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Does Investors' Personality Influence their Portfolios?

Alessandro Bucciol, Luca Zarri

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DOES INVESTORS' PERSONALITY INFLUENCE THEIR PORTFOLIOS?[*]

Alessandro Bucciol   Luca Zarri

University of Verona, Department of Economics

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Abstract

We present evidence that non-cognitive skills such as individual investors' personality traits significantly impact their portfolio choices. Based on large-scale survey data from the 2006-2012 waves of the US Health and Retirement Study (HRS) we show that portfolio decisions are influenced by a variety of traits and facets traditionally investigated in the field of personality psychology. Two personality traits that taken together depict a *self-centered* personality profile appear to have the most significant impact on financial risk taking: lower Agreeableness and higher Cynical Hostility predict higher willingness to take risks. A number of robustness checks corroborate our results. We also show that the effects of Agreeableness seem to pass through the preferences – rather than the beliefs – channel. Our findings shed new light on the non-cognitive side of individuals' risk taking and have implications for our understanding of the sources of heterogeneity in financial decisions.

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1. Introduction

Risk attitude was long thought to be the exclusive purview of human rationality, so that the classic economic approach to choice under risk is underpinned by a consequentialist view of "risk as analysis" (Slovic et al., 2004) – i.e. a view of risk attitude as a mainly cognitive construct. In the financial domain, the standard "risk as analysis" perspective posits that investors are driven by cognitive assessments of risk, thoughtfully facing the market's risk-reward trade-offs before making their financial decisions. However, in spite of the indisputable importance of examining investors' assessments of risk[1], our understanding of financial decision making might benefit from the rapid growth of a stream of literature – mainly in the fields of behavioral economics, psychology and neuroscience – that, by taking a complementary approach, has been investigating the *non-cognitive* side of risk-taking behavior[2]. In particular, a burgeoning literature has shed light on the role of non-cognitive skills such as *personality traits* in shaping risky decision-making processes (Almlund et al., 2011; Rustichini et al., 2012). In psychology, personality traits have been defined as the relatively enduring patterns of thoughts, feelings, and behaviors that differentiate individuals from one another and that reflect the tendency to respond in certain ways under certain circumstances (Roberts, 2009). Though it is fair to acknowledge that sharp contrasts between cognition and personality are not always easy to make (Borghans et al., 2008)[3], disentangling cognitive determinants of investors' risk taking from non-cognitive ones has potentially relevant implications for our understanding of the extent to which public policy, education (including financial literacy programs) and market incentives may be expected to influence individuals' financial decisions.

In this paper, we hypothesize that individual-specific factors such as personality traits may affect investors' propensity to take risks, being an important source of variation in portfolio decisions across individuals. To this aim, we use survey data from the US *Health and Retirement Study*, covering the 2006-2012 period. Our dataset contains an unusually rich and nuanced array of personality questions: to our knowledge, we are the first to conduct a large-scale study focusing on the connection between a large variety of individual investors' personality traits and sub-traits (i.e., facets) and their willingness to take financial risk. While personality traits have an important tradition in psychology, only recently economists started investigating their impact on economic variables. In particular, since in personality psychology so far the so called "Big Five" model turned out to be successful in many domains, our empirical strategy pays attention to this approach, to see whether the key personality traits and facets studied within this framework do exert a significant impact also on investors' financial decisions. However, as the current debate indicates that controversies exist about the explanatory power of the Big Five model (e.g., due to its atheoretical nature), on the whole we rely on a broader array of investors' personality traits, considering from the outset also several personality characteristics unrelated to the Big Five model (see Section 3 for details on this).

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[1] Christelis et al. (2010), focusing on individuals living in 11 European countries, show that their propensity to invest in stocks significantly and positively depends on their cognitive abilities (on the link between cognitive ability and financial decision making, see also Agarwal and Mazumder, 2013).

[2] Loewenstein et al. (2001) have established the central role that feelings play in determining people's choices under conditions of risk and uncertainty. Lerner and Keltner (2001) documented that more fearful individuals exhibit lower willingness to take risks (see on this also Cohn et al., forthcoming.) Recent work in neuroscience reveals that emotions are involved in risky decision-making, with anxiety-inducing visual cues making individuals less likely to invest in risky assets (Kuhnen and Knutson, 2011).

[3] For example, it is hard to decide whether so called 'quasi-cognitive' traits, such as, e.g., creativity and emotional intelligence, are mainly cognitive or non-cognitive.

Our major results can be summarized as follows. Personality characteristics matter, as we document that two personality traits have important effects on financial risk taking: Agreeableness and Cynical Hostility, in opposite directions. Taken together, these findings suggest that *self-centered* personality profiles characterized by either low Agreeableness or high Cynical Hostility (or both) are more prone to take financial risk, all else equal. We also show that the impact of Agreeableness on financial risk taking seems to pass through the preferences – rather than the beliefs – channel. Finally, a finer analysis allows us to offer evidence of correlation between portfolio choice and several facets associated with different personality domains.

The remainder of the paper proceeds as follows. Section 2 provides a selective review of the existing literature on personality traits and economic outcomes. Section 3 describes our data while Section 4 illustrates our main findings. Section 5 concludes. A final appendix lists the raw variables used to identify personality traits.

2. Personality traits and economic outcomes

Rather than analyzing risk taking in general, we investigate it in the financial domain, by directly focusing on investors' portfolio choice. Available empirical evidence supports the view that individuals' willingness to take risks, far from being stable across decision contexts (as it was supposed to be in several standard models in economics and finance), is highly dependent on the specific domain in which it is elicited (Dohmen et al., 2011; Loomes and Pogrebna, 2014), also when market data are used (Barseghyan et al., 2011)[4]. This suggests that economists should adopt a domain-specific approach to the measurement of risk-taking behavior (Deck et al., 2014).

A natural starting point for our analysis of the influence of investors' personality characteristics on their financial decisions is the observation that closely related constructs have been playing a central role within the fields of economics and personality psychology, respectively (Rustichini et al., 2012). On the one hand, in the standard economic approach, individuals' behavior is supposed to be driven by preferences (such as risk, time, and social preferences), in combination with expectations, beliefs, strategic considerations and constraints (Becker et al., 2012). On the other hand, personality psychology posits that individual-specific personality characteristics significantly influence outcomes. Some recent papers have attempted to specifically shed light on the still largely unexplored relationship between (economic) preferences and (psychological) measures of personality (see on this Borghans et al., 2008; Almlund et al., 2011; Becker et al., 2012; Rustichini et al., 2012).

Looking at the impact of personality traits on financial risk taking appears to be a promising research area also due to mounting evidence from economics studies that speaks to the independent predictive power of personality traits for economic outcomes. Malmendier et al. (2011) investigate the effect of managerial traits on corporate financial policies. They show that overconfident managers use less external capital and, conditional on accessing external capital, issue less equity than their peers. Almlund et al. (2011) focus on personality traits as predictors of academic and economic success, health and criminal activity and document that, for many outcomes, personality measures are just as predictive as cognitive measures, even after controlling for family background and cognition. Harrison et al.'s (2015) cross-national study reveals that

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[4] According to Weber et al. (2002), individuals view risk differently over six domains, distinguishing between financial, gambling, social, ethical, recreational and health safety risks: a person can be quite risk averse when it comes to financial decisions, but risk loving with regard to health decisions (Borghans et al., 2008).

factors such as Anxiety, Utility-For-Lifestyle, Utility-for-Investment and Awareness account for a lot of the variation in students' attitudes to their debt incurred while studying.

Personality traits are organized in hierarchical structures, with broad domains at the top of the scale and more detailed patterns of behavior at the bottom. The so called Big Five model is one of the most commonly used taxonomies in the management and psychology literature (Costa and McCrae, 1992; Deck et al., 2008). This model subsumes a huge variety of personality attributes (Lonnqvist et al., 2011) and, at the broadest level of abstraction, it posits that five traits (i.e., Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism) are fundamental and universal and that the score of an individual in these dimensions characterizes her stable pattern of thoughts and feelings (Rustichini et al., 2012). The Big Five provides us with a comprehensive categorization of personality traits that also includes progressively more narrowly defined traits (or facets) at lower and lower levels (Almlund et al., 2011).

Prior empirical work examined the relationship between the Big Five model and a variety of economic variables and life outcomes. Nyhus and Webley (2001) find that more emotionally stable and introverted individuals save more and borrow less, whereas more agreeable individuals do the opposite. Several articles focus on the relationship between Big Five traits and earnings (see, e.g., Mueller and Plug, 2006). Rustichini et al. (2012) show that personality variables affect a variety of economic and life outcomes, such as credit score, job persistence, heavy truck accidents, Body Mass Index and smoking habit, with personality traits having a stronger predictive power than economic preferences. Becker et al. (2012) compare the explanatory power of economic preferences and measures of personality in accounting for health, educational and labor market outcomes and conclude that standard measures of preferences and personality are to a large extent complementary constructs. Psychological factors related to individuals' personality seem to play an important role also with regard to people's attitude towards portfolio monitoring: Gherzi et al. (2014) find that investors behave like hyper-vigilant meerkats as they increase their portfolio monitoring following both positive and daily negative market returns. They also show that neuroticism moderates the pattern of portfolio monitoring. Based on data from the British Household Panel Survey, Brown and Taylor (2014) investigate the relationship between household finances and personality traits and document an important effect for extraversion. Their analysis differs from ours as their focus is on decisions regarding unsecured debt acquisition and financial assets; next, as far as personality traits are concerned, they exclusively refer to the Big Five taxonomy, whereas, as we make clear in Section 3, by exploiting the richness of our dataset we are able to explore a far broader and more nuanced range of personality attributes[5].

3. Data

To perform our analysis we need data on financial decisions and personality characteristics, for a representative sample of households. A suitable candidate for this purpose is the *Health and Retirement Study* (HRS), a large-scale panel survey administered in the US by the Institute for Social Research at the University of Michigan[6]. The survey collects, regularly every two years since 1992, detailed

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[5] A further key difference between the two studies is that their analysis exclusively relies on one wave, while we consider four waves from the HRS: as we argue in Section 3, we believe that considering multiple waves results in a better empirical strategy, as it makes it possible to control for time effects.

[6] The dataset, along with all the survey questions and supporting documentation, is available at: www.umich.edu/~hrswww/.

information on household socio-demographic characteristics, household portfolios, and health conditions for a representative sample of US households whose head is aged 50 or more. More recently, HRS enriched its questionnaire with additional modules on specific topics. In particular, the "participant lifestyle" module, introduced in 2004, is meant to explore the self-assessed life conditions of the respondents. In every wave questions of the module are asked to a rotating (random) 50% of the full sample, which means that the same household fills in the module every four years. Since 2006 the "participant lifestyle" module includes psychological questions on single facets of personality and every further wave typically adds more questions related to this topic. Our analysis benefits from this variety of information (uncommon in survey data) that allows us to paint a thorough and rich picture of individuals' personality.

Given the focus of this study, a further advantage of working with the HRS survey is that it is targeted to individuals aged 50 or more. The psychology literature is debating whether personality is stable over time or not. The prevailing view is that, unlike for cognitive traits, personality traits become stable only since mature age (e.g., McCrae and Costa, 2006), with rank-order stability for many personality measures peaking after age 50 (Borghans et al., 2008). Therefore, focusing on individuals aged 50 or more, our dataset should not be affected by the issue of potentially unstable personality.

We had two options to perform our analysis. On the one hand, we could have taken the HRS wave with most variables on personality traits (the 2012 wave, that is the latest available at the time of this writing); on the other hand, we could have taken all the HRS waves incorporating variables on personality (the 2006-2012 waves). In this trade-off between having more information and having more observations, we opted for the latter, therefore looking at the four waves from 2006 to 2012. The main reason is that our key variables are likely affected by short-term features of the macroeconomic and financial environment: for instance, in more recent years, in the midst of an unprecedented financial crisis, we might observe limited investment in stocks (e.g. because the investor is scared) and widespread pessimism (e.g. because the individual lost a job, experienced wealth losses, or is just influenced by the media talking about the crisis.) If we used data collected in one specific year, we would be unable to isolate these effects, and correlations would possibly be spurious. By having observations collected in different years, we can instead control for time effects. This allows us to maintain a focus on the long-term impact of individuals' personality characteristics on their willingness to take risk in the financial domain.

Our final dataset is made of 10,104 observations on 6,733 households who responded to all the questions on personality traits, and for whom we have information on all the relevant dependent, control and personality variables. To reach this final sample we concentrate only on individuals in age between 50 and 80 (we exclude individuals aged 80 or more, that HRS oversamples), and we remove observations with financial wealth below 1,000 US dollars. All monetary values in the sample are reported to 2010 prices correcting for inflation using the Consumer Price Index, all items[7].

It should be noticed that, although our dataset has a panel structure, we have just one observation for 3,762 out of 6,733 households in the sample and two observations for the remaining ones. In general, for each household we have between 1 and 2 observations, with an average of 1.50. Thus the panel dimension is tiny, which prevents us from exploiting models specifically suited for panel data. For this reason, in the following we develop a cross-sectional analysis and account for within-observation correlation by using standard errors clustered at the household level. Having no

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[7] We take the annual average. The source is the Bureau of Labor Statistics, http://www.bls.gov/cpi/.

available panel dataset is not an issue for our purpose; as long as our focus is on disentangling the contribution of personality from time disturbances, a repeated cross-sectional dataset is enough.

Table 1 reports summary statistics on the variables that we use in the study. We divide them in three groups: dependent variables (financial risk taking indicators), control variables (age, gender, wealth, etc.), and personality scores.

Beginning with the seminal contributions of Cohn et al. (1975) and Friend and Blume (1975), based on mean-variance portfolio theory, the literature frequently takes the share of financial wealth invested in risky assets (bonds and stocks) as a proxy for financial risk tolerance. Following this approach, we also consider the risky asset share[8] as a key indicator. In addition, we focus our attention on risky asset holdings, i.e., on *whether* an individual holds risky assets or not (either directly or indirectly through mutual and pension funds). This indicator captures "stock market participation" and is popular in the literature (see, e.g., Malmendier and Nagel, 2011) because it does not suffer from two shortcomings of the share measure. First, the share can carry some measurement error because respondents may not know the exact amount of their holdings and how these are allocated. Second, agents may not adjust their portfolio frequently (Calvet et al., 2009), which implies that observed changes in the portfolio shares may merely reflect the evolution of market prices. By contrast, since it is independent of monetary amounts, the holding indicator does not raise this concern. In one case we also treat as dependent variable the self-assessed chance that the stock market goes up in the next 12 months[9], which is a measure of beliefs on market returns.

Our list of control variables includes standard socio-demographic indicators (age, gender, education, wealth, etc.) plus one dummy variable on the self-assessed good health condition and one dummy variable on the presence of friends, following existing literature on the importance of health status (Rosen and Wu, 2004) and sociability (Hong et al., 2004) in financial decisions.

Personality scores are obtained from 65 raw variables on personality collected in the "participant lifestyle" module and present in all the HRS waves from 2006 to 2012[10]. The raw variables cover different facets of personality and record the answers in a discrete scale usually with 4 or 6 alternatives. We combine them as described by the HRS staff in Smith et al. (2013); for details see the Appendix. Scores typically range from 1 to 4 or from 1 to 6 on a discrete scale. For sake of comparability, we rescale all scores in the 0-1 range. On the whole, we construct 13 personality scores: as we anticipated in Section 1, while five scores denote the personality traits characterizing the well-known Big Five model (Costa and McCrae, 1992), the others cover personality traits that do not fit into that framework: Cynical Hostility, Optimism, Pessimism, Hopelessness, Loneliness, Constraints on Personal Control, Perceived Mastery and

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[8] We split a financial portfolio in deposits, bonds and stocks (held directly or indirectly through mutual and pension funds). Risky assets include both bonds and stocks. Data on income and wealth are taken from the RAND Income and Wealth Imputation Data. These data have been cleaned, processed and imputed in case of missing values in the original dataset. The imputation method is consistent across waves. For details see Hurd et al. (2014).

[9] Precisely, the question reads as follows: "We are interested in how well you think the economy will do in the future. By next year at this time, what is the percent chance that mutual fund shares invested in blue chip stocks like those in the Dow Jones Industrial Average will be worth more than they are today?" The possible answer is any integer number between 0 and 100, that we rescale to a fraction between 0 and 1.

[10] From the analysis we exclude those variables that explicitly ask about feelings in the past 7 or 30 days, such as "During the last 30 days, to what degree did you feel …?" because answers may be affected by specific circumstances and therefore have nothing in common with the portfolio allocation previously chosen.

Purpose in Life. As noted by Borghans et al. (2008), "The proliferation of personality measures reflects, in part, the more heterogeneous nature of personality in comparison to cognitive ability" (p. 986).

TABLE 1 ABOUT HERE

Financial risk taking indicators and personality scores fluctuate over time as shown in Table 2. Their time variation is often significant according to a oneway analysis of variance test: interestingly, we see that the largest variation in the variables was in years 2008 and 2010, i.e., in the beginning or in the midst of the financial crisis. In such period we observe a reduction in the holding of risky assets and the self-assessed chance that the market goes up, together with – for instance – an increase in Cynical Hostility, Mastery, Optimism and Pessimism, and a decrease in Openness. We claim that this evidence further supports our decision to look at data from multiple waves. The fact that personality factors turn out to fluctuate over time is in line with the body of evidence presented by Almlund et al. (2011), documenting that, even though personality traits are not merely situation-driven ephemera and – as we noted above – are relatively stable with age (see on this also Cobb-Clark and Schurer, 2012), they are also not set in stone and change with the environment.

TABLE 2 ABOUT HERE

4. Results

Since we aim at investigating the correlation between personality attributes and financial risk taking, we take as reference dependent variables the holding and the share of risky assets (bonds and/or stocks) in the financial portfolio. We start the analysis in Sub-section 4.1 by examining the correlation between financial investment decisions and information on personality scores. In Sub-section 4.2 we then investigate whether the correlations we observe are driven by changes in beliefs or preferences. Finally we focus on single facets of personality in Sub-section 4.3. We estimate our regression equations using a probit model for the probability to hold risky assets, and a fractional response probit model *à la* Papke and Wooldridge (1996), estimated with Bernoulli quasi-maximum likelihood and standard errors robust to heteroskedasticity, for the portfolio share in risky assets. The latter model is specifically suited to deal with fractions, that by definition are bounded in the 0-1 interval, also when a mass of observations is concentrated at the boundaries.

As robustness checks, we replicated the benchmark analysis of Sub-section 4.1 using i) alternative estimation methods (linear probability model for the holding; OLS and tobit for the share) and ii) an alternative definition of risky assets (just stocks, rather than stocks and bonds.) The results, illustrated in Appendix tables A1 and A2, respectively, confirm all of our findings and in some cases suggest more or larger significant relations than in the benchmark analysis. We prefer to rely on the benchmark analysis which is more conservative.

The output tables 3-4 report average marginal effects; in what follows we take the convention to comment only on the coefficients that are statistically significant at the 5% or lower level.

4.1. Aggregate personality scores

We initially regress our indicators over a set of basic explanatory variables capturing standard socio-demographic characteristics as well as self-assessed

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information on health status and the presence of friends. In the analysis we also control for time and cohort fixed effects by means of dummy variables to indicate the wave and the cohort as defined by HRS[11].

Columns (1) and (3) of Table 3 report the output of such regressions for our two dependent variables. We confirm previous results in the literature (see, e.g., Guiso et al., 2001; Halek and Eisenhauer, 2001; Hong et al., 2004; Rosen and Wu, 2004), and specifically that the probability to hold risky assets and the portfolio share invested in such assets are higher for better educated individuals, home-owners, individuals with more wealth, with friends[12] and in good (self-assessed) health, and lower for non-whites (only for risky asset holdings.)

We then introduce in the analysis the factor scores (columns 2 and 4 of the table), constructed following the indication of HRS, and aimed at capturing individual-specific determinants of behavior such as personality traits: five scores related to the Big Five model plus further eight scores capturing potentially relevant personality characteristics unrelated to the Big Five model (see Section 3 on this). Our previous results on the socio-demographic characteristics are preserved. In addition, we find significant effects of two scores: Agreeableness (negatively) and Cynical Hostility (positively). Investors endowed with lower degrees of the Agreeableness trait and those who exhibit more Cynical Hostility are more prone to take financial risks, ceteris paribus. Agreeableness is a trait related to interpersonal orientation: very agreeable individuals are extremely group-oriented, rather than self-centered. Next, they are cooperative and helpful[13]. By contrast, individuals who are low in Agreeableness can be rude, suspicious and manipulative. It is plausible to argue that investors who are lower on Agreeableness also display a tendency to perceive others in a more negative light, are less concerned with others' well-being, and are *more self-centered* and *uncooperative*. Therefore, it is understandable that, to earn more for themselves, they are more prone to take financial risk. Cynical Hostility is a personality trait characterized by a cynical worldview of one's environment and social interactions. Cynically hostile individuals have a more suspicious, mistrustful attitude towards others[14]. Therefore, also individual investors who score high for Cynical Hostility turn out to be more self-centered and willing to take more financial risks to increase their wealth.

The size of these effects is relatively large as, for instance, going from the bottom to the top of the Agreeableness score roughly balances the effect of having a 100% increase in financial wealth, while going from the bottom to the top of the Cynical Hostility score has an effect comparable to being home-owner or having a college degree (+7% in the probability to hold risky assets, and +6.2% in the risky asset share.)

TABLE 3 ABOUT HERE

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[11] Depression Babies, if born between 1924 and 1930; HRS cohort (our baseline), if born between 1931 and 1941; War Babies, if born between 1942 and 1947; Baby Boomers, if born since 1948.

[12] Hong et al. (2004) showed that more sociable investors are more likely to invest in the stock market than non-social ones.

[13] The items on the basis of which the Agreeableness score has been constructed are: helpful; warm; caring; softhearted and sympathetic (see on this the Appendix.)

[14] The Cynical Hostility score has been constructed on the basis of several items capturing individuals' degree of agreement with the following statements: Most people dislike putting themselves out to help other people; Most people will use somewhat unfair means to gain profit or an advantage rather than lose it; No one cares much what happens to you; I think most people would lie in order to get ahead; I commonly wonder what hidden reasons another person may have for doing something nice for me (see on this the Appendix.)

4.2. Preferences or beliefs?

Risk taking may change in response to variations in risk preferences or beliefs about future market returns. Unfortunately we do not have information to disentangle between the two dimensions. However, we follow Malmendier and Nagel (2011) to draw insights on beliefs. Specifically, we focus on a survey question asking for the percentage that the stock market will go up in the next 12 months (see Section 3 for details.) Columns (5) and (6) of Table 3 report the output of a fractional response model where the dependent variable is the self-assessed chance that the market will go up. Column (5) includes standard socio-demographic variables only, while Column (6) also adds the personality scores.

The chance that the market goes up increases with education, wealth and health status, and is lower among females, immigrants and older individuals. Not surprisingly, beliefs are worse in years 2008-2012 than in year 2006, i.e., during or right after the financial crisis. Regarding personality traits, we see that the chance that the market goes up falls with Extraversion and Optimism, while it rises with Cynical Hostility, Pessimism and Hopelessness. It should be noted, however, that the pseudo-R^2 statistic of the models in columns (5)-(6) is particularly low – much lower than in columns (1)-(4) – which suggests that most of the heterogeneity in the self-assessed chance the stock market goes up remains unexplained.

Overall Table 3 suggests that portfolio risk taking may change with Cynical Hostility because of a change in beliefs, although we cannot exclude that Cynical Hostility plays a role also through the preferences channel. What we can exclude is that Agreeableness alters beliefs. As a consequence, its correlation with risk taking should be attributable to a change in preferences.

4.3. Single facets of personality traits

The factor scores considered above originate from a set of 65 raw variables. The advantage of using scores is that they summarize the existing large amount of information. However, this comes at the cost of losing details on the single sub-traits. Our finding of significant effects only for two out of 13 scores could indeed be the consequence of having each score as the summary indicator of different variables: maybe some variables are not relevant, while others are relevant but in opposite directions. As a result, the score in itself may not accurately describe the real contribution of investors' personality to their financial decisions.

As noted by Almlund et al. (2011), this possibility is emphasized in the personality psychology literature, with some scholars suggesting that the Big Five categories are too crude to be useful and claiming that estimates based on the higher-order factors may obscure relationships between specific facets and outcomes of interest (Hough and Oswald, 2000; Paunonen and Ashton, 2001). Similarly, Becker et al. (2012) point out that each measure of personality not only comprises multiple items, but (more importantly) captures distinct aspects of a character trait. Therefore, a finer analysis is necessary: exploiting the richness of our data source by looking at the impact of personality sub-traits, i.e. *facets*, on financial risk taking is the goal of the last step of our empirical analysis.

Specifically, here we repeat our analysis by including in the specification all the 65 raw variables in place of the 13 factor scores. Each (discrete) variable takes values in the 0-1 range. Many of these 65 variables are highly correlated with each other, which gives rise to quasi-collinearity problems. To cope with this issue, and at the same time reduce the dimensionality of the regression specification, we run a statistical stepwise selection. Specifically, we perform a stepwise selection on the 65 raw variables, while always keeping in the specification the socio-demographic control variables. Given the

exploratory nature of this method, to be conservative we run stepwise selection with both backward and forward algorithms, using a relatively large significance level of 0.1. Backward and forward procedures eventually provide similar regression outputs in the case of the risky asset holding, and identical outputs in the case of the risky asset share. The raw variables retained by the stepwise selection are listed in Table 4; below each label we report within squared parentheses a code that allows identification of the variables in the "participant lifestyle" module of HRS 2010. See the Appendix for details.

Many personality scores are represented by at least one facet. The most relevant coefficients, positive and significant in all the cases, are the belief that people do not help others ("Cynical Hostility") and the feeling that the future is hopeless ("Hopelessness".) Other relevant coefficients are being broad-minded ("Openness", positive), sympathetic ("Agreeableness", negative), friendly ("Extraversion", positive), calm ("Neuroticism", negative) and striving to succeed ("Mastery", positive) for the holding, and being outgoing ("Extraversion", positive) and with directions in life ("Purpose in Life", positive) for the share. Therefore, our facet-level investigation enriches our overall analysis as it both reinforces the previous results with regard to traits such as Agreeableness and Cynical Hostility and complements it by showing that other Big Five traits – such as Openness, Extraversion and Neuroticism – and non-Big five traits – such as Hopelessness, Mastery and Purpose in Life – play a relevant role. All in all, it seems that Cynical Hostility matters for both the holding and the share, while the Big Five traits have more to do with the holding and having a Purpose in Life is more highly correlated with the share. All the above signs appear intuitive, including the negative sign of Hopelessness that may depend on the fact that investors who score high on Hopelessness believe that there is nothing or not much to lose in their future life and, therefore, their propensity to take risks is higher. We view this finding as extending to financial decisions the result from prior work pointing to a positive relationship between Hopelessness and risky behavior in other domains: for example, Bolland (2003) reports that feelings of Hopelessness among inner-city adolescents are associated with several domains of risky behavior, such as violence, substance use, sexuality and accidental injury; similarly, analyzing a pool of African American young men, Kagan et al. (2012) show that as Hopelessness increases, sexual risk behavior increases.

In contrast, none of the facets behind the scores on "Conscientiousness", "Optimism", "Pessimism", "Loneliness", and "Constraints on Personal Control" is included in the final specification with a coefficient significant at a 5% or higher level. On the whole, then, we believe that looking at the influence of personality facets on financial risk taking allowed us to corroborate and reinforce the broad idea that lies at the heart of our study: non-cognitive factors such as investors' personality attributes significantly shape their portfolio choices.

TABLE 4 ABOUT HERE

5. Concluding remarks

The aim of this paper is to provide a novel contribution to our understanding of what determines individual risk taking in the financial domain. So far, the existing literature shows that risk aversion has economic correlates (such as income and wealth), sociodemographic correlates (age, gender, education, height, civil status, parental background, cognitive ability) and depends on biological factors (for instance see Sapienza et al., 2009) as well as genetic factors (Cesarini et al., 2009; 2010). Next, peer

effects have been shown to play an important role (Hong et al., 2004), also with regard to fund managers' portfolio choices (Pool et al., forthcoming).

Based on US repeated survey data, we investigated the impact of individual investors' non-cognitive abilities on their portfolio choices and showed that they depend on a series of variables capturing characteristics of individuals' personality. The documented effects survive after controlling for known determinants of financial risk taking. Specifically, our analysis revealed that two personality traits (namely, Agreeableness and Cynical Hostility) significantly shape portfolio choice. The correlation of risky investments with these personality traits is quantitatively large, and it may balance almost completely the correlation with well-known determinants of risk taking such as college education. Next, our facet-level analysis corroborated and reinforced our trait-level results, shedding light on the influence on financial decisions of several facets associated with both Big Five and non-Big Five traits. On the whole, our major findings indicate that when investors' personality profile is mainly *self-centered* as they score either high on Cynical Hostility or Hopelessness or low on Agreeableness, they are *more likely* to take financial risks, all else equal.

More broadly, our findings corroborate the recently advanced view that conventional economic and finance theory should be enriched by incorporating key psychological findings: providing evidence that a link exists between individuals' financial risk taking and their personality characteristics points to a closer relationship between economic *preferences*, that have been mainly studied within a classic expected utility framework, and non-cognitive skills such as *personality* attributes, that traditionally have been investigated by psychologists (see on this Rustichini et al., 2012). However, as noted by Almlund et al. (2011), even though it is tempting to try to map economic preferences to more vaguely defined personality traits, the empirical connection between preferences and measures of personality (including intuitively similar personality traits) is still largely unexplored and the stream of literature combining insights from the approaches taken by economists and psychologists (Becker et al., 2012; Beauchamp et al., 2012) is still in infancy.

Further, since we know that people's personality attributes are heterogeneous, we claim that uncovering links between some personality traits and financial risk taking has also implications for the line of inquiry aimed at understanding heterogeneity in portfolio allocation (Guiso et al., 2001; Curcuru et al., 2009), including suboptimal financial decision making (Agarwal and Mazumder, 2013). In this regard, our study suggests that two individuals who do not differ in income, gender, educational attainment, wealth, background risk, cognitive ability, age and even genetic makeup, may still significantly differ in their financial decisions: the reason would be that they differ in terms of personality attributes like the ones identified in this study. Put differently, faced with the same optimization problem and budget constraints, individuals otherwise identical but characterized by different personality traits may still make significantly different portfolio choices.

Finally, a natural next step to be taken along this path will be to disentangle the effects on investors' portfolio choices of cognitive factors from non-cognitive ones. On general grounds, it is likely to be the case that while cognitive factors are key in some domains (e.g., with regard to time preferences), in others it is their *interplay* with non-cognitive skills that significantly shape people's behavior (Rustichini et al., 2012). Discovering whether this interaction is key also within a relevant decision-context such as investors' portfolio choice is left as an interesting avenue for future research on the theme.

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Appendix: Construction of score variables

Scores are constructed from the combination of some raw items developed in the psychology literature. For each item, we report below its label from HRS 2010. Each score is missing when more than half of the items are missing.

For sake of comparability, in the analysis we rescale each score in the 0-1 range.

Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism[15]
(HRS question lb033. Five more items are included to this list since wave 2010.)

> "Please indicate how well each of the following describes you.
> [lb033a] Outgoing
> [lb033b] Helpful
> [lb033d] Moody
> [lb033e] Organized
> [lb033f] Friendly
> [lb033g] Warm
> [lb033h] Worrying
> [lb033i] Responsible
> [lb033j] Lively
> [lb033k] Caring
> [lb033l] Nervous
> [lb033m] Creative
> [lb033n] Hardworking
> [lb033o] Imaginative
> [lb033p] Softhearted
> [lb033q] Calm
> [lb033s] Intelligent
> [lb033t] Curious
> [lb033u] Active
> [lb033v] Careless
> [lb033w] Broad-minded
> [lb033y] Sympathetic
> [lb033z2] Talkative
> [lb033z3] Sophisticated
> [lb033z4] Adventurous
> [lb033z5] Thorough"

Possible answers are: "A lot", "Some", "A little" and "Not at all", to which we assign the value 4, 3, 2 or 1 respectively. We assign the reverse code to items lb033q and lb033v.

Scores are the average of the following items:

Openness: lb033m, lb033o, lb033s, lb033t, lb033w, lb033z3, lb033z4.

Conscientiousness: lb033e, lb033i, lb033n, lb033v, lb033z5.

Extraversion: lb033a, lb033f, lb033j, lb033u, lb033z3.

Agreeableness: lb033b, lb033g, lb033k, lb033p, lb033y.

Neuroticism: lb033d, lb033h, lb033l, lb033q.

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[15] *Source*: Lachman, M.E., and Weaver, S.L. (1997). Midlife Development Inventory (MIDI) Personality Scales: Scale Construction and Scoring. Unpublished Technical Report. Brandeis University.(http://www.brandeis.edu/projects/lifespan/scales.html)

Cynical Hostility, Optimism, Pessimism, Hopelessness[16]
(HRS question lb019)

> "Please say how much you agree or disagree with the following statements:
>
> [lb019a] Most people dislike putting themselves out to help other people.
>
> [lb019b] Most people will use somewhat uinfair means to gain profit or an advantage rather than lose it.
>
> [lb019c] No one cares much what happens to you.
>
> [lb019d] I think most people would lie in order to get ahead.
>
> [lb019e] I commonly wonder what hidden reasons another person may have for doing something nice for me.
>
> [lb019f] If something can go wrong for me it will.
>
> [lb019g] I'm always optimistic about my future.
>
> [lb019h] In uncertain times, I usually expect the best.
>
> [lb019i] Overall, I expect more good things to happen to me than bad.
>
> [lb019j] I hardly ever expect things to go my way.
>
> [lb019k] I rarely count on good things happening to me.
>
> [lb019l] I feel it is impossible for me to reach the goals that I would like to strive for.
>
> [lb019m] The future seems hopeless to me and I can't believe that things are changing for the better.
>
> [lb019n] I don't expect to get what I really want.
>
> [lb019o] There's no use in really trying to get something I want because I probably won't get it."

Possible answers are "Strongly disagree", "Somewhat disagree", "Slightly disagree", "Slightly agree", "Somewhat agree" and "Strongly agree", to which we assign the value 1, 2, 3, 4, 5 or 6 respectively.

Scores are the average of the following items:

Cynical Hostility: lb019a, lb019b, lb019c, lb019d, lb019e.

Optimism: lb019g, lb019h, lb019i.

Pessimism: lb019f, lb019j, lb019k.

Hopelessness: lb019l, lb019m, lb019n, lb019o.

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[16] *Source*: Cook, W.W., and Medley, D.M. (1954). Proposed Hostility and Pharisaic-virtue Scales for the MMPI. *The Journal of Applied Psychology*, 38, 414-418. [Cynical hostility]

Scheier, M.F., Carver, C.S., and Bridges, M.W. (1994). Distinguishing Optimism from Neuroticism (and Trait Anxiety, Self-mastery, and Self-esteem): A Reevaluation of the Life Orientation Test. *Journal of Personality and Social Psychology*, 67, 1063-1078. [Optimism, pessimism]

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Loneliness[17]
(HRS question lb020)

> "The next questions are about how you feel about different aspects of your life. HOW MUCH OF THE TIME DO YOU FEEL …
> [lb020a] You lack companionship?
> [lb020b] Left out?
> [lb020c] Isolated from others?
> [lb020d] That you are "in tune" with the people around you?
> [lb020e] Alone?
> [lb020f] That there are people you can talk to?
> [lb020g] That there are people you can turn to?
> [lb020h] That there are people who really understand you?
> [lb020i] That there are people you feel close to?
> [lb020j] Part of a group of friends?
> [lb020k] That you have a lot in common with the people around you?"

Possible answers are "Often", "Some of the time" and "Hardly ever or never", to which we assign the value 1, 2 or 3 respectively. We assign the reverse code to items items lb020a, lb020b, lb020c and lb020e.
The score is the average of the items.

Constraints on Personal Control[18]
(HRS question lb022)

> "Please say how much you agree or disagree with the following statements.
> [lb022a] I often feel helpless in dealing with the problems of life.
> [lb022b] Other people determine most of what I can and cannot do.
> [lb022c] What happens in my life is often beyond my control.
> [lb022d] I have little control over the things that happen to me.
> [lb022e] There is really no way I can solve the problems I have."

Possible answers are "Strongly disagree", "Somewhat disagree", "Slightly disagree", "Slightly agree", "Somewhat agree" and "Strongly agree", to which we assign the value 1, 2, 3, 4, 5 or 6 respectively.
The score is the average of the items.

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[17] *Source*: Hughes, M.E., Waite, L.J., Hawkley, L.C., and Cacioppo, J.T. (2004). A Short Scale for Measuring Loneliness in Large Surveys: Results from Two Population-based Studies. *Research on Aging*, 26, 655-672.

[18] *Source*: Lachman, M.E., and Weaver, S.L. (1998). The Sense of Control as a Moderator of Social Class Differences in Health and Well-being. *Journal of Personality and Social Psychology*, 74, 763-773.
Pearlin, L.I., and Schooler, C. (1978). The Structure of Coping. *Journal of Health and Social Behavior,* 19, 2-21.

Mastery[19]
(HRS question lb023)

> "Please say how much you agree or disagree with the following statements.
> [lb023a] I can do just about anything I really set my mind to.
> [lb023b] When I really want to do something, I usually find a way to succeed at it.
> [lb023c] Whether or not I am able to get what I want is in my own hands.
> [lb023d] What happens to me in the future mostly depends on me.
> [lb023e] I can do the things that I want to do."

Possible answers are "Strongly disagree", "Somewhat disagree", "Slightly disagree", "Slightly agree", "Somewhat agree" and "Strongly agree", to which we assign the value 1, 2, 3, 4, 5 or 6 respectively.
The score is the average of the items.

Purpose in Life[20]
(HRS question lb035)

> "Please read the statements below and decide the extent to which each statement describes you.
> [lb035a] I enjoy making plans for the future and working to make them a reality.
> [lb035b] My daily activities often seem trivial and unimportant to me.
> [lb035c] I am an active person in carrying out the plans I set for myself.
> [lb035d] I don't have a good sense of what it is I'm trying to accomplish in life.
> [lb035e] I sometimes feel as if I've done all there is to do in life.
> [lb035f] I live life one day at a time and don't really think about the future.
> [lb035g] I have a sense of direction and purpose in my life."

Possible answers are "Strongly disagree", "Somewhat disagree", "Slightly disagree", "Slightly agree", "Somewhat agree" and "Strongly agree", to which we assign the value 6, 5, 4, 3, 2 or 1 respectively. We assign the reverse code to items lb035a, lb035c and lb035g.
The score is the average of the items.

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[19] *Source*: the source is the same as for "constraints on personal control".
[20] *Source*: Ryff, C.D., and Keyes, C.L.M. (1995). The Structure of Psychological Well-being Revisited. *Journal of Personality and Social Psychology*, 69, 719-727.

Table 1. Summary statistics (10,104 observations)

Variable	Dummy	Mean	Std. dev.	Min.	Max.
Dependent variables					
Risky asset holding	Yes	0.436	0.496	0	1
Risky asset share	No	0.249	0.356	0	1
Chance market up	No	0.488	0.247	0	1
Control variables					
Age	No	67.278	7.483	50	80
Female	Yes	0.570	0.495	0	1
Non-white	Yes	0.094	0.292	0	1
Immigrate	Yes	0.059	0.237	0	1
Married	Yes	0.737	0.440	0	1
Living with children	Yes	0.156	0.363	0	1
Living with other household members	Yes	0.069	0.254	0	1
High school	Yes	0.227	0.419	0	1
College	Yes	0.141	0.348	0	1
Employee	Yes	0.296	0.456	0	1
Self-employed	Yes	0.101	0.302	0	1
Home-owner	Yes	0.925	0.263	0	1
Financial wealth (thousand USD)	No	216.501	628.560	1	32,900.000
Self-assessed good health	Yes	0.533	0.499	0	1
With friends	Yes	0.967	0.178	0	1
Cohort: Depression Babies	Yes	0.055	0.229	0	1
Cohort: War Babies	Yes	0.220	0.414	0	1
Cohort: Baby Boomers	Yes	0.248	0.432	0	1
Year 2008	Yes	0.255	0.436	0	1
Year 2010	Yes	0.267	0.442	1	1
Year 2012	Yes	0.202	0.402	1	1
Personality scores					
Openness	No	0.665	0.175	0	1
Conscientiousness	No	0.813	0.147	0.083	1
Extraversion	No	0.741	0.181	0	1
Agreeableness	No	0.847	0.152	0	1
Neuroticism	No	0.325	0.196	0	1
Cynical hostility	No	0.650	0.209	0	1
Optimism	No	0.280	0.215	0	1
Pessimism	No	0.748	0.230	0	1
Hopelessness	No	0.790	0.219	0	1
Loneliness	No	0.197	0.246	0	1
Constraints on personal control	No	0.813	0.206	0	1
Mastery	No	0.219	0.203	0	1
Purpose in life	No	0.242	0.173	0	1

Table 2. Average of key variables over time

Variable	2006	2008	2010	2012	All	Mean comparison test
Dependent variables						
Risky asset holding	0.463	0.431	0.427	0.415	0.436	4.39***
Risky asset share	0.260	0.244	0.244	0.248	0.249	1.36
Chance market up	0.514	0.483	0.486	0.459	0.488	19.86***
Personality scores						
Openness	0.678	0.667	0.659	0.651	0.665	10.33***
Conscientiousness	0.813	0.816	0.812	0.812	0.813	0.27
Extraversion	0.746	0.747	0.737	0.733	0.741	3.56**
Agreeableness	0.845	0.853	0.844	0.847	0.847	1.77
Neuroticism	0.337	0.329	0.316	0.316	0.325	7.54***
Cynical hostility	0.646	0.646	0.651	0.662	0.650	2.95**
Optimism	0.274	0.274	0.279	0.298	0.280	6.13***
Pessimism	0.742	0.740	0.753	0.761	0.748	4.46***
Hopelessness	0.802	0.782	0.784	0.793	0.790	4.61***
Loneliness	0.198	0.200	0.195	0.194	0.197	0.27
Constraints on personal control	0.816	0.814	0.809	0.814	0.813	0.58
Mastery	0.213	0.212	0.221	0.232	0.219	4.87***
Purpose in life	0.249	0.229	0.240	0.254	0.242	9.10***
Observations	2,794	2,575	2,693	2,042	10,104	

Note. The last column reports the result of a oneway analysis of variance test on the equality of the means over the waves. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 3. Benchmark analysis

Dependent variable	Risky holding		Risky share		Chance market up	
	(1)	(2)	(3)	(4)	(5)	(6)
Age /100	-0.048	-0.022	-0.166	-0.166	-0.236**	-0.212**
	(0.169)	(0.169)	(0.131)	(0.132)	(0.099)	(0.099)
Female	-0.004	-0.006	-0.004	-0.007	-0.063***	-0.069***
	(0.009)	(0.010)	(0.007)	(0.008)	(0.005)	(0.006)
Non-white	-0.035**	-0.030*	-0.025*	-0.019	-0.006	-0.004
	(0.017)	(0.017)	(0.014)	(0.015)	(0.009)	(0.010)
Immigrate	-0.034*	-0.034*	-0.020	-0.018	-0.027**	-0.021*
	(0.019)	(0.019)	(0.015)	(0.016)	(0.011)	(0.011)
Married	0.009	0.013	-0.003	-0.002	-0.004	-0.002
	(0.011)	(0.011)	(0.008)	(0.009)	(0.006)	(0.006)
Living with children	0.014	0.015	0.008	0.009	0.014	0.016
	(0.013)	(0.013)	(0.010)	(0.010)	(0.007)	(0.007)
Living with other household members	-0.030	-0.030	-0.006	-0.006	-0.015*	-0.015**
	(0.019)	(0.019)	(0.015)	(0.016)	(0.011)	(0.010)
High school	0.037***	0.031***	0.034***	0.031***	0.047***	0.035***
	(0.011)	(0.011)	(0.008)	(0.008)	(0.006)	(0.006)
College	0.074***	0.065***	0.052***	0.048***	0.052***	0.034***
	(0.014)	(0.014)	(0.010)	(0.010)	(0.008)	(0.008)
Employed	0.008	0.008	-0.003	-0.003	-0.008	-0.007
	(0.011)	(0.011)	(0.009)	(0.009)	(0.006)	(0.006)
Self-employed	-0.008	-0.009	-0.013	-0.012	0.007	0.005
	(0.015)	(0.015)	(0.012)	(0.012)	(0.009)	(0.009)
Home-owner	0.100***	0.100***	0.059***	0.060***	0.020**	0.017*
	(0.019)	(0.019)	(0.015)	(0.016)	(0.010)	(0.010)
Ln(financial wealth)	0.137***	0.136***	0.104***	0.104***	0.009***	0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Self-assessed good health	0.037***	0.033***	0.034***	0.032***	0.030***	0.020***
	(0.009)	(0.009)	(0.007)	(0.007)	(0.005)	(0.005)
With friends	0.077***	0.074***	0.049**	0.047**	0.013	0.001
	(0.024)	(0.024)	(0.019)	(0.020)	(0.014)	(0.014)
Cohort: Depression Babies	-0.022	-0.024	0.010	0.010	-0.009	-0.009
	(0.023)	(0.023)	(0.017)	(0.017)	(0.015)	(0.015)
Cohort: War Babies	-0.015	-0.015	-0.018	-0.017	0.010	0.011
	(0.017)	(0.017)	(0.013)	(0.014)	(0.010)	(0.010)
Cohort: Baby Boomers	-0.017	-0.014	-0.031	-0.030	0.010	0.015
	(0.027)	(0.027)	(0.021)	(0.021)	(0.016)	(0.016)
Year 2008	-0.023**	-0.021*	-0.013	-0.012	-0.022***	-0.021***
	(0.012)	(0.012)	(0.009)	(0.009)	(0.007)	(0.007)
Year 2010	-0.025**	-0.023**	-0.008	-0.007	-0.019***	-0.019***
	(0.011)	(0.011)	(0.009)	(0.009)	(0.007)	(0.007)
Year 2012	-0.028*	-0.028*	0.005	0.004	-0.041***	-0.043***
	(0.015)	(0.015)	(0.012)	(0.012)	(0.009)	(0.009)

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Table 3. (Continued)

Dependent variable	Risky holding		Risky share		Chance market up	
	(1)	(2)	(3)	(4)	(5)	(6)
Personality scores						
Openness		0.033		-0.005		0.063
		(0.032)		(0.025)		(0.019)
Conscientiousness		0.037		0.020		-0.020
		(0.036)		(0.028)		(0.021)
Extraversion		0.056*		0.046*		-0.074***
		(0.033)		(0.026)		(0.019)
Agreeableness		-0.112***		-0.079***		-0.001
		(0.037)		(0.028)		(0.021)
Neuroticism		0.023		0.007		-0.003
		(0.026)		(0.020)		(0.016)
Cynical hostility		0.070***		0.062***		0.070***
		(0.024)		(0.019)		(0.015)
Optimism		0.005		0.018		-0.041***
		(0.023)		(0.018)		(0.014)
Pessimism		-0.021		0.013		0.047***
		(0.028)		(0.022)		(0.016)
Hopelessness		0.057*		0.031		0.037**
		(0.030)		(0.024)		(0.018)
Loneliness		0.031		0.014		0.003
		(0.021)		(0.017)		(0.012)
Constraints on personal control		0.001		-0.023		0.015
		(0.027)		(0.022)		(0.016)
Mastery		0.017		0.009		-0.000
		(0.024)		(0.019)		(0.014)
Purpose in life		0.044		0.024		0.026
		(0.033)		(0.026)		(0.020)
Pseudo-R^2	0.285	0.287	0.224	0.225	0.014	0.018
Log-likelihood	-4,949.41	-4,934.94	-3,942.72	-3,933.87	-5,077.95	-5,059.25
Observations	10,104	10,104	10,104	10,104	10,104	10,104

Note. The table reports the average marginal effects on the probability to hold risky assets (Columns 1 and 2; probit model), the risky asset share (Columns 3 and 4; fractional response model) and the chance the stock market goes up (Columns 5 and 6; fractional response model.) Household-clustered standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 4. Personality facets: stepwise selection

Dependent variable	Risky holding		Risky share	
Stepwise method	Backward	Forward	Backward	Forward
	(1)	(2)	(3)	(4)
Age /100	-0.021	-0.025	-0.165	-0.165
	(0.169)	(0.169)	(0.131)	(0.131)
Female	-0.008	-0.007	-0.006	-0.006
	(0.010)	(0.010)	(0.007)	(0.007)
Non-white	-0.028	-0.027	-0.019	-0.019
	(0.017)	(0.017)	(0.014)	(0.014)
Immigrate	-0.033*	-0.032*	-0.018	-0.018
	(0.019)	(0.019)	(0.015)	(0.015)
Married	0.011	0.011	-0.003	-0.003
	(0.011)	(0.011)	(0.009)	(0.009)
Living with children	0.014	0.015	0.009	0.009
	(0.013)	(0.013)	(0.010)	(0.010)
Living with other	-0.027	-0.028	-0.005	-0.005
household members	(0.019)	(0.019)	(0.015)	(0.015)
High school	0.030***	0.030***	0.031***	0.031***
	(0.011)	(0.011)	(0.008)	(0.008)
College	0.061***	0.064***	0.049***	0.049***
	(0.014)	(0.014)	(0.010)	(0.010)
Employed	0.006	0.008	-0.002	-0.002
	(0.011)	(0.011)	(0.008)	(0.008)
Self-employed	-0.010	-0.008	-0.012	-0.012
	(0.016)	(0.015)	(0.012)	(0.012)
Home-owner	0.102***	0.103***	0.060***	0.060***
	(0.019)	(0.019)	(0.015)	(0.015)
Ln(financial wealth)	0.136***	0.136***	0.103***	0.103***
	(0.002)	(0.002)	(0.002)	(0.002)
Self-assessed	0.035***	0.036***	0.034***	0.034***
good health	(0.009)	(0.009)	(0.007)	(0.007)
With friends	0.075***	0.074***	0.047**	0.047**
	(0.024)	(0.024)	(0.020)	(0.020)
Cohort: Depression Babies	-0.020	-0.020	0.012	0.012
	(0.023)	(0.023)	(0.017)	(0.017)
Cohort: War Babies	-0.015	-0.015	-0.017	-0.017
	(0.017)	(0.017)	(0.013)	(0.013)
Cohort: Baby Boomers	-0.015	-0.015	-0.030	-0.030
	(0.027)	(0.027)	(0.021)	(0.021)
Year 2008	-0.022*	-0.023**	-0.011	-0.011
	(0.012)	(0.012)	(0.009)	(0.009)
Year 2010	-0.023**	-0.025**	-0.007	-0.007
	(0.011)	(0.011)	(0.009)	(0.009)
Year 2012	-0.027*	-0.028*	0.005	0.005
	(0.015)	(0.015)	(0.012)	(0.012)

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Table 4. (Continued)

Dependent variable	Risky holding		Risky share	
Stepwise method	Backward	Forward	Backward	Forward
	(1)	(2)	(3)	(4)
Personality facets				
People do not help	0.037**	0.036**	0.030**	0.030**
[lb019a]	(0.015)	(0.015)	(0.012)	(0.012)
Optimistic about future			0.025*	0.025*
[lb019g]			(0.013)	(0.013)
Hopeless future	0.040**	0.039**	0.039***	0.039***
[lb019m]	(0.020)	(0.020)	(0.014)	(0.014)
Not trying to get something	0.049**	0.047**		
[lb019o]	(0.022)	(0.022)		
Left out	0.029*	0.029*		
[lb020b]	(0.017)	(0.017)		
Striving to succeed	0.046**	0.047**		
[lb023b]	(0.020)	(0.020)		
Outgoing			0.029**	0.029**
[lb033a]			(0.013)	(0.013)
Friendly	0.059**	0.052**		
[lb033f]	(0.026)	(0.025)		
Hardworking	0.041*			
[lb033n]	(0.022)			
Imaginative	-0.029*			
[lb033o]	(0.018)			
Calm	-0.042**	-0.043**		
[lb033q]	(0.019)	(0.019)		
Sympathetic	-0.046**	-0.051**		
[lb033y]	(0.022)	(0.022)		
Broad-minded	0.054***	0.053***		
[lb033w]	(0.018)	(0.018)		
Sophisticated	0.028*			
[lb033z3]	(0.016)			
Daily activities unimportant	-0.046*		-0.048***	-0.048***
[lb035b]	(0.025)		(0.018)	(0.018)
With direction in life			0.030**	0.030**
[lb035g]			(0.014)	(0.014)
Pseudo-R^2	0.289	0.289	0.226	0.226
Log-likelihood	-4,917.74	-4,923.37	-3,932.53	-3,932.53
Observations	10,104	10,104	10,104	10,104

Note. The table reports the average marginal effects on the probability to hold risky assets (Columns 1 and 2; probit model) and the risky asset share (Columns 3 and 4; fractional response model.) Personality facets are a subset of the 65 variables chosen according to backward stepwise selection (significance level for removal: 0.1). Household-clustered standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A1. Robustness checks

Dependent variable	Risky holding	Risky share	
	(1)	(2)	(3)
Age /100	-0.012	-0.143	-0.092
	(0.172)	(0.129)	(0.100)
Female	-0.005	-0.004	-0.005
	(0.010)	(0.007)	(0.006)
Non-white	-0.029*	-0.012	-0.019*
	(0.015)	(0.011)	(0.011)
Immigrate	-0.035*	-0.018	-0.019
	(0.018)	(0.014)	(0.012)
Married	0.010	-0.003	0.002
	(0.011)	(0.008)	(0.007)
Living with children	0.015	0.007	0.009
	(0.012)	(0.009)	(0.008)
Living with other	-0.019	0.007	-0.011
household members	(0.017)	(0.012)	(0.012)
High school	0.035***	0.038***	0.021***
	(0.012)	(0.009)	(0.006)
College	0.074***	0.063***	0.037***
	(0.015)	(0.012)	(0.008)
Employed	0.007	-0.003	0.002
	(0.011)	(0.008)	(0.006)
Self-employed	-0.007	-0.015	-0.007
	(0.016)	(0.012)	(0.009)
Home-owner	0.070***	0.024**	0.061***
	(0.015)	(0.010)	(0.012)
Ln(financial wealth)	0.144***	0.097***	0.086***
	(0.002)	(0.002)	(0.002)
Self-assessed	0.034***	0.031***	0.023***
good health	(0.009)	(0.007)	(0.005)
With friends	0.083***	0.047***	0.044***
	(0.023)	(0.016)	(0.015)
Cohort: Depression Babies	-0.025	0.010	-0.001
	(0.023)	(0.018)	(0.013)
Cohort: War Babies	-0.012	-0.016	-0.012
	(0.018)	(0.013)	(0.010)
Cohort: Baby Boomers	-0.015	-0.029	-0.018
	(0.028)	(0.020)	(0.016)
Year 2008	-0.019*	-0.006	-0.010
	(0.012)	(0.009)	(0.007)
Year 2010	-0.023**	-0.006	-0.010
	(0.012)	(0.009)	(0.007)
Year 2012	-0.031**	0.005	-0.004
	(0.015)	(0.011)	(0.009)

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Dependent variable	Risky holding	Risky share	
	(1)	(2)	(3)
Personality scores			
Openness	0.029	0.001	0.001
	(0.032)	(0.024)	(0.019)
Conscientiousness	0.028	0.009	0.020
	(0.036)	(0.027)	(0.021)
Extraversion	0.068**	0.054**	0.037*
	(0.033)	(0.025)	(0.019)
Agreeableness	-0.123***	-0.099***	-0.060***
	(0.037)	(0.028)	(0.021)
Neuroticism	0.019	0.005	0.007
	(0.026)	(0.019)	(0.015)
Cynical hostility	0.068***	0.058***	0.049***
	(0.024)	(0.018)	(0.014)
Optimism	0.002	0.011	0.011
	(0.023)	(0.017)	(0.014)
Pessimism	-0.014	0.008	0.001
	(0.027)	(0.020)	(0.017)
Hopelessness	0.048*	0.027	0.028
	(0.029)	(0.022)	(0.018)
Loneliness	0.032	0.017	0.014
	(0.021)	(0.015)	(0.013)
Constraints on personal control	0.000	-0.019	-0.013
	(0.027)	(0.020)	(0.017)
Mastery	0.009	-0.000	0.007
	(0.024)	(0.018)	(0.014)
Purpose in life	0.048	0.024	0.025
	(0.034)	(0.024)	(0.019)
R^2	0.331	0.293	
Pseudo-R^2			0.253
Log-likelihood			-6,273.03
Observations	10,104	10,104	10,104

Note. The table reports the average marginal effects on the probability to hold risky assets (Column 1; linear probability model), the risky asset share (Columns 2 and 3; OLS and tobit models respectively). Household-clustered standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A2. Analysis on stock shares

Dependent variable	Risky holding		Risky share	
	(1)	(2)	(3)	(4)
Age /100	0.018	0.031	-0.112	-0.120
	(0.171)	(0.171)	(0.123)	(0.124)
Female	-0.003	-0.006	-0.004	-0.007
	(0.009)	(0.010)	(0.007)	(0.007)
Non-white	-0.027	-0.021	-0.017	-0.012
	(0.018)	(0.018)	(0.013)	(0.013)
Immigrate	-0.047**	-0.047**	-0.025*	-0.024
	(0.019)	(0.019)	(0.014)	(0.015)
Married	0.018	0.021*	0.001	0.001
	(0.011)	(0.011)	(0.008)	(0.008)
Living with children	0.012	0.013	0.005	0.006
	(0.013)	(0.013)	(0.009)	(0.009)
Living with other	-0.029	-0.029	-0.004	-0.004
household members	(0.019)	(0.019)	(0.015)	(0.015)
High school	0.037***	0.031***	0.026***	0.023***
	(0.011)	(0.011)	(0.008)	(0.008)
College	0.072***	0.064***	0.037***	0.034***
	(0.014)	(0.014)	(0.009)	(0.010)
Employed	0.007	0.008	-0.002	-0.001
	(0.011)	(0.011)	(0.008)	(0.008)
Self-employed	-0.009	-0.008	-0.017	-0.017
	(0.016)	(0.016)	(0.011)	(0.012)
Home-owner	0.101***	0.102***	0.050***	0.051***
	(0.019)	(0.019)	(0.015)	(0.015)
Ln(financial wealth)	0.134***	0.133***	0.090***	0.090***
	(0.002)	(0.002)	(0.002)	(0.002)
Self-assessed	0.035***	0.033***	0.033***	0.033***
good health	(0.009)	(0.009)	(0.006)	(0.007)
With friends	0.059**	0.056**	0.032*	0.029
	(0.024)	(0.024)	(0.018)	(0.019)
Cohort: Depression Babies	-0.032	-0.033	0.002	0.002
	(0.023)	(0.023)	(0.016)	(0.016)
Cohort: War Babies	-0.003	-0.003	-0.005	-0.005
	(0.018)	(0.018)	(0.013)	(0.013)
Cohort: Baby Boomers	-0.001	0.000	-0.017	-0.017
	(0.027)	(0.027)	(0.020)	(0.020)
Year 2008	-0.027**	-0.025**	-0.014*	-0.013
	(0.012)	(0.012)	(0.008)	(0.008)
Year 2010	-0.035***	-0.033***	-0.015*	-0.015*
	(0.012)	(0.012)	(0.008)	(0.008)
Year 2012	-0.039**	-0.039**	-0.003	-0.003
	(0.015)	(0.015)	(0.011)	(0.011)

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Dependent variable	Risky holding		Risky share	
	(1)	(2)	(3)	(4)
Personality scores				
Openness		0.028		0.001
		(0.032)		(0.023)
Conscientiousness		0.041		0.013
		(0.036)		(0.026)
Extraversion		0.055*		0.043*
		(0.033)		(0.024)
Agreeableness		-0.106***		-0.057**
		(0.037)		(0.027)
Neuroticism		0.023		0.008
		(0.026)		(0.018)
Cynical hostility		0.078***		0.052***
		(0.025)		(0.018)
Optimism		0.005		0.014
		(0.023)		(0.017)
Pessimism		-0.022		0.009
		(0.028)		(0.021)
Hopelessness		0.048		0.021
		(0.030)		(0.023)
Loneliness		0.024		0.005
		(0.021)		(0.016)
Constraints on personal control		-0.010		-0.031
		(0.027)		(0.021)
Mastery		0.022		0.011
		(0.024)		(0.018)
Purpose in life		0.037		0.021
		(0.033)		(0.024)
Pseudo-R^2	0.274	0.276	0.198	0.199
Log-likelihood	-4,970.29	-4,956.58	-3,836.40	-3,829.81
Observations	10,104	10,104	10,104	10,104

Note. The table reports the average marginal effects on the probability to hold stock assets (Columns 1 and 2; probit model) and the stock asset share (Columns 3 and 4; fractional response model.) Household-clustered standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.