness.

Saez, Whitemore Schanzenbach, and Yagan (2011); Heckman, Moon, Pinto, Savelyev, and Yavitz (2010b); Heckman, Pinto, and Savelyev (2013)). Furthermore, our results have potential implications for wealth inequality. Since the financial crisis, the public debate has been increasingly concerned with the role played by bad financial choices in increasing disparities. Poor financial decision making by individuals with lower abilities is likely to exacerbate existing inequalities, as previous research shows that these individuals have, on average, lower incomes in the first place. Finally, our results have implications for bankruptcy law design. Namely, if financial distress were mostly caused by adverse shocks (e.g., bad luck), a policy favoring debt relief could be optimal. However, we show that some individuals are more exposed to financial distress due to low noncognitive abilities, which makes financial distress persistent (since noncognitive abilities are largely stable in adulthood). Policies promoting debt relief in the case of bankruptcy could prove scarcely effective in such cases, since the likelihood of recurrence is high.

I. Measuring noncognitive abilities

The economics literature provides evidence on the influence of cognitive and noncognitive abilities on labor income, employment, health behaviors, and educational attainment. While, in finance, a few papers explore the role of cognitive abilities, noncognitive abilities have largely been ignored. In this section, we survey the related literature in economics, as this provides guidance on which measures should be used in our analysis. Furthermore, we provide details on our measurement of noncognitive abilities.

A. *Measures of noncognitive abilities in the literature*

There is wide agreement on using personality traits to measure noncognitive abilities. However, previous literature uses a variety of different traits. This lack of uniformity largely stems from limited data availability. Our goal in this section is twofold. First, we make the case that our two measures of noncognitive abilities, emotional stability and conscientiousness, are the appropriate measures to use. Second, we highlight the close relation between these measures and alternatives used in the literature.

The framework that we use was originally developed in psychology and is increasingly used in economics. In a paper assessing the long-term consequences of improving noncognitive abilities on labor market outcomes, [Heckman, Pinto, and Savelyev \(2013\)](#) write that “the most influential taxonomy of personality skills is the big five personality inventory. The big five was codified long after the Perry experiment⁷ was conducted. We only have access to psychological measures of personality skills developed before the big five was codified.” Unlike [Heckman, Pinto, and Savelyev \(2013\)](#), we are able to extract the big five personality traits from our data (emotional stability and conscientiousness are two of these traits).

Instead of using the big five personality traits, several papers in economics employ available survey questions and relate them to emotional stability and conscientiousness. For instance, [Heckman, Pinto, and Savelyev \(2013\)](#) obtain 43 different personality measures for children in the Perry Preschool Study, which, using factor analysis, are summarized into three abilities: cognition, ex-

⁷The Perry Preschool Study is an experimental intervention carried out from 1962 to 1967, providing high-quality preschool education to low-IQ African-American children aged three to four living in poverty and assessed to be at high risk of school failure. [Borghans, Duckworth, Heckman, and Ter Weel \(2008\)](#) state that “the power of traits other than cognitive ability for success in life is vividly demonstrated by the Perry Preschool study.” [Conti, Heckman, and Pinto \(2016\)](#), [Heckman, Moon, Pinto, Savelyev, and Yavitz \(2010a\)](#), [Heckman, Moon, Pinto, Savelyev, and Yavitz \(2010b\)](#), and [Heckman, Pinto, and Savelyev \(2013\)](#) show that altering the noncognitive abilities of these preschoolers improved their life outcomes, including education, employment, earnings, and health, and reduced the likelihood of criminal behaviors.

ternalizing behavior, and academic motivation. Externalizing behavior is mostly related to our measure of emotional stability, while academic motivation is related to conscientiousness.

Another widely used dataset to study the influence of noncognitive abilities on economic outcomes is the National Longitudinal Survey of Youth of 1979 (NLSY79). The NLSY79 asks mothers to answer a questionnaire about their children between the ages of three and six (Cunha, Heckman, and Schennach (2010)). Among other traits, they use a child's tendency to be anxious and depressed as a proxy for noncognitive ability. This measure is tightly linked to our emotional stability measure.

Using Swedish data, Lindqvist and Vestman (2011) provide evidence that emotional stability affects wages and the probability of unemployment by using data from interviews conducted by psychologists with individuals enlisted in the military. Rustichini, DeYoung, Anderson, and Burks (2014) use a dataset of trucker trainees to show the predictive power of noncognitive abilities for credit score, job persistence, and healthy behaviors. The authors do not have direct measures of the big five personality traits but explicitly map the available survey questions onto these traits. Additionally, Kuhnen, Samanez-Larkin, and Knutson (2013) show in a lab experiment on 60 individuals that the part of emotional stability that is shaped by genes relates to hypothetical financial choices.

In their review of the literature on noncognitive abilities and economic outcomes, Almlund, Duckworth, Heckman, and Kautz (2011) state that “a growing body of evidence suggests that personality measures—especially those related to conscientiousness, and, to a lesser extent, neuroticism—predict a wide range of outcomes.”⁸ Overall, there seems to be a general consensus on using emotional stability and conscientiousness as measures of noncognitive abilities and on the fact that

⁸Neuroticism is the negative pole of emotional stability.

these are the two most relevant traits for economic outcomes.

B. Construction of the measures of noncognitive abilities

The intuition behind what our measures capture can best be illustrated using trait adjectives describing individuals who score high or low on each trait. These are shown in Table A2 in Appendix D. Summing up, emotional stability refers to a person's ability to remain calm when faced with pressure or stress and to not being easily inclined to anxiety or to act impulsively. Conscientiousness describes the tendency to be organized, practical, persistent, self-disciplined, and achievement striving (e.g., [McAdams \(2013\)](#)).

In our sample, emotional stability and conscientiousness are measured using the 20 standard questions developed in the seminal paper by [Goldberg \(1992\)](#) reported in Table I. Importantly, these questions are asked without reference to any context, which limits the potential of mechanical correlations.⁹ Respondents receive the following instruction: "Please use the rating scale below to describe how accurately each statement describes you. (1) very inaccurate, (2) moderately inaccurate, (3) neither inaccurate nor accurate, (4) moderately accurate, (5) very accurate." The respondents are not informed on what the questions are intent on measuring and the ordering of the questions is random. We summarize the 10 questions related to conscientiousness into one measure by using factor analysis. We do the same for emotional stability.

These traits describe largely permanent characteristics of people and mostly reflect genetic endowments and early life experiences. There is ample evidence that the heritable part of noncognitive abilities is greater than 50% and that the influence of the external environment after childhood

⁹For example, a respondent would be more likely to answer that she gets stressed easily *about her financial situation* if her financial situation is bad, thereby inducing a mechanical correlation in the data.

is limited (e.g., [Bouchard and Loehlin \(2001\)](#); [Bouchard and Matt \(2003\)](#)). In a review of over 150 longitudinal studies, [Roberts and DelVecchio \(2000\)](#) show that noncognitive abilities tend to become increasingly stable with age. Abilities measured for the same set of individuals from six to 30 years later display correlations between 60% and 80% with the original measurement ([Costa and McCrae \(1994\)](#)).

Table I: Survey questions to measure noncognitive abilities

The survey comprises 10 questions per noncognitive trait. A minus sign (-) after an item indicates that the question has a negative factor loading.

Instruction for respondent: Please use the rating scale below to describe how accurately each statement describes you: (1) very inaccurate, (2) moderately inaccurate, (3) neither inaccurate nor accurate, (4) moderately accurate, (5) very accurate

<u>Emotional stability</u>	Get stressed out easily (-) Am relaxed most of the time Worry about things (-) Seldom feel blue Am easily disturbed (-) Get upset easily (-) Change my mood a lot (-) Have frequent mood swings (-) Get irritated easily (-) Often feel blue (-)
<u>Conscientiousness</u>	Am always prepared Leave my belongings around (-) Pay attention to details Make a mess of things (-) Often forget to put things back in their proper place (-) Like order Shirk my duties (-) Follow a schedule Am exacting in my work Get chores done right away

Using our data, we confirm that individuals’ noncognitive abilities are remarkably stable over time. For conscientiousness, year-to-year correlations range between 0.77 and 0.88 (depending on the combination of years) and those for emotional stability range between 0.74 and 0.81. These correlations appear sizeable, especially taking into account the likely presence of noise in the measurement. To provide additional evidence on the persistence of noncognitive abilities, we show that, on average, the rank of the respondents sorted by noncognitive abilities in 2008 is preserved

over time. This can be seen in Figure [A1](#) in Appendix [D](#).

As noncognitive abilities are stable during adulthood, we take averages across years for each individual in our sample. The use of averages increases the number of available observations (because, e.g., the same respondent might answer the noncognitive abilities questions in 2008 and 2010 but not in 2009). More importantly, the use of averages attenuates minor fluctuations over the years due to reporting error and isolates the core fundamental differences across individuals. The results obtained without averaging noncognitive abilities are reported as robustness in Section [IV.B](#). The exact value of these variables has no specific interpretation other than providing a ranking among individuals. We therefore standardize our two measures to make the interpretation of the regression coefficients more intuitive.

II. Data

A. Description of the LISS dataset

The data source for this study is the LISS panel (Longitudinal Internet Study for the Social Sciences), a representative household survey conducted by CentERdata at Tilburg University, in the Netherlands. Several papers in economics are based on the same data (e.g., [Cherchye, De Rock, and Vermeulen \(2012\)](#); [Dimmock, Kouwenberg, and Wakker \(2015\)](#); [Noussair, Trautmann, and van de Kuilen \(2014\)](#)). The panel has been operational since October 2007 and we use data from 2008 to 2015. Our data comprise 11,855 individuals drawn randomly from the population register by Statistics Netherlands. Due to attrition and the subsequent addition of new individuals, at each point in time our cross section includes around 7,000 individuals.

The survey is computer based and subjects can participate from home. To limit selection bias, individuals who cannot otherwise participate are provided with a computer and an Internet connection. To encourage participation and retention, subjects are paid for each survey they complete. This dataset is particularly suited for our research, since one of the annual survey modules asks standard questions aimed at measuring noncognitive abilities following the big five personality framework. Furthermore, the dataset contains several measures of financial distress and financial decisions, along with an extensive set of demographic controls and variables related to preferences and cognitive abilities. Appendix A provides further details on the LISS panel.

B. Outcome variables

Our outcome variables are described in Table A1 in Appendix B. Table II presents information on their distribution. Several of the financial variables considered are measured annually. However, the response rates vary over time and some respondents are not asked every year, thereby affecting the number of annual observations.

In our analysis, the main variable of interest is *Financial distress: consumer delinquency*, which is an indicator variable equal to one if the respondent is behind on payment obligations, such as rent, mortgage, utilities, or other bills. Around 4.4% of the respondents are in financial distress according to this definition. In the empirical tests, we cannot observe whether the respondent is forced to be delinquent due to a lack of liquidity or strategically chooses not to pay.¹⁰ The high cost of being delinquent in the Netherlands suggests, however, that the latter case is rather unlikely, as the conditions for debt discharge are quite stringent (Niemi, Ramsay, and Whitford (2009)).

¹⁰In the United States, for instance, the rise in the number of delinquencies has been partially driven by a decrease in the costs of default, including social, information, and legal costs (Gross and Souleles (2002)).

Furthermore, we examine a number of measures of more severe financial distress. The indicator variable *Arrears rent/mortgage 3 months or more* is equal to one if the respondent was in arrears for three months or more on rent or mortgage payments in the last year. The indicator variable *Arrears utility 3 months or more* is equal to one if the respondent was in arrears for three months or more on utility bills in the last year. In the Netherlands, a person can be evicted and utilities can be cut off after not paying for three months. Slightly less than 1% of respondents are behind on mortgage or rent payments and 0.8% of the respondents are behind on their utility bills for more than three months. The indicator variable *Debt collector at the door* is equal to one if the respondent has had a debt collector at the door in the last month: 1% of the respondents report that to have been the case. The ordinal variable *Not able to pay €500* ranges from one to seven and measures the extent to which the respondent would have difficulties paying an unexpected, necessary expense of €500 without contracting a loan. The average value is equal to three in our sample.

We also explore several financial choices. The indicator variable *Saving* is equal to one if the respondent reports that expenditures are lower than his or her income and equal to zero otherwise.¹¹ In our sample, 36% of households are net savers, while the remainder either do not save (income approximately equal to consumption) or consume more than their income (either consume out of their wealth or borrow). The indicator variable *Unsecured debt* is equal to one if the respondent has a personal loan, a loan from a family member, debit card debt, a student loan, or other unsecured loans. In our sample, 39% of respondents use at least one of these loan options. The

¹¹Savings rates are notoriously hard to estimate empirically. There are potentially a number of different approaches: (1) comparing asset holdings at the beginning and end of the period, (2) adding inflows and outflows of wealth during the period, or (3) taking the difference between income and consumption expenditures in the period. [Börsch-Supan and Lusardi \(2003\)](#) argue that “wealth, consumption, and income data are severely affected by measurement error and taking first differences (as when using wealth) makes the measurement error problem even more dramatic.” Therefore, we focus on a measure of saving that is easily interpretable, directly communicated by the individual, and similar to the measurements used by [Puri and Robinson \(2007\)](#) and in the Survey of Household Economics and Decisionmaking conducted by the Federal Reserve Board.

variable *Impulse buying* measures to which degree a person is inclined to buy a product or service impulsively (i.e., without having planned to do so beforehand) and ranges from one to six, with an average value of two. The variable *Retirement planning* measures whether a person plans for financial needs after retirement and ranges from one to four, with an average value of 2.2. The indicator variable *Financial advice* is equal to one if the respondent seeks advice when deciding which financial product to purchase (e.g., bank account, mortgage, savings account, credit card, loan, or insurance). In our sample, 64% of respondents seek financial advice.

We also generate an indicator variable *Financial administration more than one hour* that is equal to one if the respondent spends more than one hour a month on financial administration tasks. We use this variable as a proxy of effort, which allows us to explore the mechanism relating noncognitive abilities to financial choices in Section III.E. About a quarter of people spend more than one hour each month on financial tasks.

Importantly, most of the variables we consider in our analysis are obtained from different surveys (modules) of the LISS panel, which we combine to generate our main dataset. For some of our variables of interest, we have only cross-sectional information as the corresponding survey has been fielded only in one year. This is the case for *Unsecured debt*, *Impulse buying*, *Retirement planning*, and *Financial advice*.

C. Control variables and instrument

Noncognitive abilities are rather stable and mostly determined before birth or at an early stage of life (see the discussion in Section I.B). This suggests that these traits are likely exogenous to most external factors. Nonetheless, in our baseline analyses, we include a battery of controls to provide

Table II: Summary statistics

This table reports summary statistics for our noncognitive ability measures, outcome variables, control variables, and instrument. The variables are defined in Table A1 in Appendix B. Several control variables have missing observations in our sample. The summary statistics include observations that have been filled in by carrying forward and backward non-missing values for the same individual. The reported statistics do not include missing observations that have been replaced with the median value of a group (groups are based on gender, education, and income category). Missing values for outcome variables and measures of noncognitive abilities are never filled in. The data cover the years from 2008 to 2015.

	Mean	Std	Min	Max	N
<i>Noncognitive ability measures</i>					
Noncognitive ability: emotional stability	0	1	-3.838	2.384	90,448
Noncognitive ability: conscientiousness	0	1	-4.358	2.438	90,448
<i>Outcome variables</i>					
Financial distress: consumer delinquency	0.044	0.204	0	1	38,519
Arrears rent/mortgage 3 months or more	0.009	0.097	0	1	38,520
Arrears utility 3 months or more	0.008	0.090	0	1	38,522
Debt collector at the door	0.010	0.099	0	1	38,763
Not able to pay €500	3.000	2.017	1	7	19,129
Saving	0.359	0.480	0	1	38,758
Unsecured debt	0.391	0.488	0	1	5,251
Impulse buying	1.973	1.267	1	6	5,285
Retirement planning	2.163	0.791	1	4	1,515
Financial advice	0.640	0.480	0	1	5,246
Financial administration more than one hour	0.267	0.442	0	1	16,527
<i>Control variables</i>					
Age	48.096	17.08	18	102	90,400
Male	0.46	0.498	0	1	90,400
Partner	0.736	0.441	0	1	90,400
Rural	2.924	1.294	1	5	90,317
Children	0.428	0.495	0	1	90,400
Employed	0.566	0.496	0	1	90,400
Unemployed	0.022	0.133	0	1	90,448
Not in labor force	0.410	0.492	0	1	94,000
No high school	0.084	0.278	0	1	90,240
High school	0.356	0.479	0	1	90,240
College	0.560	0.496	0	1	90,240
Home ownership	0.714	0.452	0	1	90,400
Log of net household income	7.836	0.569	5.525	9.018	85,145
Log of financial wealth	7.082	3.949	0	19.14	60,860
Health status	3.12	0.768	1	5	84,276
Trust	5.986	2.136	0	10	90,448
Openness	0	1	-4.949	3.031	90,448
Extraversion	0	1	-3.716	3.176	90,448
Agreeableness	0	1	-5.052	2.216	90,448
Numeracy	7.436	2.321	0	10	44,929
Financial literacy	2.133	0.865	0	3	40,507
Risk aversion	0.714	0.452	0	1	40,707
Risk aversion, self-assessed	5.169	2.171	0	10	31,503
Ambiguity aversion	0.63	0.483	0	1	15,119
Optimism	0.093	0.291	0	1	69,486
<i>Instrument</i>					
Childhood trauma	0.123	0.329	0	1	39,637

a cleaner estimation of the effect on financial choices when other channels are accounted for. Table A1 in Appendix B defines all these control variables and Table II reports the summary statistics.

Previous papers show that high noncognitive abilities have positive implications for earnings, employment, and health status. These positive effects, in turn, should lower the propensity of an individual to end up in financial distress. In other words, noncognitive abilities may have an *indirect* effect on financial distress via these channels. Therefore, to test whether noncognitive abilities have a residual effect when these channels are accounted for, we provide results controlling for the log of net household income, employment, unemployment, and health status.¹² This residual effect can be thought of as a lower bound for the total effect of noncognitive abilities on financial distress.

It is important to acknowledge that noncognitive and cognitive abilities are likely correlated. For instance, the numeracy score obtained in the survey can be influenced by anxiety (Borghans, Duckworth, Heckman, and Ter Weel (2008)). We mitigate the potential concern that we are mostly capturing the effect of cognitive skills by including proxies for cognitive ability and educational attainment (the dummy variables *high school* and *college*). We use nine numeracy questions to obtain a numeracy score¹³ and we measure financial literacy as the number of correct responses to three standard financial literacy questions (Appendix B provides the exact wording of these questions and additional details on several control variables).

Preferences and noncognitive abilities are found to have little relation with each other, while both have a complementary impact on decision making (Becker, Deckers, Dohmen, Falk, and Kosse (2012)). In our analysis, we control for risk aversion inferred using quantitative questions,

¹²Our results are robust to using individual income instead of household income.

¹³The questions are similar to those in the numeracy survey of the Health and Retirement Study and the English Longitudinal Study of Ageing used, for instance, by Banks and Mazzonna (2012).

as [Noussair, Trautmann, and van de Kuilen \(2014\)](#). In addition, we add a qualitative self-reported measure of risk aversion and the log of financial wealth (a strong predictor of risk aversion in household data; see [Calvet and Sodini \(2014\)](#)). Using a household survey, [Dimmock, Kouwenberg, Mitchell, and Peijnenburg \(2016\)](#) show that ambiguity aversion is related to several aspects of portfolio choice. We therefore also control for ambiguity aversion.

Furthermore, we control for several behavioral traits, namely, trust, optimism, and the other three big five personality traits: agreeableness, extraversion, and openness. Following [Guiso, Sapienza, and Zingales \(2008\)](#), we use the standard trust question from the World Values Survey. Our optimism variable is based on the measure used by [Puri and Robinson \(2007\)](#).

Demographics are asked each year, except for financial wealth, which is asked biannually. On the contrary, several questions eliciting behavioral traits and preferences are not asked every year. We fill in the resulting gaps by carrying forward and backward in time the available values for the same individual (under the assumption that these variables are rather stable over time). If a person never reports a value for a particular variable, we impute the missing numbers by using medians from individuals in the same demographic group (groups are based on gender, education, and income categories). This is a standard way of dealing with missing observations in household surveys (a similar approach is used, e.g., in the Survey of Consumer Finances) and allows us to expand the analysis to the entire dataset. We additionally add missing data dummy variables in all the specifications.

Our main results are, however, similar when performing a complete case analysis (see Section [IV.D](#)). This method of dealing with missing observations excludes individuals for which one or

more of the control variables is never reported.¹⁴ Importantly, we never impute outcome variables and noncognitive abilities.

Finally, we instrument emotional stability in adulthood with exposure to a traumatic event during childhood. The indicator variable *Childhood trauma* is equal to one if the person was sexually, physically, or psychologically abused before the age of 18.

III. Empirical results

In this section, we explore the relation between noncognitive abilities, financial choices, and financial distress, with a particular emphasis on the latter variable. Additionally, we provide suggestive evidence on the economic mechanism behind our findings. For all models, we report robust standard errors clustered at the household level.¹⁵ Furthermore, when indicated, we include time fixed effects to control for fluctuations of the outcome variables at an aggregate level.

A. Household financial distress

A simple graphical representation shows that people in the top quintiles of both emotional stability *and* conscientiousness have an almost nine times lower probability of being in financial distress with respect to people in the bottom quintiles (see Figure 2).

Table III shows the estimates from a multivariate framework (marginal effects are reported).

Consistent with Figure 2, we find that noncognitive abilities are negatively related to the probability

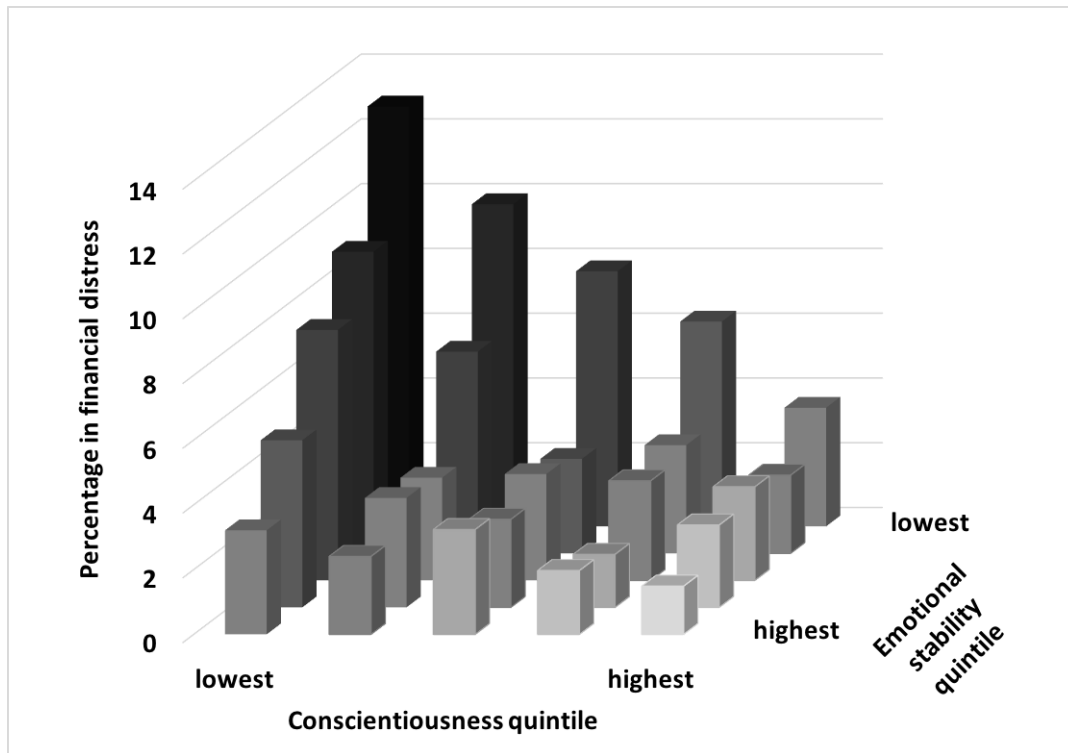
¹⁴Furthermore, our results are robust to using multiple imputation. The multiple imputation method takes into account the uncertainty about the missing data by creating several different plausible imputed data sets and appropriately combining the results obtained from each of them (Cameron and Trivedi (2005)).

¹⁵Our sample of 11,855 individuals includes respondents from 8,060 unique households, since in some cases we have noncognitive abilities for multiple members of the same household. The results are similar if we keep only one random individual per household.

of being in financial distress when no other covariates are included (see Column (1)). Our estimates indicate that a one standard deviation increase in emotional stability results in a 1.6 percentage point decrease in the probability of being in financial distress (37.1% relative to the baseline rate of 4.4%), while a one standard deviation increase in conscientiousness is associated with a 1.5 percentage point decrease in the probability of being in financial distress (35.0% relative to the same baseline).

Figure 2: Financial distress by quintile of noncognitive abilities

Percentage of households in financial distress per quintile of emotional stability and conscientiousness. Financial distress is measured as being delinquent on mortgage payments, rent payments, utility bills, or other bills.



Column (2) of Table III reports the effect of cognitive abilities and education (high school dummy, college dummy, financial literacy, and numeracy) on distress, while it excludes our two measures of noncognitive abilities. As expected, the signs of the coefficients are all negative. The coefficients of *High School* and *College* are insignificant but become statistically significant

when we exclude *Numeracy* and *Financial Literacy* (as the correlation among these variables is high).¹⁶

A number of different channels could, however, explain the relation between noncognitive abilities and financial distress. Previous papers find that noncognitive abilities influence labor income, employment, educational attainment, and health status. These, in turn, are likely to affect financial distress. The coefficients reported in Column (1) offer an estimation of the aggregate effect of noncognitive abilities on distress via multiple channels. In Column (3), we account for all known channels put forward by the literature and a set of additional control variables. In this way, we aim to estimate an *additional* effect of noncognitive abilities, over and above that potentially associated with labor income, employment, education, and health status. Importantly, this estimate is therefore likely to provide a lower bound for the total effect of noncognitive abilities.

Our baseline specification identifies an effect that is still economically large (between one-third and one-half of that estimated without including controls).¹⁷ In particular, the coefficients reported in Column (3) imply that a one standard deviation increase in emotional stability is associated with a 0.5 percentage point decrease in the probability of financial distress (11.4% relative to the baseline rate of 4.4%) and a one standard deviation increase in conscientiousness is associated with a 0.85 percentage point decrease (19.5% relative to the baseline rate of 4.4%). The coefficients of the control variables have the expected signs: unemployed, less healthy, wealth-poor, and income-poor individuals have a higher probability of facing financial distress.

¹⁶A direct comparison of the pseudo R-squared estimated for cognitive and noncognitive abilities is problematic. However, we rerun our analysis using a linear probability model (on non-imputed data only) to obtain the adjusted R-squared values. These estimates indicate that the explanatory power of noncognitive abilities in our sample is more than twice that of cognitive abilities and education.

¹⁷For some of our respondents, we have a proxy for time preference. Our results do not change when adding this variable as a control (results available upon request).

Table III: Noncognitive abilities and financial distress

This table shows marginal effect estimates from probit regressions. The dependent variable is equal to one if the respondent is in financial distress, measured as being delinquent on mortgage payments, rent payments, utility bills, or other bills. Column (1) includes our two measures of noncognitive abilities. Column (2) includes education, financial literacy, and numeracy. Column (3) includes our two measures of noncognitive abilities, education, financial literacy, numeracy, health status, employment, unemployment, (log of) net household income, (log of) household financial wealth, risk aversion (from lottery choices and self-reported), ambiguity aversion, trust, optimism, other personality traits (agreeableness, extraversion, and openness), other demographics (gender, children living at home, age, age squared, home ownership, partner, and residence in a rural area), time fixed effects, and missing data dummies. All models include a constant term. Standard errors are clustered by household and appear in parentheses. The superscripts *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
Noncognitive ability: emotional stability	-0.0162*** (0.0017)		-0.0050*** (0.0011)
Noncognitive ability: conscientiousness	-0.0153*** (0.0017)		-0.0085*** (0.0011)
<i>Cognitive abilities and education</i>			
Financial literacy		-0.0139*** (0.0025)	-0.0035** (0.0016)
Numeracy		-0.0030*** (0.0009)	-0.0011* (0.0006)
High school		-0.0013 (0.0061)	0.0034 (0.0037)
College		-0.0008 (0.0063)	0.0047 (0.0038)
<i>Indirect channels</i>			
Health status			-0.0073*** (0.0013)
Employed			0.0034 (0.0023)
Unemployed			0.0187*** (0.0043)
Log income			-0.0087*** (0.0020)
Log financial wealth			-0.0032*** (0.0003)
<i>Preferences and behavioral traits</i>			
Risk aversion			-0.0033 (0.0029)
Risk aversion, self-assessed			-0.0024*** (0.0007)
Ambiguity aversion			-0.0037 (0.0026)
Trust			-0.0020*** (0.0004)
Optimism			0.0034 (0.0030)
Other personality traits	no	no	yes
Other demographics	no	no	yes
Time fixed effects	no	no	yes
Observations	38,472	38,472	38,472
Pseudo R-squared	0.0500	0.0163	0.2040

A concern with our result is that lower emotional stability could be associated with higher risk aversion and that our two related proxies do not fully account for this possibility. However, this seems *ex ante* unlikely. The correlation between our measures of risk aversion and emotional stability is rather low in our sample. More importantly, the estimated direction of the effect of emotional stability on a household's distress seems inconsistent with this measure capturing risk aversion. Specifically, lower emotional stability is associated with a higher probability of financial distress, whereas, if lower emotional stability were capturing higher risk aversion, the associated probability of being in financial distress should be lower.¹⁸ Therefore, it appears implausible that low emotional stability works as a proxy for high risk aversion.

B. Severe distress

In the initial part of our analysis, we show an economically significant relation between noncognitive abilities and financial distress, measured by delinquency on payment obligations (regardless of the duration of the delinquency). In the following, we focus instead on measures of more *severe* financial distress. Table IV presents our results. We find that noncognitive abilities significantly affect the probability of being in arrears on rent or mortgage bills for three months or more. Our estimates indicate that a one standard deviation increase in emotional stability is associated with a 0.1 percentage point decrease in the probability of being in arrears on rent or mortgage payments for three or more months (10.0% relative to the baseline rate of 0.9%) and a one standard deviation increase in conscientiousness is associated with a 0.2 percentage point decrease in the probability of being in arrears on rent or mortgage payments for three or more months (19.8% relative to the

¹⁸It would seem reasonable to expect a negative relation between risk aversion and financial distress, for instance, because risk-averse individuals should be more reluctant to engage in behaviors that increase their risk of distress, such as borrowing large amounts.

same baseline rate). In the Netherlands, being in arrears on the rent for three months or more constitutes grounds for eviction. This period increases to nine months in the case of delinquency on mortgage payments. However, after a delinquency of three months, the mortgage provider is obliged to register the delinquent borrower in the *Bureau Krediet Registratie* (the Dutch Individual Credit Registry). Inclusion in this registry results in limitations on obtaining new credit for a period of five years *after* all previous delinquent debts have been paid back. Columns (2) to (4) show a similar negative effect when looking at the probabilities of being in arrears for three or more months on utility bills (Column (2)), having had a debt collector at the door (Column (3)), and not being able to pay €500 of unexpected expenses without contracting a loan (Column (4)). Overall, the results in this section point to an economically significant effect of noncognitive abilities on financial distress, defined in a number of different ways.

Table IV: Noncognitive abilities and severe financial distress

This table shows the results of probit regressions (Columns (1) to (3)) and ordered probit regressions (Column (4)). In Column (1), the dependent variable is equal to one if the respondent has been in arrears for three months or more on rent or mortgage payments. In Column (2), the dependent variable is equal to one if the respondent has been in arrears for three months or more on utility payments. In Column (3), the dependent variable is equal to one if the respondent has had a debt collector at the door in the last month. In Column (4), the dependent variable is an ordinal variable ranging from one to seven that measures the degree to which the respondent is unable to pay unexpected expenses equal to 500 euros. All models include a constant term and controls for risk aversion (lottery and self-reported), ambiguity aversion, numeracy, trust, optimism, financial literacy, agreeableness, openness, extraversion, health status, gender, children living at home, age, age squared, employed, unemployed, (log of) net household income, (log of) household financial wealth, home ownership, education, partner, residence in a rural area, missing data dummies, and year dummies. The controls are suppressed for brevity. Standard errors are clustered by household and appear in parentheses. The superscripts *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Arrears rent/mortgage 3 months or more	Arrears utility 3 months or more	Debt collector at the door	Not able to pay €500
	(1)	(2)	(3)	(4)
Noncognitive ability: emotional stability	-0.0009** (0.0004)	-0.0008*** (0.0002)	-0.0002 (0.0002)	-0.0773*** (0.0150)
Noncognitive ability: conscientiousness	-0.0018*** (0.0004)	-0.0010*** (0.0003)	-0.0011*** (0.0003)	-0.0959*** (0.0149)
Controls and constant	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes
Observations	38,473	38,475	38,716	19,089
Pseudo R-squared	0.146	0.208	0.261	0.118

C. Saving, unsecured debt, impulse buying, and retirement planning

In this section, we explore whether noncognitive abilities influence financial choices. Since we find a negative relation between financial distress and noncognitive abilities, we conjecture that low abilities could be associated with poor financial decision making. In particular, we focus on saving, unsecured borrowing, impulse buying, and retirement planning. Even though specific decisions in these domains are not unambiguously good or bad, previous research shows that unsecured debt dramatically increases the probability of being in financial distress (e.g., [Carrell and Zinman \(2014\)](#); [Skiba and Tobacman \(2015\)](#)). In addition, [De Nardi, French, and Jones \(2010\)](#) show that unexpected out-of-pocket medical expenses after retirement are a major source of financial fragility if households did not build a sufficiently large savings buffer ex ante. Therefore, poor financial choices will likely influence the propensity of being in distress, thus providing a (albeit only suggestive) rationale for our previous findings.

Table [V](#) shows the results of probit and ordered probit models. Column (1) shows that lower noncognitive abilities reduce the propensity to save. The marginal effects show that a one standard deviation increase in emotional stability is associated with a 2.4 percentage point increase in the probability of saving (6.6% relative to a baseline of 35.9%), whereas a one standard deviation increase in conscientiousness is associated with a 3.6 percentage point increase in the probability of saving (10.0% relative to the same baseline).

We also explore the effects on the liability side of household balance sheets.¹⁹ Column (2) shows that individuals with higher noncognitive abilities are less likely to have an unsecured loan.²⁰

¹⁹However, we do not test the effect on mortgage ownership, as it is not clear ex ante in which direction, if any, noncognitive abilities should influence the likelihood of having a mortgage.

²⁰The survey question related to this variable is included only in one year, so this column (as well as the following ones) has fewer observations and does not include time fixed effects.

This result is necessarily related to those presented in Column (1), as, to consume more than their monthly income, individuals must either reduce their accumulated wealth or borrow. Overall, this finding provides some insight into the determinants of household liabilities. Generally, liability-side decisions are likely drivers of financial distress and are receiving increasing scrutiny from policy makers but relatively little attention in household finance (with few notable exceptions, e.g., [Morse \(2011\)](#)).

Table V: Noncognitive abilities and financial choices

This table shows the results of probit regressions (Columns (1) and (2)) and ordered probit regressions (Columns (3) and (4)). In Column (1), the dependent variable is equal to one if the respondent consumes less than his or her income. In Column (2), the dependent variable is equal to one if the respondent has none of the following: a loan from a family member, debit card debt, credit card debt, a personal loan, a student loan, or some other unsecured loan. In Column (3), the dependent variable is an ordinal variable ranging from one to six that measures whether the respondent tends to buy impulsively. In Column (4), the dependent variable is an ordinal variable ranging from one to four that measures whether the respondent has thought about his or her financial needs during retirement. All models include a constant term and controls for risk aversion (lottery and self-reported), ambiguity aversion, numeracy, trust, optimism, financial literacy, agreeableness, openness, extraversion, health status, male, children living at home, age, age squared, employed, unemployed, (log of) net household income, (log of) household financial wealth, home ownership, education, partner, residence in a rural area, missing data dummies, and year dummies when indicated. The controls are suppressed for brevity. The table reports marginal effects. Standard errors are clustered by household and appear in parentheses. The superscripts *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Saving	Unsecured debt	Impulse buying	Retirement planning
	(1)	(2)	(3)	(4)
Noncognitive ability: emotional stability	0.0237*** (0.0050)	-0.0185** (0.0086)	-0.1731*** (0.0200)	-0.0041 (0.0335)
Noncognitive ability: conscientiousness	0.0358*** (0.0048)	-0.0431*** (0.0082)	-0.3186*** (0.0203)	0.0861** (0.0346)
Controls and constant	yes	yes	yes	yes
Time fixed effects	yes	no	no	no
Observations	38,711	5,245	5,249	1,515
Pseudo R-squared	0.0954	0.0983	0.0865	0.0706

Column (3) shows that people with lower noncognitive abilities tend to be more impulsive in their buying behavior. This finding is consistent with previous research in psychology ([Thompson and Prendergast \(2015\)](#)) and provides an additional rationale for the relation between low noncognitive abilities and financial distress. Again, this finding is tightly related to the previous two results on saving and unsecured borrowing. In fact, impulse purchases might be directly funded by debt or,

anyway, decrease the resources available for necessary expenses, thereby forcing the household to borrow. Related to our finding, [Vissing-Jørgensen \(2012\)](#) shows that the default rates on consumer credit are higher when the purchased products are luxury goods, which suggests that the decision to buy luxuries is made more impulsively and not after a careful assessment of its financial feasibility. Furthermore, the author finds that, when including person fixed effects, the influence of product type on delinquency diminishes significantly. In light of our findings, [Vissing-Jørgensen \(2012\)](#)'s evidence seems to suggest that person fixed effects capture the effect of the person's noncognitive abilities.

Finally, we find that people scoring high in conscientiousness are more likely to plan for retirement. This adds to the literature documenting that financial literacy relates positively to retirement planning ([Lusardi and Mitchell \(2008\)](#); [Lusardi and Mitchell \(2011\)](#)). More generally, our findings complement the sizeable literature showing that cognitive abilities influence financial choices (e.g., [Agarwal and Mazumder \(2013\)](#); [Behrman, Mitchell, Soo, and Bravo \(2012\)](#); [Grinblatt, Keloharju, and Linnainmaa \(2011\)](#); [Lusardi and Mitchell \(2014\)](#)).

D. Financial advice

In the previous section, we show that noncognitive abilities influence *which* financial choices are made. In this section, we test whether noncognitive abilities influence *how* financial choices are made. Some guidance is provided by the previous literature. For instance, [Gennaioli, Schleifer, and Vishny \(2015\)](#) suggest that many investors are too nervous and anxious to make investment decisions on their own. This generates a demand for “money doctors,” allowing portfolio managers to charge high fees. This service seems to be particularly valuable for people who are emotionally

less stable, as they are more inclined to nervousness and anxiety. More generally, individuals with low noncognitive abilities likely find it difficult and effortful to collect and process information, thereby valuing another person’s expertise (a more detailed discussion on the economic framework follows in the next section). We therefore conjecture that individuals who score lower on noncognitive abilities might be more likely to ask for advice when entering into a financial contract (e.g., bank account, mortgage, savings account, or insurance). The results reported in Table VI support this hypothesis. Consistent with [Gennaioli, Schleifer, and Vishny \(2015\)](#), we find that less emotionally stable individuals are more likely to seek financial advice. Interestingly, this does not seem to help them enough, since they are more likely to end up in distress anyway (see Section III.A). Overall, this evidence adds to a growing literature on the (lack of) value of financial advice (e.g., [Linnainmaa, Melzer, and Previtro \(2016\)](#); [Jenkinson, Jones, and Martinez \(2016\)](#)).

Table VI: Noncognitive abilities and financial advice

This table shows the marginal effect estimates from a probit regression. The dependent variable is equal to one if the respondent seeks advice when deciding which financial product to purchase. The model includes a constant term and controls for risk aversion (lottery and self-reported), ambiguity aversion, numeracy, trust, optimism, financial literacy, agreeableness, openness, extraversion, health status, male, children living at home, age, age squared, employed, unemployed, (log of) net household income, (log of) household financial wealth, home ownership, education, partner, residence in a rural area, missing data dummies. The controls are suppressed for brevity. Standard errors are clustered by household and appear in parentheses. The superscripts *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Financial advice
Noncognitive ability: emotional stability	-0.0396*** (0.0086)
Noncognitive ability: conscientiousness	-0.0085 (0.0081)
Controls and constant	yes
Observations	5,240
Pseudo R-squared	0.100

E. Discussion: Incorporating noncognitive abilities in a theoretical framework

The evidence provided in the previous sections points to an important role of noncognitive abilities in explaining the heterogeneity in financial choices. However, it is unclear *ex ante* how noncognitive abilities should be thought of in a classical economic framework. A potential way to incorporate noncognitive abilities could be to assume a relation with traditional preference parameters. However, recent empirical evidence suggests that noncognitive abilities and preferences have a complementary role in explaining important life outcomes and behaviors (Becker, Deckers, Dohmen, Falk, and Kosse (2012)). Furthermore, the correlation between classical preference parameters and noncognitive abilities is low in the data (according to both Becker, Deckers, Dohmen, Falk, and Kosse (2012) and our own estimates).

The literature modeling the economic mechanism through which noncognitive abilities affect choices is in its infancy. We are, however, able to provide some guidance by building upon Borghans, Duckworth, Heckman, and Ter Weel (2008), Chiteji (2010), and Heckman, Stixrud, and Urzua (2006). In particular, a possible way to incorporate noncognitive abilities into conventional economic models is as factors that influence the productivity and cost of effort.

This framework fits well in our setting.²¹ Good financial choices require time, focus, and decisiveness. A more emotionally stable person will presumably make a better decision than a person easily prone to stress, especially if both are time constrained. Likewise, a more conscientious

²¹As an example, consider a particular individual with certain noncognitive abilities who must decide how to handle her finances. The financial decisions she must make are time-consuming and arise from a combination of different tasks, such as keeping track of expenditures, gathering financial information, planning for future expenditure needs and risks, meeting with financial advisors, and ultimately making sound financial choices. Each of these tasks requires time and effort, but the individual's noncognitive abilities can make it easier or harder to accomplish any particular task. For example, it is easier for a conscientious person to keep track of her expenditures, plan for future expenditure needs, or estimate current and long-term income and expense risks. Conversely, a less emotionally stable person will consider it a difficult task to make financial decisions or monitor expenses. The individual's success or failure in accomplishing all of these tasks jointly is going to determine her financial situation.

person will be more willing to spend time gathering and processing information to make an optimal choice. Therefore, we expect to find a positive relation between noncognitive abilities and productivity of effort and a negative relation with cost of effort.

We attempt to find evidence consistent with the mechanisms outlined above using a proxy for the amount of effort put toward financial decision making. Specifically, we use a dummy variable equal to one if a person spends more than one hour on financial administration per month and we regress it on our measures of noncognitive abilities. The results reported in Table VII indicate that more emotionally stable individuals spend less time on their financial administration.²² In light of our previous results, this suggests that their time spent on financial matters is more productive, as they make better decisions in less time.

Table VII: Noncognitive abilities and effort put into financial administration

This table shows the marginal effect estimates from a probit regression. The dependent variable is equal to one if the respondent spends more than one hour per month on his or her financial administration. The model includes a constant term and controls for risk aversion (lottery and self-reported), ambiguity aversion, numeracy, trust, optimism, financial literacy, agreeableness, openness, extraversion, health status, male, children living at home, age, age squared, employed, unemployed, (log of) net household income, (log of) household financial wealth, home ownership, education, partner, residence in a rural area, missing data dummies, and year dummies. The controls are suppressed for brevity. Standard errors are clustered by household and appear in parentheses. The superscripts *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	More than one hour spent on financial administration
Noncognitive ability: emotional stability	-0.0115** (0.0051)
Noncognitive ability: conscientiousness	0.0134*** (0.0051)
Controls and constant	yes
Time fixed effects	yes
Observations	16,514
Pseudo R-squared	0.0515

When focusing on the possible inferences drawn from the results for conscientiousness, our interpretation is more tentative. We find that more conscientious people spend more time on financial

²²The results are qualitatively similar if we alternatively consider one and a half hours or half an hour (instead of the one-hour threshold). Furthermore, we replicate our analysis including *distress* as a control variable to account for the fact that people in financial distress may be forced to spend significantly more time on financial chores. The results remain qualitatively similar.

administration. However, we cannot disentangle whether it is this higher effort or greater productivity (or both) that leads to better financial choices. The results do suggest that these individuals face a lower cost of effort, as they choose to spend significantly more time in making decisions. However, it could be that it is the greater productivity of each unit of effort that makes it worth it for them to “go the extra mile.” Overall, our evidence points to the fact that noncognitive abilities are related to productivity and cost of effort. We want to stress, however, that these results are only suggestive.

IV. Further evidence and extensions

In this section, we perform a number of additional tests to address concerns about identification and external validity.

A. *Childhood trauma as an instrument for emotional stability*

A potential threat to our identification arises because measurement error and unobserved factors could affect the probit estimates. To mitigate this concern, we instrument emotional stability in adulthood using childhood trauma.²³

Exposure to a traumatic event during childhood satisfies the requirements for a valid instrument. Several papers in psychology document that children who experience a trauma are more likely to suffer from emotional instability, depression, and anxiety in adulthood (e.g., Browne and Finkelhor (1986); Malinosky-Rummell and Hansen (1993); Moeller, Bachmann, and Moeller (1993)). At the same time, a traumatic event during childhood is not likely to have a *direct* effect on

²³We do not have an instrument for conscientiousness.

delinquency on payment obligations in adulthood, once we control for likely confounding effects (such as education, income, and wealth).

We perform a number of tests to make sure that our instrument strongly correlates with *emotional stability* (while the exclusion restriction is not directly testable). The first-stage regression indicates that the effect of trauma on emotional stability is negative and significant at the 1% level (see Table VIII, Column (2)). Exposure to a traumatic event during childhood is associated with a decrease of emotional stability in adulthood of roughly one-third of one standard deviation. In addition, the Cragg–Donald Wald F -statistic is 549.7, which exceeds the rule of thumb for strong instruments ($F > 10$) proposed by [Staiger and Stock \(1997\)](#), as well as the 10% critical threshold value of [Stock and Yogo \(2005\)](#).²⁴ Taken together, these results suggest that weak identification is unlikely to be a relevant concern in our setting.

Table VIII: Childhood trauma as an instrument for emotional stability

This table shows the results from an IV probit regression (Column (1)) and an OLS regression (Column (2)). In Column (1), the dependent variable is equal to one if the respondent is in financial distress, measured as being delinquent on mortgage payments, rent payments, utility bills, or other bills. In Column (2), the dependent variable is our measure of noncognitive ability: emotional stability. Childhood trauma is equal to one if the respondent was physically, psychologically, or sexually abused before the age of 18. All the models include a constant term and controls for risk aversion (lottery and self-reported), ambiguity aversion, numeracy, trust, optimism, financial literacy, agreeableness, openness, extraversion, health status, male, children living at home, age, age squared, employed, unemployed, (log of) net household income, (log of) household financial wealth, home ownership, education, partner, residence in a rural area, missing data dummies, and year dummies. The controls are suppressed for brevity. The table reports marginal effects. Standard errors are clustered by household and appear in brackets. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	IV probit	OLS (first stage)
	Financial distress	Emotional stability
	(1)	(2)
Noncognitive ability: emotional stability	-0.0354** (0.0175)	
Childhood trauma		-0.3476*** (0.0406)
Controls and constant	yes	yes
Time fixed effects	yes	yes
Observations	28,021	28,021
Cragg–Donald Wald F-statistic	549.7	

²⁴We obtain the F -statistic by estimating a linear version of the model.

The results from our IV probit analysis are presented in Table VIII. The IV coefficient is negative and statistically significant at the 5% level. Under the assumption of a valid instrument, the coefficient measures the causal impact of emotional stability on financial distress. The coefficient is larger in magnitude than that obtained using our baseline specification. The bias toward zero of our baseline could be related to measurement error. For instance, individuals with low noncognitive abilities may be less likely to recall being delinquent on payment obligations, more likely to understate the severity of their financial situation, or more reluctant to disclose it (e.g., Bound, Brown, and Mathiowetz (2001)), thereby inducing a downward bias in our main coefficient of interest.

B. Year-by-year analysis

We perform additional tests exploiting the panel structure of our data. Specifically, we want to ascertain that our findings are not driven by certain years or states of the economy. Therefore, in this analysis, we do not average noncognitive abilities across years to build our measures. Instead, we show the relation between noncognitive abilities and financial distress in different years. We do not examine the years 2010, 2012, and 2015 because we have a limited number of respondents for the survey on noncognitive abilities in those years. The results for the different cross sections are presented in Table IX on the diagonal in bold. In four out of five cross sections, both measures of noncognitive abilities are statistically significant.

Table IX: Year-by-year analysis of noncognitive abilities and financial distress

This table shows the results of probit regressions. The dependent variable is equal to one if the respondent is in financial distress, measured as being delinquent on mortgage payments, rent payments, utility bills, or other bills. The dependent variable is measured in different years, from 2008 to 2015. The rows contain emotional stability and conscientiousness measured in different years, from 2008 to 2014. All the models include a constant term and controls for risk aversion (lottery and self-reported), ambiguity aversion, numeracy, trust, optimism, financial literacy, agreeableness, openness, extraversion, health status, male, children living at home, age, age squared, employed, unemployed, (log of) net household income, (log of) household financial wealth, home ownership, education, partner, residence in a rural area, and missing data dummies. The controls are suppressed for brevity. The table reports marginal effects. Standard errors are clustered by household and appear in parentheses. The superscripts *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Distress in year:							
	2008	2009	2010	2011	2012	2013	2014	2015
Noncognitive ability: emotional stability 2008	-0.0035 (0.0023)	-0.0038** (0.0019)	-0.0046** (0.0021)	-0.0050*** (0.0017)	-0.0051*** (0.0017)	-0.0037* (0.0020)	-0.0040** (0.0016)	-0.0037** (0.0017)
Noncognitive ability: conscientiousness 2008	-0.0135*** (0.0023)	-0.0044** (0.0018)	-0.0064*** (0.0020)	-0.0058*** (0.0018)	-0.0023 (0.0017)	-0.0070*** (0.0021)	-0.0010 (0.0015)	-0.0019 (0.0018)
Noncognitive ability: emotional stability 2009		-0.0038** (0.0018)	-0.0053*** (0.0019)	-0.0046*** (0.0015)	-0.0057*** (0.0015)	-0.0070*** (0.0020)	-0.0048*** (0.0015)	-0.0052*** (0.0018)
Noncognitive ability: conscientiousness 2009		-0.0054*** (0.0019)	-0.0054*** (0.0020)	-0.0063*** (0.0017)	-0.0019 (0.0015)	-0.0046** (0.0021)	-0.0021 (0.0015)	-0.0015 (0.0018)
Noncognitive ability: emotional stability 2011				-0.0040** (0.0017)	-0.0026 (0.0016)	-0.0031 (0.0020)	-0.0022 (0.0015)	-0.0024 (0.0021)
Noncognitive ability: conscientiousness 2011				-0.0074*** (0.0018)	-0.0031* (0.0016)	-0.0072*** (0.0021)	-0.0050*** (0.0016)	-0.0027 (0.0021)
Noncognitive ability: emotional stability 2013						-0.0034* (0.0018)	-0.0013 (0.0015)	-0.0020 (0.0018)
Noncognitive ability: conscientiousness 2013						-0.0072*** (0.0019)	-0.0052*** (0.0014)	-0.0043** (0.0017)
Noncognitive ability: emotional stability 2014							-0.0040** (0.0016)	-0.0048** (0.0020)
Noncognitive ability: conscientiousness 2014							-0.0065*** (0.0015)	-0.0064*** (0.0019)

The results in Table IX also mitigate concerns about reverse causality, that is, the possibility that financial distress may have an effect on emotional stability or conscientiousness. This is unlikely to be the case, since several papers find that the noncognitive abilities of adults are largely stable over time and arise from genetic endowments and early childhood experiences. Furthermore, our own findings on the stability of the two measures over time support this conclusion. However, to alleviate this concern further, we regress financial distress on noncognitive abilities at several lags. For instance, we regress financial distress in 2015 on noncognitive abilities measured in 2014, 2013, 2011, 2009, and 2008. The number of observations decreases with the lag considered, thus also causing a reduction in statistical power. We find that, in the majority of cases, lagged emotional stability and conscientiousness significantly predict financial distress. Additionally, in *all* years, the estimated coefficients have the expected sign.

C. External validity

Our previous analyses are based on a panel of Dutch households. We believe the LISS panel to be particularly suited for our purpose for two reasons. First, the dataset includes a rich set of outcome variables. Second, the time series dimension, the large availability of control variables, and the presence of an instrument allow us to mitigate identification concerns. However, using data from the Netherlands could raise concerns regarding the external validity of our findings, particularly when considering that the Netherlands is a small country with relatively few households in financial distress.

To reassure that the results hold in different settings, we examine the relation between noncognitive abilities and financial distress and choices in a cross section of American households. For

this purpose, we employ the Understanding America Survey (UAS). The UAS dataset contains questions to measure emotional stability and conscientiousness. Furthermore, the survey contains several measures of cognitive abilities (basic numeracy, advanced numeracy, verbal IQ, picture IQ, and numerical IQ), financial literacy, and education. This also allows us to control for cognitive abilities more extensively than in the main analysis. More details on the dataset are provided in Appendix C.

Table X: American households

This table shows the results of probit regressions (Columns (1), (3), (4), and (5)) and an ordered probit regression (Column (2)). In Column (1), the dependent variable is equal to one if the respondent is typically behind on credit card payments (paying less than the minimum monthly payment). In Column (2), the dependent variable is an ordinal variable that measures whether the respondent can handle a major unexpected expense, with one corresponding to completely and five to not at all. In Column (3), the dependent variable is equal to one if the respondent always has money left over at the end of the month. In Column (4), the dependent variable is equal to one if the respondent has any type of unsecured debt. In Column (5), the dependent variable is equal to one if the respondent plans ahead for her financial needs in five years or more. All models include a constant term and controls for financial literacy, basic numeracy, advanced numeracy, verbal IQ, picture IQ, numerical IQ, education, risk aversion (self-reported), agreeableness, extraversion, openness, health status, male, children living at home, age, age squared, employment, retirement, (log) of household income, (log of) household financial wealth, marital status, and missing data dummies. The controls are suppressed for brevity. The table reports marginal effects. Standard errors are clustered by household and appear in parentheses. All the results use UAS survey weights. The superscripts *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Behind on credit card payments	Severe financial distress	Saving	Unsecured debt	Financial planning
	(1)	(2)	(3)	(4)	(5)
Emotional stability	-0.0033** (0.0014)	-0.1182*** (0.0328)	0.0250** (0.0104)	-0.0417*** (0.0146)	-0.0058 (0.0066)
Conscientiousness	-0.0035*** (0.0012)	-0.0674** (0.0321)	0.0322*** (0.0117)	-0.0299* (0.0156)	0.0154** (0.0070)
Controls and constant	yes	yes	yes	yes	yes
Observations	3,973	3,212	3,235	3,265	3,986
Pseudo R-squared	0.177	0.112	0.164	0.0639	0.0667

Table X reiterates the relation between noncognitive abilities and financial distress and choices. We focus on the set of outcome variables that are the most similar to those in the main analysis. We do not consider impulse buying, since this variable is not included in the UAS dataset. In Column (1), we show a negative relation between noncognitive abilities and being consistently behind on credit card payments (paying less than the minimum monthly balance). A similar relation emerges

when focusing on a proxy for more severe financial distress: the ability to pay an unexpected expense. Furthermore, as in the sample of Dutch households, we find a negative relation between noncognitive abilities and unsecured debt holdings and a positive relation with saving and financial planning.

D. Robustness

In this section, we test whether our results are robust to alternative treatment of missing data and transformations of our measures of noncognitive abilities. In our baseline analysis, if a person never answers a particular survey question, we fill in the missing data with group medians. This allows us to conduct our analysis on the entire dataset. As a robustness test, we rerun the analysis excluding individuals for which one or more control variables are never available. This significantly limits the size of our sample. Nonetheless, our results are robust to using the complete case analysis (see Column (1) in Table [XI](#)).

Furthermore, we find that our results hold for alternative definitions of our measures. Columns (2) to (4) in Table [XI](#) show the results using rank transformations, above-median dummies, and dummies for the 10th and 90th percentiles, respectively. These findings support the robustness of our results and rule out potential concerns about the influence of outliers.

To conclude, the results in Section [IV](#) suggest that i) reverse causality, measurement error, and omitted variables are not likely to be major concerns, ii) our findings presumably hold for different countries, and iii) the results are robust to different specifications.

Table XI: Complete case analysis and alternative formulations

This table shows the results of probit regressions. The dependent variable is equal to one if the respondent is in financial distress, measured as being delinquent on mortgage payments, rent payments, utility bills, or other bills. Column (1) includes only individuals for which no variables are missing. The main independent variables are our standard noncognitive abilities measures. Column (2) includes as main independent variables an indicator if the respondent scores above the median in emotional stability and an indicator if the respondent scores above the median in conscientiousness. Column (3) includes as main independent variables rank transformations of emotional stability and conscientiousness. Column (4) includes as main independent variables our baseline emotional stability and conscientiousness measures, as well as an indicator if the respondent is in the 10th percentile of a measure and an indicator if the respondent is in the 90th percentile of the measure. All models include a constant term and controls for risk aversion (lottery and self-reported), ambiguity aversion, numeracy, trust, optimism, financial literacy, agreeableness, openness, extraversion, health status, male, children living at home, age, age squared, employed, unemployed, (log of) net household income, (log of) household financial wealth, home ownership, education, partner, residence in a rural area, missing data dummies, and year dummies. The controls are suppressed for brevity. The table reports marginal effects. Standard errors are clustered by household and appear in parentheses. The superscripts *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Complete case (1)	Above median dummies (2)	Rank (3)	Nonlinearities (4)
Noncognitive ability: emotional stability	-0.0028* (0.0015)			-0.0055*** (0.0016)
Noncognitive ability: conscientiousness	-0.0072*** (0.0021)			-0.0079*** (0.0016)
Above-median emotional stability		-0.0094*** (0.0023)		
Above-median conscientiousness		-0.0113*** (0.0022)		
Emotional stability rank			-0.0180*** (0.0039)	
Conscientiousness rank			-0.0289*** (0.0040)	
Emotional stability bottom 10%				-0.0019 (0.0037)
Conscientiousness bottom 10%				0.0009 (0.0041)
Emotional stability top 10%				0.0005 (0.0047)
Conscientiousness top 10%				-0.0032 (0.0044)
Controls and constant	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes
Observations	4,446	38,472	38,472	38,472
Pseudo R-squared	0.288	0.196	0.204	0.204

V. Conclusions

This paper provides evidence of the effect of noncognitive abilities on financial choices and outcomes using a panel of more than 7,000 Dutch individuals surveyed over eight years. A number of empirical facts emerge from the data. First, individuals with lower noncognitive abilities face

a significantly higher likelihood of being in financial distress (defined in several ways). Second, noncognitive abilities are positively related to retirement planning and saving, and negatively related to impulse buying and unsecured borrowing. Taken together, these findings suggest that people with lower noncognitive abilities tend to make poorer financial decisions, thereby increasing the likelihood of financial distress. Our results are robust to controlling for many factors that can have a direct or indirect influence on financial choices or distress. To provide further support for a causal interpretation of our findings, we instrument emotional stability in adulthood with childhood trauma and, furthermore, show that past noncognitive abilities predict future distress.

Our results have policy implications. Unlike many behavioral traits, noncognitive abilities can be nurtured. We argue that school programs should not exclusively emphasize cognitive abilities. Focusing more on noncognitive abilities could decrease the incidence of financial distress among adults, while also mitigating the disparity in wealth distribution arising due to poor financial choices. Furthermore, our results suggest that debt relief policies might be less effective if default is mostly due to low noncognitive abilities (instead of random negative shocks), as the likelihood of recurrence is high.

Future research could further improve our understanding of financial choices, building on the evidence put forward in this paper. Noncognitive abilities are likely to be important determinants of asset allocation and common financial mistakes such as underdiversification or trading too much or too little. Furthermore, this paper offers some guidance on how to incorporate noncognitive abilities into economic frameworks. In short, we believe that more research on the role played by noncognitive abilities could broaden our understanding of several aspects of financial economics.

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Appendix A. The LISS panel

The Longitudinal Internet Studies for the Social Sciences (LISS) panel is a representative sample of Dutch individuals who participate in monthly Internet surveys. The panel is based on a random

sample of households drawn from the population register by Statistics Netherlands. Households that could not otherwise participate are provided with a computer and an Internet connection. Several surveys are fielded in the household panel every year and cover a large variety of domains, including work, education, income, assets, housing, and noncognitive abilities. More information about the LISS panel can be found at www.lissdata.nl.

To generate our dataset, we combine several of these surveys. The main surveys on noncognitive abilities, income, wealth, education, and work are fielded almost every year. Therefore, we have relatively few missing observations for these variables. However, to generate some of the control variables for preferences and behavioral traits, we use surveys that are fielded only once or twice. These are custom-made surveys explicitly designed by researchers and can be on a variety of topics. We deal with missing control variables using imputation. Data for noncognitive abilities or dependent variables are never imputed.

Appendix B. Detailed variable descriptions

Risk aversion

Module 38 fielded in 2009, module 44 fielded in 2010, and module 135.2 fielded in 2013. The respondent is presented with the choice between a lottery and a sure amount. The lottery gives a 50% chance of winning and 50% chance of losing. The three modules present people with differing amounts; however, in all three modules, they are presented with a lottery that has as an expected value equal to the sure amount. Our measure of risk aversion equals one if the respondent chooses the sure amount.

Table A1: Variable definitions

Variables in the LISS panel.

<i>Outcome variables</i>	
Financial distress: consumer delinquency	Indicator equal to one if the respondent is delinquent on payment obligations for rent, mortgage, utilities, or other bills
Arrears rent/mortgage 3 months or more	Indicator equal to one if the respondent is in arrears for 3 months or more on rent or mortgage payments in the last year
Arrears utilities 3 months or more	Indicator equal to one if the respondent is in arrears for 3 months or more on utility payments in the last year
Debt collector at the door	Indicator equal to one if the respondent has had a debt collector at the door in the last month
Not able to pay €500	Ordinal variable measuring to what degree the respondent would not be able to pay unexpected expenses equal to €500: 1 corresponds to very easy, 7 very hard
Saving	Indicator if the respondent's expenses are less than his/her income
Unsecured debt	Indicator if the respondent has any unsecured debt
Impulse buying	Ordinal variable measuring to what degree the respondent is inclined to buy impulsively: 1 corresponds to disagree entirely, 6 corresponds to agree entirely
Retirement planning	Ordinal variable measuring to what degree the respondent has thought about his/her financial needs at retirement: 1 corresponds to hardly at all, 4 corresponds to a lot
Financial advice	Indicator if the respondent seeks advice about which financial product to purchase
Financial administration more than one hour	Indicator if the respondent spends more than one hour a month on his/her financial administration
<i>Control variables</i>	
Age	Age in years
Male	Indicator for male
Married	Indicator if the respondent is married or living with a partner
Children	Number of children living at home
Employed	Indicator if the respondent is employed
Unemployed	Indicator if the respondent is unemployed
Not in labor force	Indicator if the respondent is not in the labor force (e.g., student, retiree, and so on)
Health status	Self-reported health status ranging from 1 (poor) to 5 (excellent)
Log of net household income	Log of monthly household income net of taxes
Log of financial wealth	Log of household financial wealth (bank account plus investments)
Home ownership	Indicator if the respondent owns his/her own home
No high school	Indicator if the respondent has no high school education
High school	Indicator if the respondent has a high school education
College	Indicator if the respondent has a college education
Rural	Area of residence ranging from 1 (not rural) to 5 (extremely rural)
Risk aversion	Indicator if the respondent is risk averse (see Appendix C)
Risk aversion, self-reported	Ranges from 0 to 10, 0 corresponding to fully prepared to take risks and 10 corresponding to highly risk averse
Ambiguity aversion	Indicator if the respondent is ambiguity averse (see Appendix C)
Trust	Ranges from 0 to 10, answer to the question: Generally speaking, would you say that most people can be trusted or that you have to be very careful in dealing with people?
Numeracy	Number of numeracy questions answered correctly (out of 10 total; see Appendix C)
Financial literacy	Number of financial literacy questions answered correctly (out of 3 total; see Appendix C)
Optimism	Indicator if the respondent rates his/her chances of living beyond 80 years as 9 or 10 out of 10, where 10 denotes absolutely certain (see Appendix C)
Agreeableness	Continuous measure of the respondent's tendency to cooperate, be considerate, kind
Extraversion	Continuous measure of the respondent's tendency to be social, assertive, enthusiastic
Openness	Continuous measure of the respondent's tendency to be intellectually curious, open to emotion, sensitive to beauty
<i>Instrument</i>	
Childhood trauma	Indicator if the respondent was physically, psychologically, or sexually abused before the age of 18

Ambiguity aversion

Module 44 fielded in 2010. We use the method of [Dimmock, Kouwenberg, and Wakker \(2015\)](#) to obtain a measure for ambiguity aversion. The respondents are asked to choose between a risky box and an ambiguous box. Both boxes contain 100 balls that can be either purple or yellow. The respondent selects one of the two boxes or indicates indifference between the two boxes. A ball is then randomly drawn from that box. The respondent wins €15 if that ball is purple and zero if the ball is yellow. For the risky box, the number of purple balls is explicitly stated (50), as well as the number of yellow balls (50). For the ambiguous box, the number of purple balls is not given and the respondent only knows it is between zero and 100. A respondent who prefers the risky box over the ambiguous box is ambiguity averse, that is, prefers known probabilities to unknown probabilities. Using this answer, we create the variable for ambiguity aversion, an indicator equal to one if the respondent chooses the risky box and equal to zero if the respondent chooses the ambiguous box or is indifferent.

Numeracy

Module 33 fielded in 2008. The method we use to obtain our numeracy measure is similar to the approach in the Health and Retirement Study and the English Longitudinal Study of Ageing. A total of 10 questions are asked about random numbers and probabilities regarding disease risk. Our measure of numeracy is the total number of correct answers. The 10 questions are the following.

1. Imagine that we roll a fair, six-sided die 1,000 times. Out of 1,000 rolls, how many times do you think the die would come up even?
2. In the Big Bucks Lottery, the chances of winning a \$10 prize are 1%. What is your best guess about how many people would win a \$10 prize if 1,000 people each buy a single ticket from

Big Bucks?

3. In the Acma Publishing Sweepstakes, the chance of winning a car is 1 in 1,000. What percent of tickets of Acma Publishing Sweepstakes win a car?

4. Which of the following numbers represents the biggest risk of getting a disease?

Answer A) 1 in 100; answer B) 1 in 1000; answer C) 1 in 10.

5. Which of the following represents the biggest risk of getting a disease?

Answer A) 1%; answer B) 10%; answer C) 5%

6. If the chance of getting a disease is 10%, how many people would be expected to get the disease? ... out of 100

7. If the chance of getting a disease is 10%, how many people would be expected to get the disease? ... out of 1000

8. If the chance of getting a disease is 20 out of 100, this would be the same as having a x% chance of getting the disease. Fill in x?

9. The chance of getting a viral infection is 0.0005. Out of 10,000 people, about how many of them are expected to get infected?

10. What do you think is the chance that you will still be alive in 10 years? What do you think is the chance that you will still be alive in 20 years? (Correct answer if the respondent indicates that the probability of being alive in 10 years is higher or equal to the probability of being alive in 20 years.)

Financial literacy

Module 68 fielded in August 2011 and module 135.4 in 2014. The wording of the questions is

almost identical in the two modules and is used in dozens of studies (e.g., [van Rooij, Lusardi, and Alessie \(2011\)](#)). The measure is equal to the sum of correct answers. The three questions are the following.

1. Suppose you have 100 euros in a savings account and the interest is 2% per year. How much do you think you will have on the savings account after five years, assuming that you leave all your money on this savings account: More than 102 euros, exactly 102 euros, less than 102 euros?
2. Suppose that the interest on your savings account is 1% per year and that inflation amounts to 2% per year. After 1 year, would you be able to buy more, exactly the same, or less than you could today with the money on that account?
3. A share in a company usually offers a more certain return than an investment fund that only invests in shares. (True/False)

Optimism

Health modules, fielded every year. This variable is based on the optimism measure of [Puri and Robinson \(2007\)](#). We use the following four survey questions to construct our optimism variable.

Asked to respondents $age > 15$ and $age \leq 70$: How would you rate your chance of living to be 80 years old or older? Please rate your chance on a scale from 0 to 10, where 0 means “no chance at all” and 10 means “absolutely certain.”

Asked to respondents $age > 70$ and $age \leq 75$: How would you rate your chance of living to be 85 years old or older? Please rate your chance on a scale from 0 to 10, where 0 means “no chance at all” and 10 means “absolutely certain.”

Asked to respondents $age > 75$ and $age \leq 80$: How would you rate your chance of living to be 90 years old or older? Please rate your chance on a scale from 0 to 10, where 0 means “no chance at all” and 10 means “absolutely certain.”

Asked to respondents $age > 80$ and $age \leq 84$: How would you rate your chance of living to be 95 years old or older? Please rate your chance on a scale from 0 to 10, where 0 means “no chance at all” and 10 means “absolutely certain.”

The indicator variable for optimism equals one if a respondent answers nine or ten and equals zero otherwise. For respondents above the age of 84 we impute optimism using the group median, where group is based on gender and income category.

Appendix C. Understanding America Study

The Understanding America Study (UAS) is a survey conducted at the University of Southern California (USC) taken by approximately 6,000 individuals representing the entire United States. The respondents answer the survey on a computer, tablet, or smartphone. The majority of the panel members have their own Internet access. The remaining panel members are given Internet access by USC through the provision of a tablet and/or an Internet subscription. The UAS randomly selects people around the country. More information about the UAS panel can be found at www.uasdata.usc.edu.

Appendix D. Additional material

Table A2: Characteristics associated with noncognitive abilities

These characteristics are from [Goldberg \(1992\)](#) and [McAdams \(2013\)](#).

Characteristics of high scorers	Characteristics of low scorers
<p><u>Emotional stability</u> Relaxed, stress resistant, calm, non-impulsive, imperturbable.</p> <p><u>Conscientiousness</u> Organized, dependable, practical, achievement striving, thorough, self-controlled.</p>	<p>Nervous, volatile, impulsive, envious.</p> <p>Disorganized, careless, frivolous, wasteful, unreliable, impractical.</p>

Figure A1: Persistence of respondents' noncognitive abilities

Average noncognitive abilities of respondents over time per quintile of noncognitive ability in 2008.

