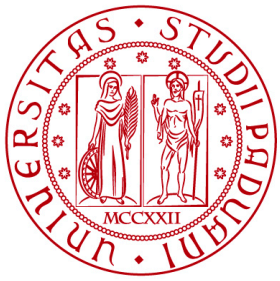

UNIVERSITÀ DEGLI STUDI DI PADOVA

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Dipartimento di Scienze Economiche e Aziendali “Marco Fanno”

SCUOLA SUPERIORE IN ECONOMIA E MANAGEMENT

CICLO XXVIII

ESSAYS ON HOUSEHOLD’S PREFERENCES AND SUBJECTIVE EVALUATIONS

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Contents

Introduction

This thesis is a collection of three empirical essays on household's preferences and subjective evaluations. The first chapter, titled "Social status and personality Traits" is a joint work with Alessandro Bucciol and Luca Zarri. This work is forthcoming in the Journal of Economic Psychology. In this work we provide direct evidence on the relationship between social status and personality traits. Using survey data from the 2006-2012 waves of the US Health and Retirement Study, we show that self-perceived social status is associated with all the "Big Five" personality traits, after controlling for observable characteristics that arguably reflect one's actual status. We also construct an objective status measure that in turn is influenced by personality traits. Objectively measured status is positively but not highly correlated with its subjective counterpart and, when incorporated in a regression specification, still leaves room for direct effects of personality traits on status perception.

The second chapter remains in the domain of behavioral economics, studying the interaction between financial risk preferences, generalized trust and financial portfolio decision. The title of the work is "Financial Risk Tolerance and Trust in Others: Substitutes or Complements for Risky Asset Holdings?" Using two waves of the Survey on Health, Ageing and Retirement in Europe (SHARE, 2006-2013), this paper explores the role jointly played by individuals' financial risk tolerance and their level of trust in other in affecting their decision to hold risky assets. I find a large variation in risk tolerance and trust across European countries and households. Moreover, I show that risky assets investments are more frequent and larger in households featuring either risk tolerance or (to a smaller extent) a combination of risk aversion and trust. Trust seems to act as an imperfect substitute for risk tolerance. These findings have relevant implications for the understanding of heterogeneity in household financial decisions as well as of the role that trust can play as a lubricant of the economic system.

The third and last chapter of the thesis is again dedicated to the study households' preferences. The title of this work is "Gender Differences in Risk and Time Preferences: The Role of Marital Status". Using Dutch survey data from 1996 to 2013, this paper investigates the differences in time and risk preferences along the gender and marital status dimensions. In order to do so, I take into consideration both a self-reported measure and a structural estimation of the preference parameters. Results from standard regressions suggest that women are indeed more risk averse than men. However, there is also a significant interaction effect of gender and marital status:

single men are less risk averse than married ones, while for women the difference isn't significant. Results for the time preference estimation are less conclusive. Structural estimation of risk aversion parameters generally confirms the regression analysis' results. Moreover, these estimations suggest an even stronger interaction between gender and marital status. As for time preferences, men seem to be more patient and have longer time horizon than women, but the results may be driven by the correlation with the risk attitude.

Introduzione

Questa tesi è una raccolta di tre lavori empirici relativi allo studio delle preferenze e delle valutazioni soggettive delle famiglie. Il primo capitolo, intitolato "*Social status and personality Traits*", è un lavoro congiunto con Alessandro Bucciol e Luca Zarri. Questo lavoro è stato accettato per la pubblicazione sul Journal of Economic Psychology. In questo lavoro troviamo prove dirette dell'esistenza di una relazione significativa tra status sociale e tratti della personalità. Usando i dati dell'indagine americana Health and Retirement Study che vanno dal 2006 al 2010, siamo in grado di dimostrare che la percezione del proprio status sociale è correlato con i cinque tratti fondamentali della personalità, i cosiddetti "Big Five", anche dopo aver controllato per le caratteristiche oggettive che in genere riflettono lo status sociale di un individuo. Nel seguito del lavoro costruiamo anche una misura oggettiva di status che si rivela anch'essa essere influenzata dalla personalità. Questa misura oggettiva è positivamente ma non eccessivamente correlata con la sua controparte soggettiva e, quando è inserita in una regressione, lascia ancora molto spazio per un effetto diretto dei tratti di personalità sulla percezione soggettiva dello status.

Il secondo capitolo rimane nel campo dell'economia comportamentale, e studia l'interazione tra preferenze per il rischio finanziario, fiducia generalizzata e decisioni di investimento. Il titolo del lavoro è "*Financial Risk Tolerance and Trust in Others: Substitutes or Complements for Risky Asset Holdings?*". Usando due rilevazioni dell'indagine SHARE – Survey on Health, Ageing and Retirement in Europe (2006, 2013), questo articolo esplora il ruolo giocato congiuntamente dalla tolleranza al rischio finanziario e il livello di fiducia degli individui nell'influenzare la decisione di possedere titoli rischiosi. Quello che si trova è un'elevata variabilità tra i vari paesi europei sia del livello di fiducia che di avversione al rischio. Inoltre, si mostra che l'investimento in titoli rischiosi è più frequente e di maggiore volume per le famiglie che hanno un livello elevato di tolleranza al rischio, oppure una combinazione di avversione al rischio ed elevati livelli di fiducia (anche se in questo caso l'effetto è meno marcato). La fiducia sembra quindi agire come un sostituto imperfetto della tolleranza al rischio. Questi risultati hanno implicazioni rilevanti per la comprensione dell'eterogeneità delle scelte finanziarie delle famiglie. Servono inoltre a chiarire il ruolo di lubrificante del sistema economico giocato dalla fiducia generalizzata.

Il terzo e ultimo capitolo della tesi è dedicato ancora allo studio delle preferenze delle famiglie. Il titolo del lavoro è "*Gender Differences in Risk and Time Preferences: The Role of Marital Status*". In questo articolo si utilizzano i dati dell'indagine olandese - DNB Household

Survey - dal 1996 al 2013, per esplorare le differenze nelle preferenze temporali e al rischio lungo le dimensione del genere e dello stato civile. Per fare ciò, si è scelto di utilizzare sia una misura auto-riportata che una stima strutturale dei parametri delle preferenze. I risultati delle regressioni suggeriscono che le donne sono effettivamente più avverse al rischio degli uomini. Tuttavia esiste anche una rilevante interazione tra l'effetto del genere e dello stato civile: gli uomini single sono meno avversi al rischio di quelli sposati, mentre per le donne la differenza non è significativa. I risultati per le stime sulle preferenze temporali sono meno concludenti. Le stime strutturali dei parametri di avversione al rischio confermano in genere i risultati delle regressioni. Inoltre, queste stime suggeriscono un effetto di interazione ancora più rilevante tra genere e stato civile. Per quanto riguarda le preferenze temporali, gli uomini sembrano essere più pazienti e con un orizzonte temporale più lungo, anche se questi risultati potrebbero essere influenzati dalla correlazione di questo parametro con quello relativo all'attitudine al rischio.

Chapter 1

SOCIAL STATUS AND PERSONALITY TRAITS

Abstract

We provide direct evidence on the relationship between social status and personality traits. Using survey data from the 2006-2012 waves of the US Health and Retirement Study, we show that self-perceived social status is associated with all the "Big Five" personality traits, after controlling for observable characteristics that arguably reflect one's actual status. We also construct an objective status measure that in turn is associated with personality traits. Objectively measured status is positively but not highly correlated with its subjective counterpart. When incorporated in a regression specification, it still leaves room for significant correlations between personality traits and status perception: traits such as openness, conscientiousness and extraversion predict a higher self-positioning on the social ladder, while agreeableness and neuroticism predict a lower one.

1.1 Introduction

While the standard economics approach posits that individuals should care only about their *absolute* levels of consumption, income or wealth, history as well as mounting empirical evidence suggest otherwise: in many parts of the world, human societies are organized in hierarchical structures, with many individuals caring about their *relative* rank in the social ladder. Although the terminology varies across disciplines and studies, the search for a better relative position in society is a classical topic in social sciences such as sociology (e.g., Veblen, 1899; Hollingshead, 1975) and social psychology (Festinger, 1954). In the last decades, starting from Duesenberry's (1949) seminal work, status-seeking behavior has been increasingly attracting the interest of economists, who recently investigated the topic both theoretically (e.g., Maccheroni et al., 2012) and empirically (Daly et al., 2013). According to Frank (1999), the quest for status is a "deep-rooted and ineradicable element in human nature" (p. 145) and, as pointed out by Postlewaite (1998), our desire to ascend to the top of a social hierarchy may have had selection value over the course of human evolution.

The existing economics literature shows that an individual's social status significantly influences subjective well-being,[1] and is correlated with behavior in various domains: ranking concerns have been shown to play a role in women's employment decisions (Neumark and Postlewaite, 1998), unethical activities (Charness et al., 2014) and violent crime, especially among males (Kuziemko et al., 2014).

In this regard, a central point is that, as far as individuals driven by a preference for status are concerned, what arguably matters most for both their choices and subjective well-being is not their 'true' position in the social ladder, but *what they perceive* as their own place in the ranking. It is plausible to believe that one's perceived (or subjective) socio-economic status – i.e., how objective features associated with one's status are subjectively filtered – need not coincide with an objective measure of relative position in society. As Franzini and Fernandez-Esquer (2006) point out, the measurement of subjective status assumes that an individual's self-ranking provides critical

1 Luttmer (2005) finds that "lagging behind the Joneses" in terms of earnings is associated with lower levels of self-reported happiness and argues that this effect is likely caused by a psychological externality. Recent neuroscientific studies exploring the impact of social comparisons on reward-related activity in the human brain (Fliessbach et al., 2007; Dohmen et al., 2011) provide further support to this idea.

information over and above that which is provided by objective status indicators.[2] Therefore, it would be important to rigorously identify the major correlates of subjective social status.

This paper aims to shed light on the relationship between social status and personality traits. In this regard, our goal is twofold: we aim to i) replicate previous studies finding a correlation between objective social status and personality, using a broader measure of social status based on income, wealth and education, and ii) explore the link between subjective socio-economic status and personality traits. In particular, by referring to the established "Big Five" model of personality traits (Costa and McCrae, 1992), that summarizes personality in five comprehensive traits (i.e., openness, conscientiousness, extraversion, agreeableness and neuroticism), we seek to discover whether, how and to what extent individuals' personality characteristics may distort their perception of their own position on the social ladder, acting on the intrapersonal process through which objective dimensions of status are subjectively filtered.

Our findings indicate that objectively measured social status is positively but not highly correlated with its subjective counterpart and, when incorporated in a regression specification, still leaves room for significant correlations between all the Big Five personality traits and one's own status perception. Despite its importance, the distinction between objective and subjective status has surprisingly received scant attention so far in the recent economics literature on the theme: most empirical studies exclusively look at objective measures of status, e.g., by considering relative income (Luttmer, 2005) or occupational prestige (Di Tella et al., 2010).[3] In contrast, we are able to assess social status not only objectively but also subjectively by exploiting a question contained in our dataset (the US Health and Retirement Study, waves 2006-2012) specifically dealing with one's own status perception. To the best of our knowledge, this micro-data source is the only one containing information on both objective and subjective social status, and at the same time a large number of facets of personality traits. On the whole, then, our study aims to shed light on the intricate relationship between social status and personality traits depicted in Figure 1.

The remainder of the paper is structured as follows. Section 2 contains a selective review of the recent strand of economics literature dealing with personality traits. In Section 3 we present the

[2] See on this also Ostrove et al. (2000), Singh-Manoux et al. (2003; 2005) and Demakakos et al. (2008). Singh-Manoux et al. (2005) construct measures of both subjective and objective socio-economic status to investigate their relationship with self-rated health and show that subjective socio-economic status is a better predictor of health status and decline in health status than objective socio-economic status. Relatedly, Cruces et al. (2013) document systematic discrepancies between objective and subjective income distributions.

[3] Senik (2009) and Clark et al. (2013) are relevant exceptions.

data we use to explore this topic. Section 4 contains the main findings of our analysis and Section 5 concludes. The Appendix provides details on the construction of some key variables and contains some robustness checks.

1.2 Related literature

This paper ties together two strands of economics literature that so far have been developing separately from each other. The first is the line of literature on status-seeking behavior and its relationship with economically relevant variables recalled in the Introduction. The second is the young but rapidly expanding research area examining the impact of individual-specific factors traditionally investigated in psychology (i.e., personality traits) on a variety of outcome variables.

The power of individuals' cognitive ability in predicting their social and economic success is well documented. In recent years, economists, psychologists, and sociologists have been taking a complementary road, by actively investigating determinants of social and economic success that go beyond those captured by cognitive ability (Borghans et al., 2008). In economics, several studies documented the effects of individual-specific features related to one's *personality*[4] in various domains, including corporate financial policies (Malmendier et al., 2011), heavy truck accidents, Body Mass Index and smoking habit (Rustichini et al., 2012). Roberts (2009) defines personality traits as "the relatively enduring patterns of thoughts, feelings, and behaviors that reflect the tendency to respond in certain ways under certain circumstances" (p.140).

In the management and psychology literature, the so called "Big Five" model (Costa and McCrae, 1992) is one of the most commonly used taxonomies to represent the personality domain (Deck et al., 2008). This framework is based on a five-factor structure and, at the broadest level of abstraction, the five key factors are traditionally labeled as: (i) openness to experience; (ii) conscientiousness; (iii) extraversion; (iv) agreeableness; and (v) neuroticism.[5] The Big Five model

[4] While some scholars refer to personality traits as to 'non-cognitive' factors, we prefer not to use this term as today in personality psychology a broad conception of personality prevails, with many aspects of cognition being captured by some personality traits (see on this e.g. Almlund et al., 2011). For example, a personality trait such as neuroticism encompasses rumination and conscientiousness encompasses planning. Moreover, openness is a mainly cognitive trait: the measure we use in our analysis includes 'intelligent' as one of its items. We thank an anonymous referee for this suggestion.

[5] From the initial letters of the five factors, the Big Five model is also called with the acronym OCEAN.

provides us with a comprehensive categorization of personality traits: in Appendix Table A.1 we report a general definition of the five factors taken from the APA Dictionary of Psychology and the personality facets (i.e., more narrowly defined traits) associated with them in our analysis. This model posits that the score of an individual in these dimensions characterizes her stable pattern of thoughts and feelings (Rustichini et al., 2012).

Subsequent research offered evidence that most of the variables used to assess personality traits in scholarly work in the field of personality psychology can be mapped into one or more of the dimensions of the Big Five (John, 1990; Costa and McCrae, 1992; Goldberg, 1993). Moreover, Costa and McCrae (1992) argue that the Big Five theory can be interpreted as the longitude and latitude of personality traits, by which all more narrowly defined traits may be categorized. However, in our work we will stick to the more common approach and assume that each personality aspect is associated to one trait only. This approach is also suggested for our survey data in Smith et al. (2013).

As far as the relationship between personality and social status is concerned, it is plausible to conjecture that an individual's personality traits may be important correlates of both her *actual* success in life and her *perception* of it. However, little can be found so far in the empirical literature in order to specifically shed light on the intricate interplays between objectively measured social status, perceived social status and personality traits. Some studies tested the general hypothesis that personality traits play an important role in people's success in life, affecting their socio-economic condition and, therefore, their actual location on the social ladder. Some prior research, analyzing the effects on achievement and vocational success of the interaction between personality traits and (purely) cognitive abilities, emphasized the role of a personality trait such as conscientiousness (Jensen, 1998). Recent work specifically investigates the impact of personality on key components of actual status, such as economic success, education and occupational status. Almlund et al. (2011) focus on personality traits as predictors of several outcome variables including academic and economic success and document that personality measures are as predictive as classic cognitive measures, even after controlling for family background and cognition (see on this also Becker et al., 2012). As to the effect of personality on earnings, Drago (2011) shows that individuals' self-esteem – i.e., the perception that individuals have about their own ability – has a large causal impact on their earnings. Caliendo et al. (2014) find that several personality characteristics significantly affect entry into self-employment and survival of self-employed persons, documenting that the explanatory power of personality variables is comparable to that of education, which is one of the

key determinants of entrepreneurship. Proto and Rustichini's (2015) study reveals that personality traits such as openness, conscientiousness and extraversion significantly increase income.

1.3 Data

Our analysis is based on data from the US *Health and Retirement Study* (HRS), a biannual panel survey on a representative national sample of the American population aged 50 or more. HRS was designed to obtain detailed information regarding the dynamics of retirement and how retirement interacts with health, health insurance, and economic well-being. The survey provides detailed information on a wide range of domains such as demographics, health status, housing, disability, employment history and net worth.

HRS is made of a core part available since the introduction of the survey (in 1992), plus further sections that have been added over time. In this study we focus our attention on the "psychosocial and lifestyle" section. This module was introduced in 2004, and included personality variables since 2006. For this reason, the analysis presented in this paper is based only on the last four waves (from 2006 to 2012) available at the time of writing. In every wave questions of the "psychosocial and lifestyle" module are asked to a rotating 50% of the full sample, which means that the same household fills in the module every four years. Therefore, a typical household in our sample answers twice to the same questions: in 2006 and 2010, or in 2008 and 2012. Overall we have 16,516 observations on 9,979 households. As a sample restriction we exclude from the analysis individuals aged more than 80, for two reasons: i) the older elderly are deliberately oversampled in the HRS design, and ii) we are concerned they may find it difficult to understand the questions on personality and report the correct answers. Due to this sample restriction, and because of the HRS sampling design targeted to people aged 50 or more, we focus on individuals with full information on all the variables under investigation and in the 50-80 age range, which is important because individuals in this age group have been shown to have stable personality traits (Terracciano, et al., 2006; Cobb-Clark and Schurer, 2012). In particular, Cobb-Clark and Schurer (2012), by means of a large, nationally-representative sample of working-age adults, demonstrate that average personality changes are small across age groups, claiming that intra-individual personality change is unlikely to be economically meaningful. This limited age range was also used in Bucciol and Zarri (2015) in another analysis based on the same data source.

1.3.1 Summary statistics

The target variable for this study is the subjective evaluation of an individual's own position on the social ladder (i.e., her Subjective Socio-Economic Status; hereafter, SSES). The variable originates from the following question of the HRS psychosocial module, known as MacArthur scale of subjective social status:[6]

"Think of this ladder as representing where people stand in our society. At the top of the ladder are the people who are the best off – those who have the most money, most education, and best jobs. At the bottom are the people who are the worst off – who have the least money, least education, and the worst jobs or no jobs. The higher up you are on this ladder, the closer you are to the people at the very top and the lower you are, the closer you are to the people at the very bottom."

The answer has to be provided by drawing a cross on one of the ten rungs in a picture of a ladder. It is worth stressing that the question makes people think about their position by explicitly mentioning (and therefore making salient) three objective dimensions such as *money*, *education*, and *jobs*. We should then expect that a rational agent indicates a rung of the ladder coherent with these dimensions. Panel a) of Figure 2, displaying the distribution of the answers in our sample, highlights the skewness of the self-assessed social status – with more observations featuring higher values.

Our main goal is to understand whether the self-assessed position in the social ladder correlates with personality traits, after controlling for the observable information on actual social status. The Big Five personality traits are built as five indexes (openness, conscientiousness, extraversion, agreeableness, and neuroticism) from the answers to a question asking to report how well each of 26 adjectives fits the respondent. The procedure is taken from Smith et al. (2013); for details see the Appendix.

Table 1 reports summary statistics on the variables used in this analysis. We divide the explanatory variables in three groups: status, control and personality variables. The first group is meant to collect the objective dimensions that mirror the ones recalled in the social status question and that should characterize one's actual positioning in the social ladder (that is, income, wealth,

[6] http://www.macses.ucsf.edu/research/psychosocial/subjective.php. Accessed June 23 2015.

and education).[7] From this group of variables we exclude occupation because our sample is mainly made of retirees (48.12% of the respondents). Occupation is instead considered in the group of control variables, which also includes basic demographic information (age, gender, race, etc.), as well as information on experienced past traumas and (subjective and objective) health status. We include the trauma variables (for details see the Appendix) as we believe that health and negative life events may bias one's (subjective and objective) social status.

At the end of Table 1 we report summary statistics for SSES and for a variable that we label Objectively measured Socio-Economic Status (hereafter, OSES). This index is built from a factor analysis with polychoric correlation, computed separately for each wave, taking as explanatory variables the degree of education (college, high school, lower), and the logs of income, financial and real wealth. This variable should provide us with an 'objective' measure of social status,[8] or at least a measure coherent with the HRS 'social ladder' question that, as we noted above, explicitly mentions these variables.[9] We rescaled the OSES index to have the same average as SSES.

The last two columns of Table 1 show the polychoric correlation[10] of each variable with the OSES and SSES indexes. Reassuringly, OSES is highly – although not extremely – positively correlated with SSES (0.39). Panel b) of Figure 2 plots the distribution of OSES in our sample. In fact we notice that this distribution is moderately left skewed in a way similar to SSES. Interestingly the direction of the skewness is the opposite than that of income (rescaled and overlapped in the figure), because OSES also depends on further status dimensions and, especially, on wealth.[11]

From Table 1 we see that, as expected, correlations of SSES and (especially) OSES are the highest with the status variables. They are also generally high with race, immigrant and marital

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[7] All monetary values are reported to 2010 prices. Inflation adjustments are made using the BLS Consumer Price Index, all urban consumers, all items (annual average).

[8] The factor is mostly determined by income and wealth, as it is highly correlated (0.99) with an alternative indicator drawn from factor analysis but excluding information on education. In other words, as to objectively measured social status, in our data individuals' social status is well captured by their economic status.

[9] To be precise, the HRS question on the social ladder refers to "the most money, most education, and best jobs" and "the least money, least education, and the worst jobs or no jobs". While it is easy to create a ranking for education and money, the definition of "best jobs" is highly subjective. For this reason, we decided to build the OSES index disregarding information on jobs.

[10] We use polychoric correlation because the variables involved in the analysis are discrete.

[11] The data exhibit a Gini inequality index of 0.139 for OSES and 0.509 for income (in line with official statistics from OECD Stats, where for the whole population the average was 0.497 in the 2006-2010 period.) There is then less inequality on social status than on income.

status, and self-assessed health. Moreover, correlations are not negligible between social status and personality traits: we notice that people who are more open, conscientious, extraverted and agreeable on average report a higher position on the social ladder. On the contrary, individuals with a higher neuroticism index declare a lower position. The signs are the same when looking at OSES and SSES, although they are larger with the latter variable.

We can interpret the correlations of Table 1 as a preliminary indication that the self-evaluation of an individual is linked with her socio-economic characteristics as well as her personality traits. However, these correlations may be spurious, as we are not controlling for observable characteristics that in turn may influence individuals' social ladder positioning. The purpose of the next section is to explore more in depth the connection between self-assessed social status and personality variables, by means of regression analyses that also control for observable characteristics of an individual.

1.4 Empirical analysis

The link with personality is likely to differ depending on the social status measure that we consider: if we analyze OSES, personality may interfere with *behavior* (e.g., being associated with outcome variables such as educational attainment and professional success) while, if we consider SSES, it might act as a lens that distorts the *perception* of the individuals. It follows that the two measures are likely to be tightly linked via personality traits. In order to better understand these relations, we estimated some regression models with different specifications.

We start in Sub-section 4.1 with an analysis of the link between OSES and personality. In Sub-section 4.2 we study the relationship between SSES and personality and finally, in Sub-section 4.3, we wonder how this may be linked to OSES. Although the dataset follows a panel structure, we have just 1 or 2 observations per household. This limited number of repeated observations generates small variability within the same household, which prevents us from using models specifically suited for panel data. For this reason, in what follows we develop a cross-sectional OLS analysis with standard errors clustered at the household level to account for possible correlations across observations from the same household.

1.4.1 Objectively measured social status

It is plausible that some characteristics of personality operate through the behavioral channel and affect the probability to gain levels in the actual social ladder. As we observed in Section 2, by focusing on the key components of objective social status, prior research has provided some support to this hypothesis. For example, more open people may be more active and successful when searching for a job (e.g., Barrick and Mount, 1991; Boudreau et al., 2001). More conscientious individuals may be more committed to their studies, allowing them to obtain higher education (Noftle and Robins, 2007) and achieve academic and vocational success (Jensen, 1998). Proto and Rustichini (2015) find that conscientiousness and openness positively affect income. In contrast, recent evidence indicates that neuroticism (defined as a chronic level of emotional instability and proneness to psychological distress) negatively impacts educational attainment and labor market success (see on this Almlund et al., 2011). Cobb-Clark and Tan (2011) show that for both men and women personality traits are often linked to the occupations in which they are employed: specifically, men who rate themselves as more agreeable have a lower probability of working as managers and as business professionals and women who score higher on agreeableness have a lower probability of being employed as managers or science and engineering associates. In this sub-section we therefore explore the links between personality traits and actual social ladder positioning.

In Table 2 we report the results of OLS regressions where the dependent variable is our objective measure of social status, OSES. In order to obtain clear results, the explanatory variables for these regressions include only control variables, thus excluding status variables, i.e., those that we used in the factor analysis to construct OSES. From Column (1) we find that the level of OSES increases with age and is higher for married individuals, employees and self-employed workers, while it falls for females, immigrates, and non-white individuals. Reporting very good health condition is highly positively correlated with the level of social status, while reporting chronic diseases or life traumas shows opposite correlations. Finally, the year of the survey is also relevant; it seems that the objective socio-economic position lowers with time. This result suggests that either the correlation between status and age cleaned of the cohort effect is negative, or more simply that the recent financial crisis has worsened the economic situation for many individuals.

In Column (2) of Table 2 we report the estimate of the model in which we add the five variables representing the Big Five factors of personality. Personality traits are tightly linked to the objectively measured status. Individuals who score higher on openness and conscientiousness

achieve higher status; in contrast more extraverted, agreeable and neurotic persons achieve lower status. Finally, the basic socio-demographics we inserted in the models remain significant and the effects are similar to what we had found in the basic specification.

1.4.2 Subjective social status

The alteration of the individual's perspective might be another channel through which personality correlates with social status. Columns (1)-(3) of Table 3 report the output of several OLS regressions where the dependent variable is SSES. The first model, shown in Column (1), takes as regressors only the status variables mentioned in the social ladder question. This basic regression tells us that, as expected, these variables are highly relevant: better educated and richer individuals report themselves higher on the ladder.

In Column (2) we enrich the specification by also adding the control variables. The results about the variables already used in Column (1) are in large part confirmed, for both the size and the significance of the effects. As for the newly added explanatory variables, Column (2) tells us that older, married individuals, self-employed workers and individuals declaring very good health report higher status. In contrast, women, individuals with chronic diseases or who suffered from some sort of trauma during life – in particular during childhood or adolescence – report lower SSES. It is interesting to notice that self-reported good health – a variable that is considered an excellent measure of general health and a strong predictor of mortality (Singh-Manoux et al., 2005) – is the socio-demographic variable with the highest correlation with perceived social status. In this regard, the existing literature makes clear that the two variables may influence each other: self-reported good health is likely to impact one's status perception, but, as shown by prior work on the theme (see, e.g., Ostrove et al., 2000; Singh-Manoux et al., 2005; Franzini and Fernandez-Esquer, 2006; and Demakakos et al., 2008), the latter in turn may affect her evaluation of her own health status even when objective dimensions of status are taken into account. Hence, we cannot rule out that some common factors affecting both types of self-evaluation are at play: some omitted variable might account for the general predisposition of the individual in self-rating herself, including relevant domains such as health and social status.

To discover what correlates with the perception of individuals, in Column (3) we insert in the specification also the Big Five personality traits. The results are in line with what we expected. As we have conjectured in previous sections, the personality of an individual is important to characterize her own status perception. In support of this, we notice that the R-squared statistic

increases considerably once we insert the Big Five variables in the regression (much more than after adding the eleven socio-demographic variables in Column (2).) As our preliminary analysis suggested, traits like openness, conscientiousness and extraversion have a positive and highly significant correlation; agreeableness and neuroticism on the other hand display a negative but still significant correlation. The signs of the coefficients are identical to those from descriptive statistics in Column (1), with the exception of agreeableness that is now negative because we control for other socio-economic and demographic characteristics. The signs are also in line with those obtained in Table 2 for OSES, with the only exception of extraversion that exhibits a negative correlation with OSES and a positive correlation with SSES. As noted by Steel et al. (2008), extraverts may tend to engage more in recreational activities that produce pleasure; this distracts them from professional efforts and decisions that would lead to higher positions in the actual social ladder (OSES).[12] At the same time, they may subjectively rate their social position highly (SSES) due to the increased life satisfaction that prior research has shown to be associated with extraversion.[13] In other words, extraversion may act as a lens that favorably distorts extroverts' perception of their social reality, while at the same time being an ultimately unfavorable trait with regard to their actual status achievements.

The correlation of the remaining characteristics is similar to our previous regressions, with the main exception of the self-assessed health status that is now much lower. The lower correlation between SSES and self-assessed health status suggests that personality traits play an important role in mediating the relationship between the two self-evaluations. This supports our previous argument that the coefficient in Column (2) was biased by the omission of personality variables.

1.4.3 Subjective and objectively measured social status

As a final step in our analysis we put together the variables of interest illustrated so far, in order to link personality traits, objectively measured social status and subjective social status. Back to our scheme of Figure 1, we now aim to link SSES with OSES. In Column (4) of Table 3 we report an OLS regression similar to the one shown in Column (3) of the same table, where we

[12] Cobb-Clark and Tan (2011) find that, with one minor exception, extraversion has no relationship with men's occupational attainment at all.

[13] Steel et al.'s (2008) empirical analysis indicates that extraversion is a strong predictor of positive affect, happiness, overall affect and quality of life.

replace all the socio-economic variables with OSES (which originates from them.) The results confirm that OSES is the most important factor that can describe self-assessed social status. The pattern of effects of the socio-demographics is similar to the previous regression, and overall the explanatory power of the regression is not too penalized by the fact that here we are summarizing all the relevant economic determinants through a single index. Personality still shows to have a large and significant correlation.

As we have seen so far, the OSES and SSES measures are both correlated with the personality traits of the individual answering the questionnaire. It is therefore possible that the previous OLS regression shown in Column (4) suffers from a bias due to the endogeneity of the OSES variable. To formalize this, let us define X a vector of observed exogenous explanatory variables and $\varepsilon = (\varepsilon_S, \varepsilon_O)$ two unobserved error processes, possibly correlated with each other. Consider a triangular structural model of the form

(1) $$SSES = X\beta_1 + OSES\gamma + \varepsilon_S$$

(2) $$OSES = X\beta_2 + \varepsilon_O.$$

Estimation of Equation (1) may give rise to biased OLS results because OSES is an endogenous variable. In order to solve this problem we use an instrumental variable approach that will ensure clearer and unbiased results (provided that the instruments used are valid). We estimate the model based on the approach of Lewbel (2012). The technique allows to artificially create instruments for the first stage equation, and is useful when the IV model otherwise does not meet the order condition for identification – that is, when there are no valid instruments available (as in our case.)

Lewbel (2012) suggests to run the first stage regression of the endogenous variable on all exogenous variables (that is, to estimate Equation (2)) and then generate instruments Z as the residuals e_0 from Equation (2) multiplied by each exogenous regressor in mean-centered form,

(3) $$Z = \left(X - \overline{X}\right)e_0.$$

Identification is achieved by imposing that $Cov\left(X, \varepsilon_O^2\right) \neq 0$ and $Cov\left(X, \varepsilon_S \varepsilon_O\right) = 0$.[14] In the presence of heteroskedasticity in the error process, *Z* is correlated with OSES; the correlation is higher the greater the degree of heteroskedasticity. The estimator works well in simulations and empirical applications (Lewbel, 2012), although it is less precise than an IV estimator obtained from standard exclusion restrictions. The results of the second stage regression, reported in Column (5) of Table 3, are reassuring. The vast majority of the correlations are confirmed, and only the marginal effect of OSES decreases considerably, from 0.302 to 0.092. However, it is still significant. This number means that, when OSES increases by 1, SSES increases much less than proportionally – by one eleventh. It is worth noting that personality still displays not only the same sign but also a similar magnitude of the coefficients. This result provides further evidence that indeed our key constructs (personality, subjective and objectively measured social status) are tightly linked together and omitting one of them may introduce a non-negligible bias in the analysis.

In a robustness check, whose output is shown in Appendix Table A.2, we repeated the analysis using an OSES index derived from a factor analysis that incorporates employment status (a dummy variable for being employed) in the set of explanatory variables. The purpose was to have an OSES index mirroring the content of the SSES index as closely as possible, although with the already mentioned limitations on occupation (we cannot rank different jobs). The new OSES index is highly correlated with the one used so far (the correlation is 0.99) and our findings are preserved.

As a further robustness check we investigated whether other personality variables could be relevant in determining the bias in social ladder perception. We constructed these variables from HRS following Smith et al. (2013). Personality variables other than the Big Five ones (especially hopelessness, mastery and reciprocity) are significant, decreasing only in part the predictive power of the Big Five variables. Although the analysis loses about 1,500 observations when incorporating these further personality dimensions, the main results are nonetheless confirmed. The only exception is the conscientiousness variable: its correlation is preserved in the IV model but it is now absorbed by the new personality variables in some other models. The full regression output is shown in Appendix Table A.3.

[14] Lewbel (2012) shows that these restrictions are common in models featuring endogeneity or mis-measurement.

1.5 Concluding remarks

In this paper we wondered whether an individual's social status is linked with her personality traits. Results from our regression analysis suggest that a large number of individual objective characteristics are significantly related to one's self-assessment in the social ladder. Age and gender play an important role in describing how an individual self-evaluates herself; married individuals and people in good health are more likely to report higher social ladder levels. Importantly but not surprisingly, perceived social status is highly correlated with the variables that are usually viewed as the key objective dimensions of socio-economic status, that is the level of education and the amount of income and wealth. Moreover the subjective socio-economic status measure (SSES) is positively correlated with such personality traits as openness, conscientiousness and extraversion and negatively correlated with such traits as agreeableness and neuroticism. Similar results are found when focusing on an objective measure of social status (OSES) derived from information on income, wealth, and education, i.e., the dimensions explicitly mentioned by the HRS social ladder question that is central for our analysis.

As a final step we inserted OSES in a regression of SSES, finding the expected positive correlation between the two measures. More interestingly, we showed that the five traits describing the personality of an individual are still relevant as they are significantly correlated with one's perception of her position in the social ladder. Specifically, traits such as openness, conscientiousness and extraversion predict a higher self-positioning on the social ladder, while agreeableness and neuroticism predict a lower one. To address a potential endogeneity problem we also estimated an IV regression based on the approach of Lewbel (2012). The results are all confirmed even with this specification.

The main message we can take out of the analyses carried out in this paper is that individual-specific factors such as personality traits are important correlates of both objective and subjective socio-economic status. On the whole, a dual channel through which personality is linked to self-perceived status seems to be at work: a *perception-based* channel through SSES and a *behavioral* channel through OSES. Moreover, our evidence offers further support to the idea that subjective and objective measures of status provide independent information, so that future empirical research on social status may benefit from the simultaneous recourse to the two indicators and obtain new, insightful results on the relationship between social status and economically relevant variables.

This study has two main limitations. One is on the causal interpretation of our findings. As far as the stability of personality traits is concerned, in Section 3 we referred to recent empirical studies (Terracciano et al., 2006; Cobb-Clark and Schurer, 2012) indicating that personality traits of individuals in our age group (the 50-80 range) have been shown to be relatively stable over time. In particular, Cobb-Clark and Schurer (2012) find that there is little evidence that economically meaningful, intra-individual personality changes can be associated with adverse life events, also when life events that arguably significantly affect one's subjective and objective status are considered, such as events related to the employment and income domain (e.g., worsening of finances, retiring and being fired). However, even though the above evidence makes it plausible to believe that personality has a causal influence on both objective and subjective status, it is important to make clear that establishing causality is beyond the scope of our empirical analysis, as it is not possible to rule out that both objective and subjective status in turn have some influence on one's personality traits. Relatedly, a second limitation is that we analyze a restricted age group (50-80); in the future it would be interesting to consider a larger age range and, in particular, include younger individuals. Unfortunately, the dataset we use in this study does not allow us to do so.

We claim that shedding light on new determinants of status concerns is important as knowing where people believe that they are positioned in the social ladder is relevant for our understanding of economic phenomena such as, e.g., labor supply or aggregate consumption and savings patterns. Moreover, one's self-ranking perception is likely to directly and significantly shape one's preferences for redistributive policies (Alesina and Giuliano, 2010; Cruces et al., 2013), which in turn are likely to impact one's voting behavior.

We also believe that our findings are relevant for the literature investigating the link between self-rated health and social status. In line with prior work on the theme, we showed that a strong positive correlation exists between self-rated health and a subjective measure of social status. In principle, as noted by Ostrove et al. (2000), Singh-Manoux et al. (2005) and Demakakos et al. (2008), this association could be spurious, as the two self-evaluations may be influenced by a common underlying mechanism, such as some general sense of self worth, response bias, a personality variable or a set of cognitive functions. In this regard, the contribution of our paper is twofold: we showed that subjective status is strongly correlated with self-rated health also when we consider personality traits, but also that in the presence of personality traits the correlation between subjective status and self-rated health is much lower. This suggests that personality traits play an

important role in mediating the link between the two self-evaluations, but, at the same time, that this important relationship deserves further attention by future research on the theme.

Finally, our result has implications also for the happiness literature. In this stream of research, recent work indicates that personality traits mediate the complex relationship between income and life satisfaction (Steel et al., 2008; Proto and Rustichini, 2015). In this regard, insofar as one's perception of her own position in the social ladder influences her happiness, our finding would imply that subjective social status is a further channel through which personality traits might contribute to predict individual happiness. Also this theme is left as an interesting avenue for future research.

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Appendix A. Health, trauma and personality scores

A.1 Health

The "self-assessed good health" variable originates from the following question:

"Would you say your health is excellent, very good, good, fair, or poor?"

Possible answers are: "Excellent", "Very good", "Good", "Fair" and "Poor". We consider a dummy variable equal to 1 if the answer to the previous question is "Excellent" or "Very good".

The "chronic diseases" variable originates from the following list of questions on chronic diseases:

"Has a doctor ever told you that you have cancer or a malignant tumor, excluding minor skin cancer?"

"Has a doctor ever told you that you have high blood pressure or hypertension?"

"Has a doctor ever told you that you have diabetes or high blood sugar?"

"Has a doctor ever told you that you have chronic lung disease such as chronic bronchitis or emphysema?"

"Has a doctor ever told you that you have had a heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems?"

"Has a doctor ever told you that you have had a stroke?"

"Have you ever had or has a doctor ever told you that you have any emotional, nervous, or psychiatric problems?"

"Have you ever had, or has a doctor ever told you that you have arthritis or rheumatism?"

Possible answers to each item are: "Yes", "Disputes previous wave record, but now has condition", "Disputes previous wave record, does not have condition" and "No". We consider a dummy variable equal to one if at least two of the eight chronic diseases have ever been experienced, i.e., if the respondent answered "Yes" to at least two of the above questions. We chose to consider the presence of at least two, rather than just one, chronic diseases to have more heterogeneity in this dimension. In fact, in our sample nearly 88% of the respondents answered "Yes" to at least one of the above questions. Moreover, only individuals with two or more chronic diseases less frequently self-assess good health status in our data.

A.2 Traumas

The “life traumas” variable originates from the following question:

“For each of the following events, please indicate whether the event occurred at any point in your life. If the event did happen, please indicate the year in which it happened most recently.

Has a child of yours ever died?

Have you ever been in a major fire, flood, earthquake, or other natural disaster?

Have you ever fired a weapon in combat or been fired upon in combat?

Has your spouse, partner, or child ever been addicted to drugs or alcohol?

Were you victim of a serious physical attack or assault in your life?

Did you ever have a life-threatening illness or accident?

Did your spouse or a child of yours ever have a life-threatening illness or accident?”

Possible answers to each item are: “Yes” and “No”. Following Smith et al. (2013), our variable is the sum of the events arisen.

The “early life traumas” variable originates from the following question:

“For the next set of events, please think about your childhood growing up, before you were 18 years old.

Before you were 18 years old, did you have to do a year of school over again?

Before you were 18 years old, did either of your parents drink or use drugs so often that it caused problems in the family?

Before you were 18 years old, were you ever physically abused by either of your parents?”

Possible answers to each item are: “Yes” and “No”. Following Smith et al. (2013), our variable is the sum of the events arisen.

A.3 Personality

Personality scores are constructed from the following question:[15]

"Please indicate how well each of the following describes you.

[a] Outgoing

[b] Helpful

[c] Moody

[d] Organized

[e] Friendly

[f] Warm

[g] Worrying

[h] Responsible

[i] Lively

[j] Caring

[k] Nervous

[l] Creative

[m] Hardworking

[n] Imaginative

[o] Softhearted

[p] Calm

[q] Intelligent

[r] Curious

[s] Active

[t] Careless

[u] Broad-minded

[15] Since 2010 the question includes five more items: "Reckless", "Self-disciplined", "Impulsive", "Cautious" and "Thrifty". We exclude them from the analysis as they are not available for the whole sample.

[v] Sympathetic

[w] Talkative

[x] Sophisticated

[y] Adventurous

[z] Thorough"

Possible answers to each item 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 all items apart from [p] and [t]. Following Smith et al. (2013), scores are built as the average of the following items:

Openness: [l], [n], [q], [r], [u], [x], [y].

Conscientiousness: [d], [h], [m], [t], [z].

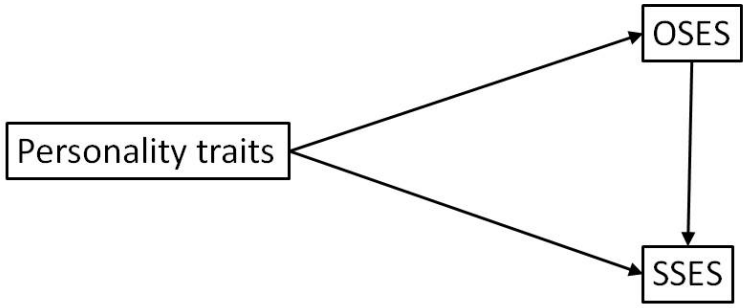
Extraversion: [a], [e], [i], [s], [w].

Agreeableness: [b], [f], [j], [o], [v].

Neuroticism: [c], [g], [k], [p].

Each score is missing when more than half of the underlying items are missing.

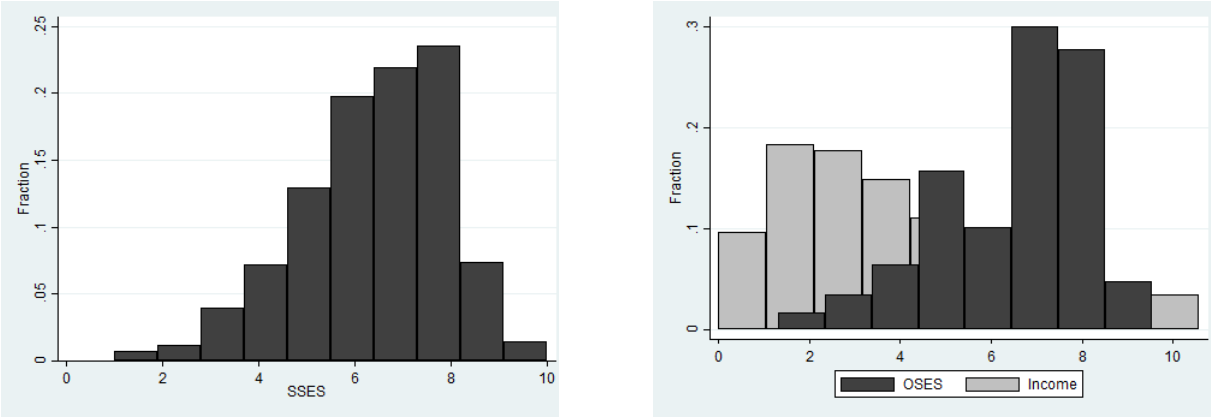
Figure 1. Personality traits and socio-economic status



Note: SSES stands for Subjective Socio-Economic Status, while OSES stands for Objectively measured Socio-Economic Status.

Figure 2. Social status distribution

a) Subjective (SSES) b) Objective (OSES)



Note: In panel b), income is rescaled to have the same average as SSES and OSES. For the sake of readability, the figure excludes observations with income above the highest OSES (10.594).

Table 1. Summary statistics (16,516 observations)

Variable	Mean	Std. Dev.	Min.	Max.	Correlation	
					with OSES	with SSES
Status variables						
High school	0.187	0.390	0	1	0.199	0.226
College	0.104	0.305	0	1	0.264	0.399
Ln(income)	10.624	1.282	0	15.540	0.559	0.277
Ln(financial wealth)	8.092	4.591	0.668	17.308	0.892	0.334
Ln(real wealth)	10.918	3.200	0.668	18.295	0.763	0.280
Home owner	0.846	0.361	0	1	0.520	0.273
Control variables						
Age/10	6.685	0.759	5	8	0.062	0.062
Female	0.597	0.491	0	1	-0.090	-0.096
Non-white	0.157	0.364	0	1	-0.317	-0.165
Immigrate	0.087	0.281	0	1	-0.131	-0.078
Married	0.678	0.467	0	1	0.322	0.210
Employee	0.296	0.456	0	1	0.023	0.027
Self-employed	0.090	0.287	0	1	0.108	0.156
Self-assessed good health	0.451	0.498	0	1	0.287	0.307
Chronic diseases	0.643	0.479	0	1	-0.140	-0.155
Life trauma	1.186	1.177	0	7	-0.086	-0.082
Early life trauma	0.389	0.639	0	3	-0.107	-0.153
Year 2008	0.256	0.437	0	1	0.022	-0.017
Year 2010	0.249	0.432	0	1	-0.002	0.009
Year 2012	0.211	0.408	0	1	-0.060	-0.053
Personality variables						
Openness	2.950	0.548	1	4	0.142	0.280
Conscientiousness	3.388	0.469	1	4	0.184	0.225
Extraversion	3.201	0.553	1	4	0.074	0.237
Agreeableness	3.531	0.477	1	4	0.022	0.096
Neuroticism	2.023	0.606	1	4	-0.113	-0.236
Socio-economic status						
Objective (OSES)	6.489	1.541	-0.001	10.594	1	0.393
Subjective (SSES)	6.489	1.723	1	10	0.393	1

Note. Polychoric or polyserial correlation in the last column. All correlations are significantly different from zero at the 1% significance level, except for those involving year 2008 and year 2010 that are not significant at standard significance levels.

Table 2. Objective social status indicator: regression analysis

	(1)	(2)
Age/10	0.261***	0.270***
	(0.020)	(0.020)
Female	-0.059**	-0.034
	(0.028)	(0.029)
Non-white	-1.015***	-1.019***
	(0.042)	(0.042)
Immigrate	-0.523***	-0.512***
	(0.061)	(0.060)
Married	0.917***	0.911***
	(0.032)	(0.031)
Employee	0.170***	0.137***
	(0.031)	(0.031)
Self-employed	0.398***	0.343***
	(0.046)	(0.045)
Self-assessed good health	0.638***	0.546***
	(0.026)	(0.027)
Chronic diseases	-0.171***	-0.143***
	(0.029)	(0.028)
Life trauma	-0.044***	-0.056***
	(0.011)	(0.011)
Early life trauma	-0.197***	-0.172***
	(0.021)	(0.020)
Openness		0.294***
		(0.029)
Conscientiousness		0.350***
		(0.033)
Extraversion		-0.101***
		(0.030)
Agreeableness		-0.190***
		(0.035)
Neuroticism		-0.050**
		(0.023)
Year 2008	0.052*	0.039
	(0.028)	(0.028)
Year 2010	-0.098***	-0.110***
	(0.022)	(0.022)
Year 2012	-0.210***	-0.221***
	(0.034)	(0.033)
Constant	4.281***	3.305***
	(0.149)	(0.206)
Observations	16,516	16,516
R-squared	0.262	0.281

Note. Household-clustered standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 3. Self-perception of social status: regression analysis

	(1)	(2)	(3)	(4)	(5)
High school	0.490***	0.465***	0.384***		
	(0.035)	(0.034)	(0.033)		
College	0.876***	0.809***	0.682***		
	(0.042)	(0.042)	(0.040)		
Ln(income)	0.159***	0.143***	0.127***		
	(0.015)	(0.016)	(0.015)		
Ln(financial wealth)	0.073***	0.058***	0.055***		
	(0.004)	(0.004)	(0.003)		
Ln(real wealth)	0.060***	0.048***	0.041***		
	(0.007)	(0.006)	(0.006)		
Home owner	0.055	0.027	0.036		
	(0.053)	(0.052)	(0.050)		
OSES				0.301***	0.089***
				(0.010)	(0.028)
Age/10		0.211***	0.174***	0.147***	0.204***
		(0.022)	(0.021)	(0.021)	(0.022)
Female		-0.084***	-0.062**	-0.087***	-0.095***
		(0.028)	(0.029)	(0.029)	(0.030)
Non-white		0.073	-0.060	-0.052	-0.268***
		(0.045)	(0.043)	(0.043)	(0.050)
Immigrate		0.011	0.046	0.051	-0.058
		(0.055)	(0.052)	(0.052)	(0.053)
Married		0.149***	0.175***	0.190***	0.383***
		(0.034)	(0.032)	(0.031)	(0.039)
Employee		0.011	-0.016	0.053*	0.082**
		(0.034)	(0.032)	(0.031)	(0.032)
Self-employed		0.148***	0.042	0.100**	0.172***
		(0.046)	(0.044)	(0.044)	(0.046)
Self-assessed good health		0.403***	0.197***	0.228***	0.344***
		(0.028)	(0.028)	(0.028)	(0.032)
Chronic diseases		-0.093***	-0.045	-0.040	-0.071**
		(0.030)	(0.029)	(0.029)	(0.030)
Life trauma		-0.042***	-0.058***	-0.052***	-0.064***
		(0.012)	(0.012)	(0.012)	(0.012)
Early life trauma		-0.167***	-0.132***	-0.155***	-0.192***
		(0.023)	(0.022)	(0.022)	(0.023)
Openness			0.400***	0.488***	0.551***
			(0.030)	(0.030)	(0.032)
Conscientiousness			0.145***	0.147***	0.221***
			(0.033)	(0.034)	(0.035)
Extraversion			0.379***	0.339***	0.318***
			(0.031)	(0.032)	(0.033)
Agreeableness			-0.217***	-0.236***	-0.277***
			(0.035)	(0.035)	(0.037)
Neuroticism			-0.309***	-0.312***	-0.323***
			(0.024)	(0.024)	(0.025)
Year 2008	-0.091***	-0.085***	-0.097***	-0.115***	-0.107***
	(0.033)	(0.033)	(0.031)	(0.032)	(0.032)
Year 2010	-0.035	-0.073***	-0.077***	-0.070**	-0.093***
	(0.027)	(0.028)	(0.027)	(0.027)	(0.027)
Year 2012	-0.071**	-0.127***	-0.125***	-0.136***	-0.183***
	(0.036)	(0.036)	(0.035)	(0.035)	(0.036)
Constant	3.375***	2.349***	1.480***	2.023***	2.722***
	(0.154)	(0.233)	(0.261)	(0.218)	(0.244)
Observations	16,516	16,516	16,516	16,516	16,516
R-squared	0.180	0.210	0.270	0.256	0.227

Note. Column (5) reports the output of an IV regression based on the approach of Lewbel (2012), where heteroskedasticity-based instruments are generated from the data. Household-clustered standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table A.1. The "Big Five" personality traits

Personality Trait	**Definition from APA Dictionary of Psychology**	**Facets in HRS**
Openness	"The tendency to be open to new aesthetic, cultural, or intellectual experiences."	Creative Imaginative Intelligent Curious Broad-minded Sophisticated Adventurous
Conscientiousness	"The tendency to be organized, responsible, and hardworking."	Organized Responsible Hardworking (Not) Careless Thorough
Extraversion	"An orientation of one's interests and energies toward the outer world of people and things rather than the inner world of subjective experience; characterized by positive affect and sociability."	Outgoing Friendly Lively Active Talkative
Agreeableness	"The tendency to act in a cooperative, unselfish manner."	Helpful Warm Caring Softhearted Sympathetic
Neuroticism	"A chronic level of emotional instability and proneness to psychological distress. Emotional stability is predictability and consistency in emotional reactions, with absence of rapid mood changes."	Moody Worrying Nervous (Not) Calm

Table A.2. OSES definition: regression analysis

Dependent variable	**OSES**	**SSES**	**SSES**
Method	**OLS**	**OLS**	**IV**
	(1)	**(2)**	**(3)**
OSES		0.350***	0.097***
		(0.011)	(0.032)
Age/10	0.224***	0.149***	0.206***
	(0.018)	(0.021)	(0.022)
Female	-0.035	-0.085***	-0.094***
	(0.025)	(0.029)	(0.030)
Non-white	-0.885***	-0.049	-0.272***
	(0.037)	(0.043)	(0.049)
Immigrate	-0.463***	0.059	-0.058
	(0.053)	(0.052)	(0.053)
Married	0.838***	0.170***	0.382***
	(0.027)	(0.031)	(0.039)
Employee	0.285***	-0.005	0.067**
	(0.027)	(0.031)	(0.033)
Self-employed	0.458***	0.043	0.158***
	(0.040)	(0.044)	(0.048)
Self-assessed good health	0.480***	0.225***	0.346***
	(0.023)	(0.028)	(0.032)
Chronic diseases	-0.122***	-0.041	-0.071**
	(0.025)	(0.029)	(0.030)
Life trauma	-0.046***	-0.053***	-0.065***
	(0.010)	(0.012)	(0.012)
Early life trauma	-0.151***	-0.154***	-0.192***
	(0.018)	(0.022)	(0.023)
Openness	-0.107***	-0.066**	-0.093***
	(0.024)	(0.032)	(0.032)
Conscientiousness	-0.271***	-0.008	-0.076***
	(0.020)	(0.027)	(0.028)
Extraversion	-0.511***	-0.024	-0.153***
	(0.029)	(0.035)	(0.038)
Agreeableness	0.266***	0.484***	0.551***
	(0.025)	(0.030)	(0.032)
Neuroticism	0.304***	0.146***	0.223***
	(0.029)	(0.033)	(0.035)
Year 2008	-0.090***	0.340***	0.318***
	(0.026)	(0.031)	(0.033)
Year 2010	-0.164***	-0.236***	-0.278***
	(0.031)	(0.035)	(0.037)
Year 2012	-0.045**	-0.311***	-0.323***
	(0.020)	(0.024)	(0.025)
Constant	3.815***	1.681***	2.645***
	(0.180)	(0.221)	(0.259)
Observations	16,516	16,516	16,516
R-squared	0.308	0.258	0.227

Note. Column (3) reports the output of an IV regression based on the approach of Lewbel (2012), where heteroskedasticity-based instruments are generated from the data. Household-clustered standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table A.3. Further personality traits: regression analysis

Dependent variable	**OSES**	**SSES**	**SSES**	**SSES**
Method	**OLS**	**OLS**	**OLS**	**IV**
	(1)	**(2)**	**(3)**	**(4)**
OSES			0.270***	0.080***
			(0.010)	(0.029)
High school		0.367***		
		(0.033)		
College		0.639***		
		(0.040)		
Ln(income)		0.147***		
		(0.015)		
Ln(financial wealth)		0.046***		
		(0.003)		
Ln(real wealth)		0.039***		
		(0.006)		
Home owner		-0.025		
		(0.051)		
Age/10	0.242***	0.165***	0.134***	0.180***
	(0.020)	(0.021)	(0.021)	(0.022)
Female	-0.105***	-0.061**	-0.100***	-0.120***
	(0.029)	(0.030)	(0.030)	(0.031)
Non-white	-0.933***	-0.088**	-0.073*	-0.250***
	(0.044)	(0.044)	(0.045)	(0.050)
Immigrate	-0.386***	0.036	0.048	-0.025
	(0.061)	(0.053)	(0.054)	(0.054)
Married	0.772***	0.130***	0.154***	0.300***
	(0.032)	(0.033)	(0.032)	(0.038)
Employee	0.073**	-0.024	0.056*	0.070**
	(0.031)	(0.032)	(0.031)	(0.032)
Self-employed	0.278***	0.019	0.084**	0.137***
	(0.045)	(0.043)	(0.043)	(0.045)
Self-assessed good health	0.437***	0.106***	0.133***	0.216***
	(0.027)	(0.028)	(0.028)	(0.031)
Chronic diseases	-0.108***	-0.020	-0.014	-0.035
	(0.028)	(0.028)	(0.029)	(0.029)
Life trauma	-0.061***	-0.035***	-0.031***	-0.042***
	(0.011)	(0.012)	(0.012)	(0.012)
Early life trauma	-0.146***	-0.105***	-0.127***	-0.155***
	(0.020)	(0.022)	(0.022)	(0.023)
Openness	0.195***	0.347***	0.431***	0.468***
	(0.029)	(0.031)	(0.031)	(0.032)
Conscientiousness	0.252***	0.055	0.054	0.102***
	(0.034)	(0.035)	(0.035)	(0.036)
Extraversion	-0.137***	0.267***	0.232***	0.206***
	(0.031)	(0.032)	(0.033)	(0.034)
Agreeableness	-0.263***	-0.278***	-0.303***	-0.353***
	(0.035)	(0.035)	(0.036)	(0.037)
Neuroticism	0.115***	-0.110***	-0.107***	-0.085***
	(0.025)	(0.026)	(0.027)	(0.027)

Table A.3. (Continued)

Dependent variable	**OSES**	**SSES**	**SSES**	**SSES**
Method	**OLS**	**OLS**	**OLS**	**IV**
	(1)	**(2)**	**(3)**	**(4)**
Cynical hostility	-0.115***	-0.050***	-0.067***	-0.089***
	(0.013)	(0.015)	(0.015)	(0.015)
Optimism	-0.028**	0.037***	0.039***	0.034**
	(0.012)	(0.014)	(0.014)	(0.014)
Pessimism	-0.078***	0.013	0.005	-0.010
	(0.015)	(0.016)	(0.016)	(0.016)
Hopelessness	-0.131***	-0.130***	-0.139***	-0.164***
	(0.017)	(0.018)	(0.018)	(0.018)
Loneliness	-0.009	-0.009	0.005	0.003
	(0.030)	(0.032)	(0.032)	(0.033)
Personal constraints	-0.040***	-0.035**	-0.034**	-0.041**
	(0.015)	(0.016)	(0.016)	(0.017)
Mastery	0.021	0.118***	0.110***	0.114***
	(0.013)	(0.015)	(0.015)	(0.015)
Reciprocity	-0.012	0.135***	0.124***	0.121***
	(0.016)	(0.016)	(0.016)	(0.017)
Purpose in life	0.020	0.051**	0.055***	0.059***
	(0.019)	(0.020)	(0.020)	(0.021)
Year 2008	0.047*	-0.103***	-0.121***	-0.112***
	(0.028)	(0.031)	(0.032)	(0.032)
Year 2010	-0.103***	-0.078***	-0.071**	-0.091***
	(0.023)	(0.028)	(0.028)	(0.028)
Year 2012	-0.217***	-0.127***	-0.147***	-0.188***
	(0.034)	(0.035)	(0.035)	(0.036)
Constant	5.235***	1.127***	2.097***	3.089***
	(0.237)	(0.295)	(0.255)	(0.302)
Observations	14,940	14,940	14,940	14,940
R-squared	0.295	0.303	0.288	0.266

Note. Column (4) reports the output of an IV regression based on the approach of Lewbel (2012), where heteroskedasticity-based instruments are generated from the data. Household-clustered standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

2 Chapter 2

FINANCIAL RISK TOLERANCE AND TRUST IN OTHERS: SUBSTITUTES OR COMPLEMENTS FOR RISKY ASSET HOLDINGS?

Abstract

Using two waves of the Survey on Health, Ageing and Retirement in Europe (SHARE, 2006-2013), this paper explores the role jointly played by individuals' financial risk tolerance and their level of trust in others (generalized trust) in affecting their decision to hold risky assets. We find a large variation in risk tolerance and trust across European countries and households. Moreover, we show that risky assets investments are more frequent and larger in households featuring either risk tolerance or (to a smaller extent) a combination of risk aversion and trust. Trust seems to act as an imperfect substitute for risk tolerance. Our findings have implications for our understanding of heterogeneity in household financial decisions as well as of the role that trust can play as a lubricant of the economic system.

2.1 Introduction

In the last fifty years, several studies have been trying to understand the main determinants of investors' portfolio choice, with a particular focus on the decision to invest in risky assets. Earlier studies mostly document the correlation that exists between risky investment choice and *individual-level* socio-demographic variables such as age, gender, education and wealth (e.g., Friend and Blume, 1975; Cohn et al., 1975). More recent studies provide further evidence on the relevance of individual characteristics for portfolio choice (e.g., Guiso and Paiella, 2008), but focus also on the link between portfolio choice and a variable directly dealing with the *interpersonal* dimension such as trust in others. The interesting findings is that stock market participation is more likely among more trusting individuals (see Guiso et al., 2008; Georgarakos and Pasini, 2011.)

In this paper, we will concentrate on trust attitude measured at the household level but, unlike prior work, we take a different (and possibly complementary) path: we examine, to our knowledge for the first time, the empirical relationship between individual investors' financial risk attitude and their trust in others and shed light on the role that these variables *jointly play* in affecting portfolio decisions.

According to Markowitz (1952) the decision to investment in risky financial assets is strongly driven by the risk preference of the investor. Some other scholars, basing their studies on this theory, suggest that portfolio composition is a good proxy for risk attitude (e.g., Riley and Chow, 1992; Bucciol and Miniaci, forthcoming). It is by now common knowledge from the literature that financial risk attitude is widely heterogeneous in the population; it is highly correlated with individual characteristics (e.g., age, gender, education, wealth and cognitive ability; see, e.g., Guiso and Paiella, 2008) and, in part also genetically transmitted (Cesarini et al., 2010.) In this paper we exploit a self-reported measure of risk attitude as a measure of individuals' *risk tolerance*. Self-assessed measures have proven to be reliable indicators of risk attitude as demonstrated by Dohmen et al. (2011) .

We focus on the degree of individuals' trust in others, the so called 'generalized trust'. Trust plays a central role in almost all human relationships and it is extremely important in economic and financial ones: since trust can be viewed as "the belief a person has that his counterpart in a transaction will not take advantage of him" (Guiso, 2010) and legal protection is typically imperfect and costly, it follows that even in advanced countries economic transactions call for a minimum amount of trust to effectively work. As dramatically confirmed by the recent financial crisis, this

holds true also for the proper functioning of financial markets (Guiso, 2010). In the literature the generalized trust is usually considered a key component of so called 'social capital' and it has been described as an important lubricant of social systems (Arrow, 1974). At the country level, trust has been shown to be related to important economic variables such as GDP growth, inflation, and the volume of trade between countries (respectively see Knack and Keefer, 1997; LaPorta et al., 1997; Guiso et al., 2009).

In this paper, we try to evaluate the joint effect of risk attitude and the level of individuals' generalized trust on their portfolio choices.[16] We focus specifically on the combined influence of these two variables on investment decisions in risky financial assets. In principle, it is plausible to hypothesize that at the micro level risk tolerance and trust are *complements*, in the sense that both are necessary to induce risky financial behavior. On the other hand, it can also be true that they are *substitutes:* a high level of trust might (maybe partially) compensate for the absence of risk tolerance and induce some level of risky investment. In this second case, high (resp., low) trust in others increases (resp., decreases) the expected return of risky investments, as individual investors' level of trust makes them more (resp., less) likely to believe that their counterparts will respect contracts. In other words, generalized trust may alter the perception of the riskiness of a given investment. In this circumstance, in the presence of a high level of trust in others, even risk averse individuals might end up making risky investment choices.

To the best of our knowledge, data on risk tolerance and generalized trust are separately available in several household surveys, but they are treated together only in the Survey on Health Ageing and Retirement in Europe (SHARE). For this reason, we decided that SHARE is the ideal source of data for our purpose. Moreover, we can also exploit the cross-country and panel nature of the dataset in order to obtain a cross-country comparison of the relationship over time between risk attitude, trust and portfolio decisions in fourteen European countries with large differences in terms of size, GDP, market capitalization and saving behavior.

Data exploration shows that there is a wide variation in risk tolerance and trust across European countries and households. Our main results confirm previous evidence on the correlation between portfolio decisions and socio-demographic characteristics, but more importantly show also

[16] Recent work confirms that risk attitude and trust in others are governed by distinct cognitive processes (see, e.g. Ahern et al., 2014).

that investment in risky financial asset is more common in the presence of risk tolerance or high levels of trust. Interestingly, we document that, in the presence of risk tolerance, risky assets investments are uncorrelated with trust. Risky investments are instead positively correlated with trust when households are risk averse – even though the size of this correlation is not as large as the one that link investment decision and risk tolerance. Hence, trust seems to act as a substitute (albeit an imperfect one) for risk tolerance.

The remainder of the paper is structured as follows. Section 2 contains a brief literature review on the relevance of individuals' risk attitude and their trust in others for their financial decisions. In Section 3 we present the data that we use to explore the topic, while Section 4 contains the main findings of our analysis and Section 5 concludes.

2.2 Literature review

In this section, we briefly review some of the major findings present so far in the economic literature that deal with the two dimensions of interest, that is *risk attitude* (Sub-section 2.1) and *trust* (Sub-section 2.2.)

2.2.1 Risk attitude

Many scholars have been putting their efforts in trying to understand what can affect the individuals' predisposition towards risk and, in turn, how risk attitude influences a large number of human behaviors. These behaviors include, among others, insurance purchase (e.g., Williams, 1966), preferences for gambles (Kahneman and Tversky, 1979), financial portfolio choices (Xiao et al., 2001), and even the distance from which people choose to toss a ring onto a pole (McClelland, 1967). The concept of risk attitude is relevant for several domains of application, but in this paper we will concentrate our attention only on the *financial* one. This predisposition or attitude toward risk has been called "risk tolerance" as we will refer to it from here on.

In general, individuals' risk tolerance has been measured in one of three ways: from observable outcome choices such as investment decisions (e.g., Halek and Eisenhauer, 2001; Bucciol and Miniaci, 2011), from choices between hypothetical lotteries (e.g., Guiso and Paiella, 2008; Kimball et al., 2009) or from self-reported measures (e.g., Shaw, 1996; Dohmen et al., 2011). In this paper, we base our analysis on a *self-reported* measure of risk tolerance. Previous works

have already analyzed the reliability of different measures, obtained from different sources. Those studies suggest that simple self-reported measures are highly correlated with more complicated measures derived from observable outcomes as in Bucciol and Miniaci (2011) or hypothetical lotteries as in Dohmen et al. (2011). In the financial domain, the self-reported measures may even be better able to explain actual portfolio decisions than the alternative measures (Kapteyn and Teppa, 2011), since they are of easier understanding.

In the literature, there is robust evidence that financial risk attitude is widely heterogeneous in the population and varies with individual characteristics such as age, gender, education and wealth (see, e.g., Barsky et al., 1997; Halek and Eisenhauer, 2001; Bucciol and Miniaci, 2011). Recently, some scholars demonstrated the existence of a link also between portfolio choice and a variable directly related to the interpersonal dimension such as trust in others (Guiso et al., 2008.)

2.2.2 Trust

Trust plays a key role in almost all human relationships, from friendship and family ties to economic and financial interactions. Due to its relevance, this notion has attracted the interest of many scholars in different social sciences, and the attention for this topic has been steadily growing during the last decades. Some scholars contributed to the development of experimental tools for measuring trust (Fehr et al., 1993) and its determinants (Bohnet et al., 2004, 2008; Eckel and Wilson, 2004; Houser et al., 2008.) The growing availability of survey measures of trust in international panel data sets has stimulated both the analysis of the impact of institutions on trust (Bohnet and Huck, 2004; Brown et al., 2004) and cross-national comparisons of trust (Knack and Keefer, 1997; LaPorta et al., 1997; Guiso et al., 2009.) Knack and Keefer (1997) report positive correlations between a measure of trust and a country's average annual GDP growth rate between 1980 and 1992. LaPorta et al. (1997) show that a large share of trusting people is negatively correlated with inflation rates and positively correlated with GDP growth across countries. More recently, Guiso et al. (2009) find that higher bilateral trust between two countries is associated with more trade between the countries and document that this effect is stronger for more trust-intensive goods.

The same authors also provide microeconomic evidence on the role of trust in financial markets (Guiso et al., 2004, 2008.) In their 2008 paper, for example, they show that less trusting individuals are less likely to buy stock, and, when they do so, they buy less of it. The authors suggest that lack of individual trust in the stock market could partly explain the so called "participation puzzle" – that is, why so few people take advantage of the existence of a stock

market. Georgarakos and Pasini (2011) offer evidence that both regional trust and sociability are important determinants of stock market participation in Europe. Pevzner et al. (forthcoming) examine the effect of societal trust on investor reactions to corporate earnings announcements and find that these reactions are significantly higher in more trusting countries. They also document that the positive effect of trust is stronger when a country's investor protection and disclosure requirements are weaker.

A further, closely related question that needs to be addressed in empirical work on trust is the following: what is the best way to measure it? In the last years, trust has been frequently assessed through laboratory experiments based on the classic 'trust game' design (Berg et al., 1995) or by means of survey data based on self-reported measures of individuals' levels of trust in others. A large number of papers generally measure trust relying on the answer to the World Values Survey (WVS) and General Social Survey (GSS) question: "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?"[17] Our analysis makes use of a similar variable. Therefore, we will consider a self-reported measure of so called 'generalized trust', i.e., the amount of trust that individuals have in people they *do not personally know*. Unlike variables capturing trust in friends or relatives (that matter in relational contracts), generalized trust is the component of social capital that has been shown to play an important role for the efficiency of *large-scale*, *anonymous* market economies, as it turned out to be associated with financial development (Guiso et al., 2004) and economic growth (Knack and Keefer, 1997.) In other words, to borrow Putnam's (2000) terminology, we will look at a form of *bridging* – rather than *bonding* – social capital, that is what so far seems the most economically relevant type of social capital.[18]

[17] In the past few years, scholars tried to validate the power of this measure to give an accurate evaluation of individuals' trust. Fehr et al. (2002), using a large sample of German households, show that the sender behavior in a trust game is correlated with other survey-based measures of trust. Glaeser et al. (2000), however, challenge this result suggesting that the question provides a measure of trustworthiness rather than trust.

[18] The survey with the most comprehensive information on trust is the World Value Survey. Narrowing the sample to the period and the countries under investigation in this paper, it is possible to show that generalized trust is positively highly correlated with measures of trust in specific persons (e.g., family, neighbourhood) or institutions (e.g., press, government.)

2.3 Data

We employ data from the Survey on Health, Ageing and Retirement in Europe (SHARE), collected in two periods: 2006/2007 and 2013 (waves 2 and 5)[19]. SHARE is an interdisciplinary survey run every two years since 2004 on a sample of households whose head is aged 50 or more in a host of several European countries (see Börsch-Supan et al., 2008)[20]. The thirteen countries surveyed in the 2006 wave range from the North (Sweden and Denmark) to the South (Italy, Spain and Greece), from the West (Austria, Belgium, France, Germany, the Netherlands and Switzerland) to the East (Czech Republic, Poland). In addition to these countries, in the more recent wave, we have data also on Luxembourg, Estonia and Slovenia. Unfortunately, due to problem in currency conversion and comparability of many variables of interest, Poland and Greece will not be included in the sample. In the years under investigation the countries showed large difference in terms of population size (from 500 thousand inhabitants of Luxembourg to 80 million inhabitants of Germany[21]), per capita GDP (from 13 thousand USD of Poland to 110 thousand USD of Luxembourg), stock market capitalization (from 10% of GDP for Estonia to 162% of GDP for Switzerland) and saving habits (from 14% of GDP for Luxembourg to 38% of GDP for Switzerland[22])

The sample is roughly balanced across the different countries, which means that smaller countries are over-represented. For this reason, and to make our analysis representative of the actual situation in Europe, our subsequent analysis makes use of the weights provided by SHARE[23].

From the original SHARE sample we focus on the household heads, excluding those aged more than 80 who are deliberately over-sampled in the SHARE design, and households with net worth below 10 thousand euros (purchasing power parity adjusted.) Our final sample is made of 41,838 observations (10,978 in wave 2) with full information on our variables of interest.

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[19] Data are freely available at www.share-project.org. In this paper we use version 2.6 and 5.1 of the dataset. These two waves are the only ones where the variables of interest are collected for the whole sample and in a comparable way.

[20] The 2006 wave was also run in one non-European country, Israel. We chose to exclude this country to focus on Europe only. In the aggregate, the Israelian sample is characterized by levels of risk attitude, trust and investment in risky assets that are in line with the average of the other countries.

[21] United Nations – World Population Prospects: http://esa.un.org/unpd/wpp/Excel-Data/population.htm.

[22] Source for this and the previous three statistics: World Bank World Bank – World Development Indicators (2013): http://data.worldbank.org/indicator/.

[23] SHARE provides a list of weights, differing along several dimensions (e.g., the unit of observation, the sample type). We use the calibrated cross-sectional weights at the household level in the main sample, which are more appropriate for our analysis.

Unfortunately we cannot expand our dataset to include other waves in addition to the two we have selected. Questions on risk attitude and trust in others – the two key dimensions in this study – are asked only in the years 2006, 2010 and 1013. Unfortunately, the wave of 2010 is not comparable: the questions of interest were asked only to the individuals newly entered in the sample, that were selected to be younger than the original sample (in order to reduce the overall sample age and let it constant over waves).

In the remainder of this section we provide summary statistics on the sample variables (Sub-section 3.1) and specifically on risk attitude and trust (Sub-section 3.2.)

2.3.1 Summary statistics

Our analysis makes use of the variables whose summary statistics are reported in Table 1[24]. In addition to the variables on risk attitude and trust, described in detail in Sub-section 3.2, we have information on the standard socio-demographic variables (e.g., age, gender, education) and economic variables (home-ownership, net worth adjusted for purchasing power parity)[25]. The table documents that the average individual is aged 63 and likely to own the house she lives in. Since the respondents are 50 years old or more, most of them are married and have children. For the same reason, only a relatively small fraction of individuals is still working. As for education attainment, roughly half of the sample does not have high school or higher degree. This variable can have a great impact on the level of risk attitude since, as pointed out in Sub-section 2.1, the lack of financial literacy significantly increases aversion to risk and decreases the probability of buying risky assets. Individuals with limited education background may not have the necessary knowledge to be able to acquire an adequate level of financial literacy.

In this paper we measure portfolio decisions as follows. We consider the financial portfolio as made of bank accounts, contractual savings, life insurances, government and corporate bonds, retirement accounts, mutual funds and stocks, i.e., the financial instruments recorded in SHARE. For our analyses, we then focus on the riskier categories – stocks, bonds and mutual funds – that we generically label risky assets. In the analysis we define two variables, namely the *risky assets*

[24] The weighted statistics reported in the table are relative to the pooled sample (wave 2006 and 2013). Monetary values are purchasing power parity adjusted and converted in 2013 euro.

[25] Variables on net worth and amounts invested in single financial assets come from the imputation file of SHARE. Imputed data are estimates of monetary values of interest for individuals who did not supply an answer and coincide with observed data in all the other cases. Ignoring the observations with missing data would lead to inefficient and possibly biased estimates; the imputed data are computed taking into account the information the respondent directly supplies in the survey.

holding and the *risky assets share*. The former is a binary variable equal to one if the household owns any risky assets, while the latter is the share of the financial portfolio held in risky assets.

Figure 1 shows for each SHARE country the proportion of households holding risky assets (panel a) and the average portfolio share in risky assets (panel b).[26] The pattern shows wide heterogeneity, going from a 5% holders and a 2.4% share in Estonia to a 65% holders and a 26% share in Sweden. In general, Northern and Western European countries are more likely to own risky assets than Southern and Eastern countries. Possible explanations of this heterogeneity are variations in financial literacy and development of the financial sector, but also differences in risk attitude and (possibly) in levels of trust in others.

2.3.2 Risk attitude and trust

In SHARE, the question asked to the respondent in order to capture the self-assessed attitude towards financial risk, is the one reported below. The question is the same as in the US Survey of Consumer Finances[27]:

> *"When people invest their savings they can choose between assets that give low return with little risk to lose money, for instance a bank account or a safe bond, or assets with a high return but also a higher risk of losing, for instance stocks and shares. Which of the statements on the card comes closest to the amount of financial risk that you are willing to take when you save or make investments?*
>
> *1. Take substantial financial risks expecting to earn substantial returns*
>
> *2. Take above average financial risks expecting to earn above average returns*
>
> *3. Take average financial risks expecting to earn average returns*
>
> *4. Not willing to take any financial risks"*

Given the high concentration of answers (74.23%) in the last option, in our analysis we consider a binary variable equal to 0 if the individual is "not willing to take any financial risks" and

[26] The reported statistics are relative to the pooled sample; the same picture for the year 2006 and 2013 separately are available at request, but the pattern delineated with these sub-samples remains quite similar.

[27] For a specific review of the literature on measures of risk attitude and the reliability of this specific question in measuring financial risk aversion see Dohmen et al. 2011. The paper contains an in depth exploration of the validity of this measure, also in comparison with an experimental approach, and the results support the reliability of this question in capturing financial risk attitudes.

1 otherwise. As a result the variable, that we label *risk tolerance*, indicates whether the individual is risk tolerant or not[28]. Panel a) of Figure 2 displays the proportion of risk tolerant individuals in each country according to this variable. The proportion ranges from less than 9% for Spain to 57% for Denmark. From the maps emerge a large difference across European areas: risk tolerance individuals are more frequent in Northern and Western Europe, and less frequent in Eastern and Southern countries, similarly to what we have found for to the distribution of risky assets shown in Figure 1.

SHARE also asks the respondent to state her own level of trust in others (i.e., generalized trust.) The question is similar to the one included in the World Value Survey[29]:

> *"I would now like to ask a question about how you view other people. Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?*
>
> *Please tell me on a scale from 0 to 10, where 0 means you can't be too careful and 10 means that most people can be trusted."*

Answers are split along the whole scale, although nearly 69% of the respondents declare a trust level between 5 and 8, with a mode on 5 (chosen by 22% of the respondents). The variable is highly correlated with risk tolerance: on average it is equal to 5.95 among risk tolerant households, and 5.36 among risk averse households. The difference is significant according to a mean-comparison F-test (p-value <0.01).

Panel b) of Figure 2 displays the average level of trust in the countries we analyze. Trust ranges from 5.28 for Spain to 7.67 for Denmark, and its ranking is in line with that from other sources.[30] The pattern identified by this variable is indeed similar to the one of risk tolerance: Southern countries overall display lower levels of trust compared to Northern countries. The graphs in Figure 2 suggest the presence of a positive correlation between risk tolerance and generalized trust. If we consider also the maps in Figure 1, the graphical analysis further suggest that both dimensions are positively correlated with the decision to invest in risky assets.

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[28] The decision to rescale the variable to the binary version stems not only from the high concentration of the answer, but also because the interpretation of the analysis of the effect of the variable in itself and its interaction with trust is much more relevant and easier with this specification.

[29] The only difference is that, in our data, the answer is reported in a 0-10 scale rather than as "yes" or "no".

[30] For instance, ranking countries based on the answer to the analogous WVS question (wave 2005-2009), countries in the first four positions are identical; statistics are available upon request. It is worth noting, however, that WVS treats only eight out of the fifteen countries surveyed in SHARE.

The main goal of this paper is to explore the role *jointly played* by risk attitude and trust in others in influencing risky portfolio choices. In order to do this, in Table 2 we split the fourteen countries in four groups based on their aggregate levels of risk tolerance and trust. In other words, we exploit the high heterogeneity in risk tolerance and trust in others among the European countries in order to rank them along these two dimensions: we classify the countries into four groups, that is countries with (1) risk tolerance and high trust; (2) risk tolerance and low trust; (3) risk aversion and high trust and (4) risk aversion and low trust.

Group 1 includes Denmark, Sweden and Switzerland, i.e., those countries ranking in the first seven positions on both risk tolerance and trust. Group 4 includes Italy, Slovenia, Spain and Luxembourg, i.e., those countries ranking in the last seven positions on both risk tolerance and trust. The remaining countries are assigned to either Group 2 or Group 3 depending on the dimension on which they rank higher. Group 2 on risk tolerance and low trust thus includes Czech Republic, France and Germany, while Group 3 on risk aversion and high trust includes Belgium, Austria, the Netherlands and Estonia.

In Table 2 we report for each group the average levels of risk tolerance, trust and risky assets investments. As it was predictable, risky assets investment is more common in the countries characterized by more widespread risk tolerance (i.e. Groups 1 and 2)[31].

However, risky assets are more frequent in Group (1) than in Group (2), and in Group (3) than in Group (4), that is, in those countries featuring high trust compared to countries with low trust despite having similar risk tolerance. In particular, Table 2 also reveals that trust plays an important role in countries where risk tolerance is scarce: if we compare two groups of countries characterized by a similarly low frequency of risk tolerance but endowed with different levels of trust (Groups 3 and 4), we notice that in the group where trust is relatively high (i.e., Belgium, Austria, the Netherlands and Estonia), both the holding and the share indicators are significantly higher than in the group where trust is relatively low (i.e., Italy, Slovenia, Spain and Luxembourg).

From this preliminary analysis we can conclude that there seems to be a positive link between trust in others and attitude towards risk: investments in risky assets seems to be more common in the presence of trust. In Section 4 we explore this relationship controlling for risk tolerance as well as socio-demographic and economic variables.

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[31] The difference in the average levels of risky assets holding and share is statistically significant according to a one-way analysis of variance test of mean equality (p-value <0.01) and to separate paired t-tests on the equality of the mean in any pair of groups (p-value <0.01 for each test.)

2.4 Empirical analysis

In this section we relate different measures of financial risky assets investments to socio-demographic variables and the self-assessed levels of risk tolerance and trust in others. We consider several regression models with different dependent variable and various specifications. The following comments are relative only on average marginal effects that are significant at least at the 5% level.

In Table 3 we report average marginal effects from logit regressions taking as dependent variable a binary indicator equal to one if the household held risky assets in its financial portfolio.

The first model in Column (1), takes as explanatory variables standard socio-demographic characteristics of the individuals and a set of country dummies to capture the cross-country differences. The result of this regression generally confirms the standard findings in the literature: risky assets holding is positively correlated with wealth and higher education, and negatively correlated with home ownership, being a female or having children (see, e.g., Bucciol and Miniaci, 2015.)

In Column (2) we extend the specification to include a variable on the level of trust, as already done in the literature. The variable is highly significant although the magnitude of its effect is small: one more point in the 0-10 scale leads to a 0.7% increase in the probability to hold risky assets. It is also worth noting that the other coefficients are almost unchanged with respect to the pervious specification and the overall fit of the model (measured by the pseudo-R^2 statistic), is virtually unchanged with respect to Column (1).

Column (3) further adds to the specification a binary variable on risk tolerance. This variable is very significant and its effect is also very large: being risk tolerant increases the probability to hold risky assets by 20%. This is a large amount, if we consider that only 27.30% of the households in the sample invest in risky assets. Furthermore, the introduction of the risk tolerance variable improves the overall fit of the model, with the pseudo-R^2 increasing by about 4 percentage points from Column (2). The effect of trust remains significant, but the magnitude of the effect is even smaller. Hence, in contrast with previous literature, trust does not seem to capture a key dimension to explain portfolio choice – plausibly because of its high correlation with risk tolerance.

Our major goal, however, is to understand the role played jointly by risk attitude and trust in others. That is, we want to understand whether trust *alone*, in the presence of risk averse

households, can still influence the decision to invest in risky assets. In order to do so, in Column (4) we replace the trust variable from the previous specification with two interaction terms between trust and the binary variable for risk tolerance. The final specification includes a variable isolating the contribution of trust in the presence of risk tolerance (*trust with risk tolerance)*, and another that capture the effect of trust in absence of risk tolerance (*trust with risk aversion)*. Interestingly, while the effect of the first is not significant, the effect of trust with risk aversion is significant and equal to 0.007. The size of this effect remain still quantitatively small: going from the bottom to the top of the trust scale (i.e., from 0 to 10) the probability to hold risky assets would increase by 7%, about one third of the effect of being risk tolerant (24.4%). The results for the other explanatory variables remain stable also with this specification. It is finally worth noting that the time of the survey does not play a role in any specification: the year dummy relative to the 2013 survey period is never significant. This result might suggest that, after controlling for personal characteristics and risk attitude of the households, there is no measurable effect of the great recession of 2008/2009 on the decision to hold risky asset in subsequent years or alternatively if an effect was there it is already vanished.

In general, we can still say that the analysis so far suggests that trust acts as a *substitute* for risk tolerance: when risk tolerance is present, trust does not influence the decision to hold risky assets; however, when households are risk averse, trust does play a role and has a positive impact on risky assets holdings. More trusting people are therefore more willing to invest in risky asset even if they are not risk tolerant. However, trust is an imperfect substitute for risk tolerance: the highest possible level of trust has an effect on the risky asset holding that is not even close the one of being risk tolerant.

The analysis we present in Table 4 replicates what we have done before, taking as dependent variable the share of the financial portfolio invested in risky. In this case we are interested in investigating the magnitude of the investment decision rather than the decision itself. Given that we are now considering the portfolio share invested in risky asset, we will employ for our analyses a fractional response logit model estimated with Bernoulli quasi-maximum likelihood and robust standard errors as in Papke and Wooldridge (1996.) The main advantage of this model, compared to alternatives such as an OLS regression, is to acknowledge that the dependent variable takes values

between 0 and 1, possibly with a mass of observations concentrated at the boundaries. In Table 4 we report the average marginal effects from this model[32].

Our previous findings are supported also by these analyses. The results in fact suggest that trust plays a role in the decision of the share of risky assets investments only when the household is not risk tolerant. More precisely, a ten-point rise in the trust scale increases the portfolio share in risky assets by 4.14% – again, about half the effect of being risk tolerant (11.27%).

2.5 Conclusion

Explaining individuals' behavior towards financial investments has been the main focus of a number of scholars since a long time. In the literature there are many studies providing evidence that financial portfolio composition is widely heterogeneous in the population, and that it is also correlated with many individual-level characteristics. The main objective of this paper is to explore the possibility that the decision to invest in risky assets is also affected by a key component of 'social capital' such as *trust in others*. We base our empirical analysis on SHARE survey data collected in years 2006 and 2013: we explore the association between risk tolerance and trust in others in order to examine their joint effect on portfolio choice across Europe.

Differently from to previous work on similar research questions (e.g., Guiso et al., 2004, 2008), our major goal is to disentangle the contribution of trust from that of risk tolerance. The results of our analyses suggest that trust matters only when the household is risk not risk tolerant, in which case if trust is high, also risky assets investment is more frequent. Our claim is that trust acts as a substitute for risk tolerance: it plays a key role on portfolio decisions only when households are risk averse. Trust is however only an imperfect substitute as its effect on risky assets investment is much smaller than that of risk tolerance alone.

As Sapienza and Zingales (2011) observe: "Because financial contracts require trust, differential levels of social capital may have important consequences for the way that financial markets develop". Our research, showing that trust in risk averse environments helps to increase risky assets investments, sheds light on a specific channel through which trust can act as a lubricant of the economic system: its ability to act as a substitute (albeit an imperfect one) for risk tolerance in shaping individuals' portfolio decisions. This suggests that promoting interpersonal trust – and

[32] The same analyses estimated with a standard OLS model provide similar results and are available upon request.

not only improving person-specific attributes such as one's level of financial literacy – could contribute to the development of financial markets.

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Table 1. Summary statistics (41,838 observations)

Variable	Mean	Std. dev.	Min.	Max.
Age	63.954	8.467	50	80
Female	0.529	0.499	0	1
Foreign	0.055	0.228	0	1
High school	0.343	0.474	0	1
College	0.213	0.410	0	1
Worker	0.304	0.460	0	1
Married	0.703	0.467	0	1
With children	0.874	0.331	0	1
Home owner	0.867	0.338	0	1
Net worth (k euros)	447.680	1,331.137	10.000	72,947
Variables of interest				
Risky asset holding	0.*273*	0.445	0	1
Risky asset share	0.*130*	0.269	0	1
Self-assessed risk tolerance	0.*258*	0.437	0	1
Trust	5.517	2.453	0	10

Table 2. Risk taking by country group

Group	Risky asset holding	Risky asset share	Risk tolerance	Trust
(1) Risk tolerance, High trust *(Denmark, Sweden, Switzerland)*	0.583	0.229	0.462	6.960
(2) Risk tolerance, Low trust *(Czech Republic, France, Germany)*	0.314	0.126	0.307	5.302
(3) Risk aversion, High trust *(Austria, Belgium, Netherlands, Estonia)*	0.277	0.126	0.285	6.093
(4) Risk aversion, Low trust *(Spain, Italy, Slovenia, Luxembourg)*	0.177	0.118	0.166	5.304
TOTAL	*0.273*	*0.130*	*0. 258*	*5.571*

Note: Countries are grouped based on their ranking on the frequency of risk tolerance and average trust. We include in Group 1 the countries that rank in the first seven positions on both risk tolerance and trust. We include in Group 4 the countries that rank in the last seven positions on both risk tolerance and trust. The remaining countries are included in Group 2 if they rank higher on risk tolerance, or in Group 3 if they rank higher on trust. One-way analysis of variance and paired t-tests always reject the null hypothesis of identical holding and share of risky assets in any pair of groups, with the only exception of asset holding in group 2 and 3.

Table 3. Average marginal effects on risky asset holdings

	(1)	(2)	(3)	(4)
Risk tolerance			0.200***	0.244***
			(0.007)	(0.022)
Trust		0.007***	0.005***	
		(0.001)	(0.001)	
Trust with risk tolerance				-0.001
				(0.003)
Trust with risk aversion				0.007***
				(0.002)
Age/10	-0.010**	-0.011**	0.001	0.002
	(0.005)	(0.005)	(0.005)	(0.005)
Female	-0.036***	-0.037***	-0.011**	-0.011**
	(0.004)	(0.004)	(0.005)	(0.005)
Foreign	-0.026	-0.026	-0.017	-0.017
	(0.022)	(0.021)	(0.016)	(0.016)
High school	0.065***	0.062***	0.045***	0.046***
	(0.009)	(0.009)	(0.006)	(0.007)
College	0.110***	0.104***	0.071***	0.071***
	(0.010)	(0.010)	(0.009)	(0.009)
Worker	-0.007	-0.009	-0.012	-0.012
	(0.009)	(0.008)	(0.008)	(0.009)
Married	0.027**	0.026**	0.025**	0.025**
	(0.012)	(0.011)	(0.011)	(0.011)
With children	-0.047***	-0.046***	-0.040***	-0.040***
	(0.014)	(0.014)	(0.013)	(0.013)
Home owner	-0.159***	-0.159***	-0.135***	-0.135***
	(0.028)	(0.027)	(0.024)	(0.024)
Ln(Net worth)	0.110***	0.109***	0.092***	0.092***
	(0.009)	(0.009)	(0.008)	(0.008)
Year 2013	-0.007	-0.010	-0.020**	-0.020**
	(0.013)	(0.012)	(0.010)	(0.010)
Country dummies	YES	YES	YES	YES
Pseudo-R^2	0.1665	0.1679	0.2169	0.2174
Observations	41,838	41,838	41,838	41,838

Note: The table reports average marginal effects from a logit regression. Standard errors clustered at the country level in parentheses; *** p<0.01, ** p<0.05, * p<0.1

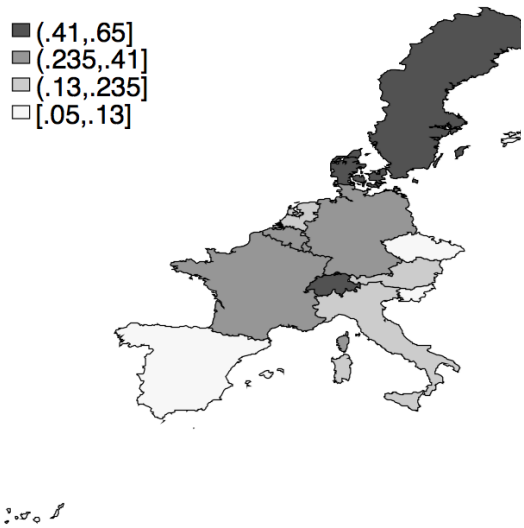
Table 4. Average marginal effects (multiplied by 100) on risky asset share

	(1)	(2)	(3)	(4)
Risk tolerance			8.211***	11.275***
			(0.329)	(1.209)
Trust		0.306***	0.211***	
		(0.034)	(0.025)	
Trust with risk tolerance				-0.106
				(0.138)
Trust with risk aversion				0.414***
				(0.062)
Age/10	0.622	0.609	1.090**	1.129**
	(0.609)	(0.596)	(0.552)	(0.538)
Female	-0.887***	-0.915***	0.086	0.099
	(0.216)	(0.212)	(0.220)	(0.221)
Foreign	0.223	0.211	0.516	0.523
	(0.660)	(0.618)	(0.506)	(0.501)
High school	3.063***	2.939***	2.349***	2.359***
	(0.348)	(0.334)	(0.299)	(0.317)
College	4.516***	4.272***	3.045***	3.101***
	(0.241)	(0.250)	(0.271)	(0.249)
Worker	-1.552**	-1.624**	-1.822***	-1.789***
	(0.629)	(0.633)	(0.669)	(0.685)
Married	0.432	0.412	0.361	0.343
	(0.838)	(0.824)	(0.842)	(0.828)
With children	-2.264***	-2.241***	-2.112***	-2.126***
	(0.370)	(0.388)	(0.327)	(0.318)
Home owner	-5.998***	-6.012***	-5.572***	-5.590***
	(1.504)	(1.491)	(1.418)	(1.432)
Ln(Net worth)	3.777***	3.772***	3.330***	3.360***
	(0.555)	(0.553)	(0.527)	(0.537)
Year 2013	0.248	0.150	-0.329	-0.324
	(0.854)	(0.831)	(0.718)	(0.709)
Country dummies	YES	YES	YES	YES
Pseudo-R^2	0.1047	0.1061	0.1429	0.1439
Observations	41,838	41,838	41,838	41,838

Note: The table reports average marginal effects from a fractional response logit model. Standard errors clustered at the country level in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Figure 1. Distribution of risky assets investments

a) Fraction of risky assets holders



b) Average risky assets share

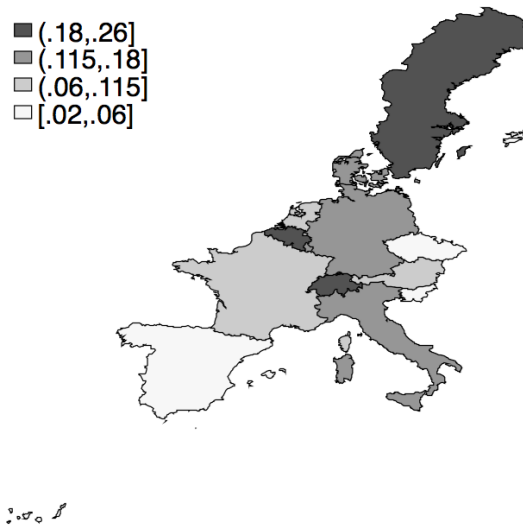
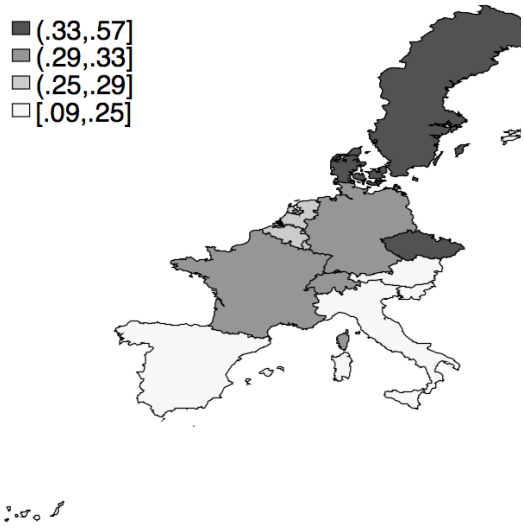
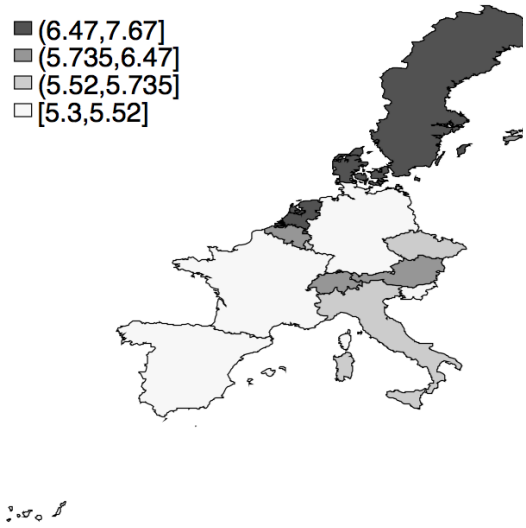


Figure 2. Distribution of risk tolerance and trust

a) Fraction of risk tolerant households



b) Average trust level



3 Chapter 3

GENDER DIFFERENCES IN RISK AND TIME PREFERENCES: THE ROLE OF MARITAL STATUS

Abstract

Using Dutch survey data from 1996 to 2013, this paper investigates the differences in time and risk preferences along the gender and marital status dimensions. In order to do so, we take into consideration both a self-reported measure and a structural estimation of the preference parameters. Results from standard regressions suggest that women are indeed more risk averse than men. However, there is also a significant interaction effect of gender and marital status: single men are less risk averse than married ones, while for women the difference isn't significant. Results for the time preference estimation are less conclusive. Structural estimation of risk aversion parameters generally confirms the regression analysis' results. Moreover, these estimations suggest an even stronger interaction between gender and marital status. As for time preferences, men seem to be more patient and have longer time horizon than women, but the results may be driven by the correlation with the risk attitude.

3.1 Introduction

In the last decades, the analyses of risk and time preferences of individuals are attracting an ever-growing interest. The reason behind this large attention can be found in the fundamental role that both time and risk attitude play in economic models. In the literature, many works relate individuals' preference for risk and time discounting to many basic socio-demographics such as gender, education and cognitive abilities, income and wealth. These variables are seen as part of the background risk, which people take into account before planning for savings and financial investment (see for example Heaton and Lucas, 2000). Employing a large variety of indexes of preferences, many scholars found a tight relationship between risk and time discount preferences and the individuals' characteristics (Guiso and Paiella, 2008). The study of gender differences in preferences is maybe the most studied and controversial line of research in this sector of the literature.

Most studies that use measures of risk aversion from field data conclude that women are more risk averse than men (Jianakoplos and Bernasek, 1998; Barber and Odean, 2001), whereas experimental evidence from laboratory studies is less conclusive (Eckel and Grossman, 2008). The major problem with these studies is that they typically fail to control for the interaction of other demographic factors, and in particular marital status and household composition, that might bias the measure of male/female difference in risky choices. In this paper, we will take into consideration this possibility as well. By so doing, we will contribute to shed light on the reasons *why* men and women differ, in their attitude towards risk, as the current literature so far fails to provide a clear and satisfactory answer to this question.

In the literature much less can be found with regard to the differences in time preference along the gender and marital status dimensions. So far, cognitive abilities, age and in some cases gender interaction with time discounting have been explored. Moreover, it is common that time and risk preferences are jointly measured and examined. Patience and risk tolerance are found to be positively correlated with one-another (Anderhub et al., 2001) and with cognitive abilities (Dohmen et al., 2010). Frederick (2005) finds that the direction of the correlation depends on the domain chosen for the elicitation, but also find some evidence of gender differences. Nevertheless, strong and conclusive results giving indication of the connection between time preference and general individual characteristics are still missing.

This paper contributes to the body of evidence on heterogeneous preferences by examining in detail how risk and time preferences change according to different gender and marital status. In particular, our analysis will take into consideration the possibility of interaction between these two dimensions. This interaction effect is rarely examined in the literature. Employing data from the DNB Household Survey (DHS) from 1996 to 2013, we are able to exploit the large set of information on individual characteristics, together with the self-reported measure on time and risk preference, to study the complex net of connections between these dimensions. Different regression analyses are estimated and the results are in general in line with the literature's main findings on the topic. However, the novelty of our approach lies in the fact that we will examine the differences in preferences not only by means of self-reported survey data, but also with a very precise and detailed structural estimation of these parameters.

In the recent literature optimal life-cycle models have been employed to simulate the effect of this background risk on saving and asset allocation decision. Results of these analyses again demonstrate the importance of variables such as income, age, education and family composition (Caroll and Samwick, 1997; Cocco, 2005; Mazzocco, 2004). In this paper we solve numerically for the optimal portfolio and savings decisions using a realistically and quantitatively calibrated model. Our model is closely related to models largely used in the recent consumption literature on buffer-stock saving (Deaton, 1991; Carroll, 1997; Gourinchas and Parker, 2002).

The main findings we obtain with this structural analysis closely follow the results we obtain with the study of the self-reported preferences. In general, men are less risk averse than women. Singles are more risk averse than couples, but this holds only for women. For men the opposite holds true, hinting that some interaction between gender and marital status might indeed be present. Results for time preference are less conclusive, even if we can find that in general time discount is correlated with risk preference. Hence, more risk averse individuals demonstrate shorter time horizon/higher time discount factor.

The rest of the paper is organized as follows. The next section offers a brief review of previous works on risk and time preference. Section 3 details the data used in the paper, the regression analyses and the major results we obtain from it. The theoretical life-cycle model is illustrated in Section 4. In Section 5, we report the calibration and the structural estimation of the parameters of interest. Section 6 concludes.

3.2 Literature review

In this section, we recall some of the major findings obtained so far in the economic literature with respect to the risk and time preferences for different types of household. We are interested in particular in the different attitude towards risk and time horizon of households whose head is either married or single, male or female. The gender dimension has attracted so far a lot of attention from scholars with respect to risk preference. However, the connection between risk preference and marital status, as well as the connection between time preference, gender and marital status, has been explored only seldom.

3.2.1 Measures of risk and time preferences

The literature on risk preference is by now vast and covers many different aspects of individuals' risk taking behavior. In this paper, we are going to concentrate our attention only on financial risk. In the literature, we can find a large number of different measures for this preference parameter. In general, there are three main approaches to obtain such a measure: from answers to general questions on risk attitude (the so called self-reported measure, e.g., Shaw, 1996; Dohmen et al., 2011), from choices between experimental or hypothetical lotteries (e.g., Holt and Laury, 2002; Guiso and Paiella, 2008), or from observable outcome choices such as investment decisions (e.g., Halek and Eisenhauer, 2001; Bucciol and Miniaci, 2011). An additional measure of risk aversion can also be obtained with structural estimation of preference parameters in life-cycle models (e.g., Gourinchas and Parker, 2002; Cagetti, 2003). The last measure is however different from all the others, since it is a synthetic measure that reflects the behavior of the average individual and not an individual specific measure. In this paper, we are going to explore the difference along the dimensions of gender and marital status with both an individual specific self-reported measure and a structural estimation of the parameters for the different groups of interest.

Measuring the time preferences is as complicate as measuring risk attitude, if not more. In the literature, there are a number of different studies that try to capture the individuals' time preference, and quite a large number of elicitation methods. Similarly to what happens for all the other preference parameters, the consensus on the best measure of time discounting has yet to be reached. As for the risk preference, it can be measured through laboratory experiments (Frederick, Loewenstein, and Donoghue, 2002; Andreoni and Sprenger, 2012), field experiments/survey data (Ashraf et al., 2006), and also structural estimation (e.g., Gourinchas and Parker, 2002; Cagetti, 2003). Moreover, as a proxy for time preference, some researchers have used a question on the

financial planning horizon, included, among other surveys, in the Survey of Consumer Finance (SCF), in the Health and Retirement Study (HRS) and in the DNB Household Survey (DHS). The intuition behind the use of the time-horizon variable to measure time preferences is easily explained: in economic models of household decision-making, time horizon depends on the discount rate; a higher discount rate will lead to a shorter time horizon and a lower discount rate will lead to a longer time horizon[33]. In our analysis, we will adopt this measure of time horizon as a proxy for the time preference of an individual. Moreover, as with the risk preference parameters, we are going to obtain an alternative measure of time preference through our structural estimation.

3.2.2 Gender and marital status differences in preferences

Regardless of the chosen measure of preference, in the literature there is by now a great amount of evidence supporting the presence of a gender difference in risk attitude. However, what is less clear is *why* men and women seem to significantly differ in their attitude towards risk. Using survey data on the proportion of wealth invested in risky assets, Jianakoplos and Bernasek (1998) found that single women are more risk averse than single men, after controlling for age and education. Race and household size were instead correlated with the risk preference. Halek and Eisenhauer (2001) found that marital status is also correlated with risk aversion, but the direction of the effect seems unclear and domain specific. A similar study by Sunden and Surette (1998) found that it is not gender alone that determines investment choice but, rather, a combination of gender and marital status. Finally, structural estimates by Mazzocco (2004) generally confirm that the possibility to share risks between couples' members, determines a collective degree of risk aversion that can be quite different from the preference for risk of the two partners alone.

In addition to the results in the economic literature, psychologists and sociologists have also explored the differences in risk attitude, but in domains generally different from the financial one. Zuckeman (1994) noted, for example, that differences in risk attitude might be linked to genetic bases (such as inherited differences in the brain's electrochemistry) that can account for some of the differences across gender and race. Moreover, hormonal changes caused by ageing, pregnancy, mental diseases, in addition to changes in the living environment (marriage, household relocation, birth of a child) can alter individual's attitude toward risk. Research in behavioral economics relies on these findings to incorporate psychological concepts into economic models in order to overcome

[33] Some doubts about the reliability of this measure arose in the recent literature; see for examples Hong and Hanna (2014). Nevertheless, no clear proof against the validity of this proxy has been found.

some of the puzzles that traditional economic theory could not explain. An important finding that is very much related to the gender difference in risk attitude is the problem of overconfidence. Psychological research has already established that men are more prone to overconfidence than women. Barber and Odean (2001) show that, as a consequence of a higher level of overconfidence, men are less risk averse than women, the effect being even more pronounced for single men. On the other hand, according to their findings, single women hold safer portfolios than married ones, and they are indeed more reluctant to take additional risks.

The literature regarding the difference in gender and marital status for time preference is much less extensive. Moreover, time preference is frequently elicited with laboratory or field experiments that jointly recover also a risk aversion coefficient (or a priori postulate risk neutrality). This elicitation methodology allows the study of risk and time preference jointly[34]. So far, the most relevant line of studies on time preference tries to explain its link to individuals' cognitive abilities. In fact, there are many studies that show how cognitive abilities and time preference are positively correlated, and that this correlation is influenced also by other personal characteristics such as gender, marital status, age, etc. The common link with the personal characteristics and in particular cognitive abilities determines also a strong correlation between risk and time preferences. Using GSOEP data, Dohmen et al. (2010) find that nonverbal IQ and word fluency are positively correlated with patience and risk tolerance. Similar findings on the U.S. are reported by Burks et al. (2009). A more articulated research by Frederick (2005) finds that the direction of the correlation between individuals' cognitive abilities and time preferences depends on the domain chosen for the elicitation (gain lotteries reveal an opposite pattern with respect to lotteries involving losses). In this study, there is also strong evidence of gender differences. The author shows how "smarter" women are more patient while "smarter" men take more risks. In addition, Anderhub et al. (2001) show that risk aversion and time preferences are directly correlated. They find in fact that a lower level of risk aversion is usually correlated with a longer time discounting and vice versa. Finally, there are some studies that look primarily at correlates of time preference. Leigh (1986), using 1972 PSID, shows that marriage, number of children and wages are negatively correlated with impatience. Similar results are obtained in an experimental setting, where Abdellaoui et al. (2013) find that making joint decision inside a couple reduces impatience. Rubalcava et al. (2009) find that women in the 2005 Mexican Family Life Survey (MxFLS) seem to be more patient than men. On the other hand, in the

[34] It is nevertheless possible that the joint estimation of both preference parameters determines a correlation between the two measures that is in part spurious and linked to the assumption taken a priori on the utility function or directly to the estimation methods. So far, researchers found scant evidence of this spurious correlation.

Netherlands, van Praag and Booij (2003) have found that men are more patient than women in a sample of newspaper readers (even tough their sample was not representative of the entire population). Other two studies by Anderson et al. (2004) and Tanaka et al. (2010) found no significant gender differences in the time discount preference. In the end, in the literature, there is neither much evidence on how time preference varies by gender, nor a generally accepted prior hypothesis.

3.2.3 Testable hypotheses

Summarizing, the existing literature gives us a general picture of the major differences one can find along the gender and the marital status dimensions for both time and risk preferences. Specifically, it is plausible to hypothesize that in general, males will be less risk averse than females. A different predisposition toward time horizon might also be present, but in the literature only scant and contrasting evidence are present.

Hypothesis 1: Men are less risk averse than women.

Plausible differences are present also between married and single agents. Households whose head is in couple can share labor and investment risk with the partner. The possibility to diversify and share risk can determine a lower level of risk aversion. Moreover, couples' members have to coordinate their financial decision with the partner. The household portfolio might therefore reflect a combination of the partners' attitude towards risk. As a result, married women are less risk averse than single women, because they probably incorporate in their preference the lower risk aversion of the male husband. The opposite effect holds for men. It is then worth noting that overconfidence and different family burden can determine a very different behavior between single males and single females[35]. It is quite possible that single males can demonstrate a much lower aversion to risk than single females. As a consequence of these facts, the gender difference might be larger for singles than for couples.

Hypothesis 2: Gender differences in preferences are much more pronounced for single agents.

[35] In case of divorce it is common for women to receive the custody of children. It is therefore plausible for divorced women to be less prone to undertake any kind of risky investment, either for the lack of savings or simply to preserve the future wellbeing of her children.

Predictions for the possible difference in preference for time discounting along the dimension of gender and marital status are more difficult to make. The only strong result in the literature is that cognitive abilities directly affect patience, but also risk tolerance. Hence time preferences turn out therefore to be correlated with the risk tolerance of individuals. We can then hypothesize that more risk averse individuals also have higher time discount rate. These findings increase the probability that time preference follow in general a similar pattern of risk preference.

Hypothesis 3: Time preferences display less gender and marital status differences, but generally display a pattern similar to risk aversion since the two preferences are correlated.

The empirical analysis we are going to present in the next sections precisely aim at empirically validate or confute these hypotheses.

3.3 Empirical analysis

The main objective of our analysis is now to test the hypotheses we formulated on the basis of the existing literature. In order to do so, we will employ a large sample from the DNB Household Survey (henceforth DHS) data. This survey contains detailed information on income, housing, financial assets, health, as well as demographic and psychological characteristics - including risk and time preferences - relative to a representative sample of the Dutch population. The survey is run yearly on a sample of over 2,000 households and covers more than two decades, starting from 1993. The interview is conducted over the Internet, without interviewer, at the convenience of the respondent; participants who do not have Internet access are provided with a device and technical support. Over the years, some changes to the questionnaire have been made, for the most part without compromising the waves comparability. For our purposes and needs, we decided nonetheless to concentrate our attention on the waves 1996-2013[36]. We focus on individuals in the age range 20-80, not self-employed, with positive financial wealth and positive total household income from any source (from both the head and in case the spouse) that have participated in at least two consecutive waves. The final sample we consider in our analyses contains information on 8,695 individuals in 2,438 households. The main advantage of using this survey for our estimation

[36] We excluded the first two waves that were part of another project (VSB-Center Saving Project) since the questionnaire and sampling strategies were different. We excluded also the 1995 wave because of the high number of missing value and inconsistency with subsequent waves in different variables of interest.

is that it contains detailed information on portfolio composition as well as six self-reported measures of risk taste and one measure of time preference. Moreover, the panel dimension of the dataset allows us to effectively distinguish between age and cohort effects and to control for individual heterogeneity.

3.3.1 Risk aversion

As we have seen in the literature, it is still a very complicated task to define a clear and effective measure of risk aversion. In the DHS we can find six different questions that are specifically constructed to elicit individuals' financial risk taste. Each question captures a different aspect of the attitude towards risk, and together they can give us a good approximation of the general degree of risk aversion of the individuals (on this see Kapteyn and Teppa, 2011). Specifically, the questions ask the respondent to evaluate on a scale from 1 to 7 how much they agree with a statement relative to her financial risk attitude. The list of the statements is reported in Table 1. The first three items are relative to risk aversion and the last three capture instead risk tolerance. In order to have six comparable items, we inverted the first three items (the value 7 is converted into a 1, the value 6 becomes a 2 and so on). From this transformation, we obtain six variables with homogeneous answer categories: a higher value is now always associated with higher aversion towards risk. The Cronbach's alpha of the six items is 0.69, which indicates that the variables are indeed correlated but do not exactly measure the same thing. In order to get a synthetic measure of risk aversion out of these six items, we performed a polychoric factor analysis. The resulting factor is then rescaled to take values between 1 and 7 (as the original items).

With the index of risk aversion we constructed, we are now able to study if there are some differences in terms of risk attitude along the dimensions of interest: *gender* and *marital status*. In order to test our initial hypothesis, we perform some regression analyses. The first specification of the model includes, in addition to the variables of interest, some control variables on socio-economic characteristics (age, employment status and income). In the second specification we insert as controls also financial situation and financial sophistication with one year lag[37] (holding of risky assets, self-reported expertise in financial matters, resort to professional advice or to advice available on general media regarding financial investments). In Table 2 we reported the summary statistics of the variable we consider in the analyses. In all the regression analyses, we also include

[37] The variables relative to the financial domain reflect the situation in the prior year in order to avoid problem of simultaneous determination with the variables of interest.

year dummies to control for cohort effects and macroeconomic conditions. Robust standard errors with household clusters are computed to test the significance of the estimation. We use these specifications to estimate bivariate OLS regressions which results are reported in Table 3.

In the first column of Table 3 we reported the result of a regression analyses where the dependent variable is the risk aversion index described above. In order to explore also the joint effect of gender and marital status, we insert in the specification three dummy variables representing the interaction of these two dimensions. Considering that the reference group is the subsample of married males, the estimated coefficients on the variables of interest suggest that women (both singles and couples) are significantly more risk averse, but there is no significant difference along the marital status dimension. On the other hand, single males exhibit a significantly lower level of risk aversion than their married counterparts. To explain why single men are less risk averse than married ones, we can imagine that overconfidence in their capabilities encourages them to invest more and lead them to be less averse to risk. They might also have less family burden than married men, with consequently more freedom to invest in risky assets without having to worry about the financial support of dependent children. Single men have also shorter life expectancy, making them less concerned about saving for retirement and more willing to take risks. Another possible channel that can determine this correlation between marital status and risk aversion for male individuals is the process of selection into marriage. It is indeed possible that more risk averse individual prefer to marry in order to split the risk with a partner, instead men who decide not to get married may be less risk averse to begin with. However, the exploration of the causes of this relation is not the focus of this work.

As for the control variables inserted in the model, the general pattern is in line with what we previous findings. The age profile is slightly hump shaped, individuals with higher wage and education are less risk averse, even if the education does not seem to be very significant.

In column 3 we report the second specification of the model where the dependent variable remains the risk aversion index, but the explanatory variables include also the variables on financial domain we illustrated above. The results confirm again the relationship of interest: being female is positive correlated with risk aversion (i.e., women are always more risk averse), male instead display negative correlation. For men there is also a significant difference between single and married individuals, where the first ones seem to be even more risk tolerant than the second. The pattern for the control variables does not change too much. It is instead interesting to notice that risk aversion is negatively correlated with the presence of risky assets in the investment portfolio last

year. Financial sophistication is also very relevant: being financially knowledgeable and looking for financial information in any type of media decreases significantly the degree of risk aversion. All these variables are referred to the previous year in order to avoid reverse causality problems. It is in fact very plausible that a specification with financial sophistication and financial risk aversion measured in the same year might suffer from endogeneity problems due to contemporaneity and missing variables problems.

3.3.2 Time preferences

As mentioned in the literature review, in the DHS dataset there is a specific question relative to time horizon in a financial setting that can be used as a proxy for individuals' time preference. The question is reported in Table 1. In order to study the gender and marital status difference in time preference we employ a regression analyses similar to the one we used for risk aversion. The specifications of the model include the three variables representing the interaction between gender and marital status, some control variables on socio-economic characteristics, financial investment and financial sophistication. The results are reported in the second and fourth column of Table 3.

In general, the results of our analyses suggest that there are no differences in time preference along the gender and marital status dimensions. Even considering the possible interaction effect, being married or single, man or woman does not count in terms of time discounting preference. The resulting coefficients on the control variables follow what we could find in the previous literature. College, that can be seen as a proxy for cognitive abilities, is positively and significantly correlated with the time preference. Financial sophistication (always considered with one year lag) does also matter. Being financially knowledgeable and having hold risky asset in the investment portfolio are in general positively associated with patience. Moreover, asking for financial advice to a professional significantly correlate with a longer investment horizon. All these results are in line with the common sense suggestions: investing in risky financial assets requires a longer time horizon in order to accommodate the possible longer period of losses recovery. This effect is even stronger for people that actually understand the financial market principles and for those who usually ask advice to professionals that are quite comfortable with the same notions.

3.4 The model

The model considered in this paper is derived from the "buffer-stock" model of life-cycle consumption and investment choices that accounts for uncertainty regarding labor income and mortality. Time is considered to be discrete with each period representing one year. Each agent will be "born" at age 24 (t=0) and live maximum up to 100 year (i.e., agents die with certainty at T=75). The lifespan of the individuals will be characterized by two different phases: the first one is the working phase that last K periods, and the second is the retirement phase that lasts T-K periods. The retirement age K is considered to be exogenous, equal to 39 (the average retirement age in the sample). Agents face mortality risk, having therefore a survival probability from each period to the following one. This probability (identified with π) is considered to be constant as in Hubbard et al. (1995)[38].

At the beginning of each period agents form their expectation about future available resources and select the consumption C_t that accomplish the standard goal of maximizing expected lifecycle utility. Preferences and evolution process of recourses will be presented in the next two sub-sections.

3.4.1 Preferences

At the beginning of each period, each agent start with an endowment of cash-on-hand A_t out of which she consumes and saves for the future. Current period consumption will be financed with saving from previous period and current income. The amount of income in each period is variable and is influenced by the risk of unemployment. In addition to labor income, as we have seen, people also face mortality risk. In the event of death, they will receive some utility from leaving a bequest. The inter-temporal preference of the agents can be summarized by the following expected utility function:

$$u(C_t) + E_t\left[\sum_{k=t+1}^{D} (\beta\pi)^{k-t}\big(\pi\, u(C_k)\big) + (1-\pi)B(S_k)\right]$$

where β is the time discount factor.

[38] The constant survival probability π is computed to ensure that the expected life span for each agent is equal to 75 (100 years old).

We assume, for tractability reasons, that the agent evaluates the consumption choice in each period with the standard isoelastic, Constant Relative Risk Aversion (CRRA) utility function that is commonly used in this setting (e.g., Carroll 1992; Hubbard et al. 1995; Cocco et al. 2005).

$$u(C_t) = \frac{(C_t)^{1-\rho} - 1}{1 - \rho}$$

where ρ>0 corresponds to the relative risk aversion coefficient. Finally we assume that the utility received from dying leaving behind a bequest is a rescaled CRRA, also popular in the literature (e.g. Cagetti 2003):

$$B(S_t) = \alpha\, u(S_t)$$

where α is the degree of altruism coefficient.

3.4.2 Income process

The income process is different during working and retirement period; it is exogenous to the model and it will be defined closely following Bucciol (2012).

Working period income $Y_t = W_t^W$ ($t < K$) is defined as follows:

$$\ln(W_t^W) = \ln(P_t) + E_t^T$$

$$\ln(P_t) = G_t^W + \ln(P_{t-1}) + E_t^P$$

where P_t is the permanent income, G_t^W is the deterministic component – function of demographics characteristics, such as age, number of household member, etc. – E_t^T is a transitory component and E_t^P is the innovation of the permanent part. Transitory and permanent shocks follow two i.i.d. normal distributions with mean 0 and variance σ_T^2 and σ_P^2 respectively. Moreover, income uncertainty during the working years is augmented by unemployment risk. Agents face in each period the probability θ of being unemployed. Income during unemployment is defined as $Y_t = \xi W_t^W$.

The income process during retirement age $Y_t = W_t^R$ ($t \geq K$) is defined in a similar way, but it is completely deterministic (i.e., neither permanent nor transitory shocks are present).

$$\ln(W_t^R) = \ln(P_t)$$

$$\ln(P_t) = G_t^R + \ln(P_{t-1})$$

where G_t^R is the deterministic component, defined similarly to G_t^W.

3.4.3 Model solution

Putting together all the elements of the model, we are able to finally represent the optimization problem of the agents with the following recursive value function:

$$V_t(S_t, P_t) = \max_{C_t} u(C_t) + \pi\, E_t[\beta\, V_{t+1}(S_{t+1}, P_{t+1})] + (1-\pi) E_t[\beta\, B(S_{t+1}, P_{t+1})]$$

s.t.

$$S_{t+1} \leq R\, A_t + Y_t$$

$$A_t = S_t - C_t$$

The control variables in this model are $\{C_t\}_{t=1}^T$, and the state variables are $\{t, S_t, P_t\}_{t=1}^T$. To simplify the solution of this model, it is possible to reduce the number of state variables, dividing everything by the permanent income P_t as in Carroll (1992). The standardized variables will be denoted with lowercase letters (e.g., $c_t = C_t/P_t$). Unfortunately, the problem does not have a closed form solution and therefore a numerical solution will be computed. The policy function $c_t = c(s_t, t)$ is derived using the backward induction approach.

After some manipulation, the first order condition of the model takes the form[39]:

$$\frac{\partial u}{\partial c_t} = \pi\, E_t\left[\beta_{t+1}^* R \frac{\partial u}{\partial c_{t+1}}\right] + (1-\pi)\, E_t\left[\beta_{t+1}^* R \frac{\partial B}{\partial s_{t+1}}\right]$$

where $\beta_{t+1}^* = \beta(P_{t+1}/P_t)^{-\rho}$. This equation is in fact the standard Euler equation if bequest motives are added to the model.

[39] Further details and explicit derivation of the solution are reported in appendix A.

As a final remark, the expectations considered in the model are taken over earnings and unemployment uncertainty: integrals are approximated with the quadrature methods as in Tauchen and Hussey (1991) with a Gauss-Hermite quadrature of order nine.

3.5 Calibration and estimation

The estimation of the parameters of interest (β, ρ) will be carried out with a two-step procedure, the so-called method of simulated moments (MSM) from Pakes and Pollard (1989). As the name suggests, this methodology aims at estimating the structural parameters of interest by comparing simulated moments with the actual moments observed in the reference population. The first step of the MSM is dedicated to the estimation of exogenous parameters and their relative variance. In the second step, the first stage parameters are plugged into the model in order to obtain a high number of simulations of the life-cycle decision at a given β and ρ. The simulation allows the computation of the consumption and savings profiles. The simulated moments for saving are then compared to the empirical moments obtained from the DNB Household Survey. The procedure computes the difference between simulated and actual moments for different kinds of β and ρ, and stops when it is minimized. One of the most interesting features of this kind of estimation method is that the estimator is consistent regardless of the functional form specified in the model. Moreover, it does not need long time series of wealth or consumption data to obtain the estimate, which can be a very interesting aspect when dealing with survey data that are long at most two decades.

3.5.1 Method of simulated moments

The basic procedure of the MSM estimation was originally developed by McFadden (1989) as a way to achieve the consistency and the asymptotical distribution convergence of estimations trough Monte Carlo simulation instead of relying on direct derivation based on high-dimensional integrals. The method used in this paper comes from the further extension developed by Pakes and Pollard (1989).

As we have seen above, there are two sets of parameters in the model we are going to estimate: a set of exogenous nuisance parameters χ (e.g., interest rate, retirement age, asset returns, etc.) and a set of endogenous parameters θ (the preference parameters we are interested in, β and ρ). As in Gourinchas and Parker (2002) and Laibson et al. (2009), the estimation procedure is divided in two steps. In the first phase, it is necessary to carefully calibrate the set of exogenous

parameters χ, in order to have them closely reflect the real economy of the country of interest – the Netherlands in this case. It is then necessary to associate to the estimates $\hat{\chi}$ the respective covariance matrix $Var(\hat{\chi}) = \widehat{\Omega}_{\chi}$. In the second stage, conditionally on $\hat{\chi}$ and $\widehat{\Omega}_{\chi}$, the Method of Simulated Moment is applied to finally obtain the estimation of θ. Define now the vector $\bar{m} = \sum_{i=1}^{N} m_i/N$ as the vector containing the average of the M target moments in the sample of the reference population with size N. The simulation analogue will then be $\bar{m}(\theta, \chi) = \sum_{j=1}^{S} m_j(\theta, \chi)/S$, the vector with the average over the S simulations. We can now define the moment condition for the estimation of θ as follows:

$$E[g(\theta_0, \chi_0)] = E[\bar{m} - \bar{m}(\theta_0, \chi_0)] = 0$$

where (θ_0, χ_0) is the vector of true parameters. We also define W as a weighting, positive-definite matrix of size $M \times M$. The estimation of θ will be obtained minimizing the weighted sum of squared deviation of the simulated moments from the empirical target.

Since $q(\theta, \chi; W) = g(\theta, \chi)' W g(\theta, \chi)$, we have

$$\hat{\theta} = arg \min_{\theta} q(\theta, \chi; W)$$

As demonstrated by Pakes and Pollard (1989), under some regularity conditions that hold in our case, $\hat{\theta}$ is a consistent estimation of the parameter of interest and it is also asymptotically normally distributed with variance:

$$\Omega_{\theta} = (\mathrm{G'}_{\theta} W \mathrm{G}_{\theta})^{-1} \mathrm{G'}_{\theta} W \left(\Omega_g \left(1 + \frac{N}{S} \right) + \mathrm{G}_{\chi} \Omega_{\chi} \mathrm{G'}_{\chi} \right) W \mathrm{G}_{\theta} (\mathrm{G'}_{\theta} W \mathrm{G}_{\theta})^{-1}$$

where G_{θ} and G_{χ} are the first derivatives of $g(\theta_0, \chi_0)$ in θ and χ respectively. The matrix Ω_g is defined as $E[g(\theta_0, \chi_0)\, g(\theta_0, \chi_0)']$. Different weighting matrixes can be used. In this paper we decided to employ the robust weighting matrix defined as $W_0 = (\widehat{\Omega}_g)^{-1}$. It is finally important to notice that the formula of the variance matrix takes into consideration the correction for the simulation error (1+N/S) and also the correction for the first stage uncertainty $\mathrm{G}_{\chi} \Omega_{\chi} \mathrm{G'}_{\chi}$. Test and confidence intervals will be computed using this matrix.

3.5.2 First stage calibration and target

The estimation of the model of interest will follow the procedure of MSM separately for different types of agent[40]. In fact, in order to capture the effect of gender and marital status on time and risk preference, it is necessary to estimate the parameters of interest separately for different groups. The estimation of the first stage parameters is only in part common to all the types of agent (e.g., retirement age, survival probability and unemployment risk). The income profile, the permanent and transitory innovation variances are computed separately for single and couple (male and female). Calibration results for these parameters are reported in Table 4 (details on the estimation process are reported in Appendix B).

After the first stage calibration, we concentrated on the estimation of the target moments, which are the focal point of the whole estimation process. Different targets can be exploited to carry out the estimation. There is not in fact a choice of target moments that is clearly and unequivocally better than the other. In this paper, we have chosen to concentrate on the ratio of financial asset holdings to permanent income as in Cagetti (2003). In particular, we selected 7 indicators that will reflect the age profile of the ratio: the average over 5-year groups during the working age[41] depurated from the cohort effects. As for the income process, targets are computed separately for marital status/gender groups. The resulting targets are reported in Table 5. Specific details on the computation of the target moments are reported in Appendix B.

Finally, in order to understand the goodness of the fit of the model we also computed an adaptation index defined as:

$$AI = \sqrt{\left[\sum_{i=1}^{7} (M_{S,i} - M_{T,i})^2\right]/7}$$

which is the squared root of the average quadratic distance of the simulated moments ($M_{S,i}$) from the respective target moments ($M_{T,i}$). The index is a rescaled version of the minimization criteria employed in the MSM to obtain the estimation of the parameters of interest. The closer to

[40] The method of endogenous grid points from Carrol (2006) is employed to speed the solution of the dynamic stochastic optimization of our model.

[41] The resulting targets are the average of the ratio of financial asset to permanent income for the age groups 28-32, 33-37, 38-42, 43-47, 48-52, 53-57 and 58-62. We do not consider targets in older age since we do not explicitly model health shock and social security support.

zero the adaptation index is, the better the estimated parameters are at replicating the reality of the economic behavior for the group of interest.

3.5.3 Results

As already mentioned above, in order to capture and understand the difference along the gender and marital status dimensions in terms of time and risk preferences, we estimated our model separately for 4 groups of individuals: married male, married female, single male and single female. Table 6 contains the results of our estimation.

The estimated risk aversion parameters suggest that men are in general less risk averse than women. This result is strictly in line with the existing literature and confirms our first hypothesis. It is interesting to also notice that single men appear to be the least risk averse group (ρ=1.958). Married men are a little bit more risk averse than the singles (ρ=2.097). This result can be due to the fact that married men have to coordinate their financial investment decision with a spouse of a different gender that is usually more risk averse. The combination of the two individuals' risk aversion attitude determines that the head of household, even if male, demonstrates a higher risk aversion than his single counterpart. For women the difference is larger but it goes in the opposite direction. The estimated parameters for married women is ρ=2.329 and for the singles is ρ=2.516. The estimation suggests also that our second hypothesis is in fact true. The gender difference of risk attitudes for singles is larger than for married individuals. Similar considerations to the ones we have made for the risk preferences can be repeated for the time preference. The results show in fact that single men have the longest time horizon, as they are the least risk averse group. Married men come second, and the difference with single men is highly significant. Then in the same order as before, married women and single women come. The similar pattern for the difference in risk and time preference suggests that indeed two dimensions are correlated as we supposed in our third hypothesis.

It is nevertheless true that the differences in time preference are much smaller and less pronounced than the ones we got for risk attitudes. We therefore decided to evaluate the significance of the differences between the estimated parameters computing and comparing the

actualized consumption for each group of interest with different parameters. The actualized consumption is defined as follows[42]:

$$AC = \frac{1}{NT}\sum_{i=1}^{N}\sum_{t=0}^{T}\frac{1}{(1+0.025)^t}c_t$$

We change the values of the parameters β and ρ in the process of simulation of the life cycle model in order to evaluate the effect of different preference on the consumption profile. In particular in Table 7, we keep fixed the value of ρ (equal to the ρ estimated for the specific reference group) and let β vary (in each row the β will be equal to the β estimated for a different category). For example in the first column we have the estimated actualized consumption for married men, computed with a fixed ρ equal to 2.09 and different β. In the first row there is the value with the β actually estimated for married man; in the second we use the β of married women; in the third the one of single men and in the last row the β of single female. For the other column we have a similar pattern: ρ is constant and equal to the actual estimation of that group, the β will change in the exact same way we have seen for married men. In parenthesis we report the standard deviation. What we can see from the table is that for all groups if they were more patient (higher ρ) actualized consumption would be higher. This effect is stronger for females because they have also a higher risk aversion parameter (they prefer to save more). It is interesting to notice that the significant changes in the values of actualized consumption with different preference parameters suggest that the differences in time preference among the groups are indeed significant even if the magnitude of the variation in itself is not that high.

In Table 8 we have done a similar exercise as in Table 7, but here in each row we change simultaneously both parameters. In this table we are therefore able to appreciate the joint effect of the two preference parameters. The results are very similar to the ones we obtained before. However, the differences for the all four groups are smaller, albeit still significant. More patient individuals still have higher actualized consumption. Moreover, comparing the result of the two

[42] The value of consumption considered here is expressed in unit of permanent income ($c_t = C_t/P_t$). The consumption profile is computed with the same simulation process used in the estimation phase. β and ρ enters only in the consumption simulation process. We do not consider death risk, so each agent will live until T=76, because the comparability of actualized value of consumption for individual that live for the same amount of year is more meaningful. Similar result can be obtained considering also survival probability, but additional uncertainty would require more simulation to contain the higher volatility and obtain meaningful results. N is equal to 1000, and the discount rate (0.025) is the average return rate on three months T-bills during the sample period, which we considered a good proxy for risk free investments.

tables, we are able to extrapolate the effect of risk aversion alone. The results in this case suggest that impatient individuals with also higher level of risk aversion have higher value of actualized consumption than in the case where they were less averse to risk. Higher levels of risk aversion in fact push individuals to invest (and therefore save) less, always increasing the level of consumption. Summarizing, the pattern of differences in preferences are supported also in this case, and moreover we are now able to confirm that even if the variation of the estimation of ρ we obtained is very moderate, the effect on consumption decision is very relevant.

3.6 Conclusion

The main objective of this paper was to analyze the difference in time and risk preference of individuals along the gender and marital status dimensions, and empirically test the following hypotheses: H1: Men are less risk averse than women; H2: Gender differences in preferences are much more pronounced for single agents; H3: Time preferences display less gender and marital status differences, but they generally display a pattern similar to risk aversion since the two preferences are correlated. In order to test these hypotheses we employed data from the DHS survey to carry out two different types of analyses. Results from both analyses generally go in the direction we hypothesized.

In the first part of the paper we concentrate our attention on two self-reported measures of time and risk preference. First, we run a detailed regression analysis on Dutch survey data where the dependent variables are in turn one of the two preference parameters. The results suggest that women are indeed more risk averse than men (H1). Single men are less risk averse than married men, while single women do not differ in risk preference from married ones. It is therefore true that gender differences are much stronger for single individuals than for married ones (H2). The results for time preferences are much less conclusive. We find no difference in either gender or marital status. In both cases, the pattern underlined by the control variables we inserted in the model is in line with previous results. It is nonetheless interesting to notice the strong role played by financial sophistication in determining both the risk and the time preferences. Being financially knowledgeable simultaneously decreases the risk aversion and extends the investments' time horizon. The same results are confirmed also with a bivariate regression that takes into account the correlation between the two dependent variables.

The second part of the paper is dedicated to the development and simulation of a life-cycle model, the solution of which allows us to obtain a structural estimation of the parameters of interest. Through an application of the method of simulated moments we are able to recover an estimation of the time discount and the risk aversion parameters, separately for the four groups of interest: single men, single women, married men and married women. Our results provide support for all of our hypotheses. Similarly to the regression analyses, the estimated parameters for risk aversion highlight that women are always more risk averse than men (H1). The estimated risk aversion parameters for married individuals lie inside the extreme estimates of single individuals. We can therefore confirm that the differences in risk attitude for married agents are less pronounced than for single ones (H2). It is also plausible to accept the fact that the preference parameters for a married man reflect partially the higher risk aversion parameter of his wife and therefore appears to be more risk averse than a single man. The opposite can be said for married women that appear to be less risk averse than their single counterparts. Finally, the time preference discounts we estimate display a pattern of differences for the four groups that closely follow the one we find for risk aversion. The correlation between the two preference parameters appears clearly: individuals with lower aversion to risk also have longer time horizon (H3). It is nonetheless important to notice that the difference between married and single women appears marginal if any, and that in general the differences in time preferences are much less pronounced than the difference in risk preference.

In future extensions of this work, we plan to consider a more detailed characterization of the life-cycle model with individual-specific utility functions and intra-household allocation for married individuals. A model in which individual-specific preferences for each member of the household are specified, can give us further insights on how financial investments of married individuals differ from the saving decisions of singles. The understanding of the gender differences might also benefit from such a richer characterization.

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Appendix A: Solution of the life-cycle model

In order to solve the life-cycle problem in the most efficient and simple way, it is necessary at first to reduce the dimensionality of the state space. We choose to standardize the variables by dividing everything by permanent income (P_t). We denote with C_t^* the optimal level of consumption in period t, and with the lowercase c_t^* the optimal level of standardized consumption defined as C_t^*/P_t. Lowercase letters will denote standardized value also for any other variable in the model.

We now define the relationship between the original and the standardized end of life value function as:

$$\begin{aligned} V_T(S_T, P_T) &= u(C_T^*) + \pi E_T[\beta\, B(S_T, P_T)] \\ &= (P_T)^{1-\rho}\, u(c_T^*) + \pi E_T[\beta\, (P_{T+1})^{1-\rho} B(s_T)] \\ &= (P_T)^{1-\rho} \left(u(c_T^*) + \pi E_T \left[\beta \left(\frac{P_{T+1}}{P_T} \right)^{1-\rho} B(s_T) \right] \right) \\ &= (P_T)^{1-\rho}\, V_T(s_T) \end{aligned}$$

In period t=T-1 we get a similar result:

$$V_{T-1}(S_{T-1}, P_{T-1}) = (P_{T-1})^{1-\rho} \left(u(c_{T-1}^*) + E_T \left[\beta \left(\frac{P_T}{P_{T-1}} \right)^{1-\rho} \{\pi\, V(s_{T-1}) + (1-\pi) B(s_{T-1})\} \right] \right)$$

$$= (P_T)^{1-\rho}\, V_T(s_T)$$

The standardized dynamic budget constraint becomes:

$$s_T \leq R a_{T-1} \frac{P_{T-1}}{P_T} + y_T$$

$$a_{T-1} = s_{T-1} - c_{T-1}^*$$

This formula can now be generalized to any period of life:

$$V_t(S_t,\, P_t) = (P_t)^{1-\rho}\, V_t(s_t)$$

where

$$V_t(s_t) = u(c_t^*) + \pi\, E_t[\beta_{t+1}\, V_{t+1}(s_{t+1})] + (1-\pi)\, E_t[\beta_{t+1} B(s_{t+1})]$$

subject to the budget constraint:

$$s_{t+1} \leq R(s_t - c_t^*)\frac{P_t}{P_{t+1}} + y_{t+1}$$

defining also

$$\beta_{t+1} = \beta\left(\frac{P_t}{P_{t+1}}\right)^{1-\rho}$$

$$\beta_{t+1}^* = \beta\left(\frac{P_t}{P_{t+1}}\right)^{-\rho}$$

We can now identify the solution of the model maximizing the new definition of the value function. The standardized function differs from the original one by only a scale factor and therefore it is indifferent for the consumer to maximize one or the other. The first order condition we obtain is:

$$\frac{\partial V_t(s_t)}{\partial c_t} = 0 \implies$$

$$\frac{\partial u(c_t)}{\partial c_t} = \pi\, E_t\left[\beta_{t+1}^* R \frac{\partial V_{t+1}(s_{t+1})}{\partial s_{t+1}}\right] + (1-\pi)\, E_t\left[\beta_{t+1}^* R \frac{\partial B(s_{t+1})}{\partial s_{t+1}}\right]$$

Using the envelope theorem we obtain the following form of the FOC:

$$\frac{\partial u(c_t)}{\partial c_t} = \pi\, E_t\left[\beta_{t+1}^* R \frac{\partial u(c_{t+1})}{\partial c_{t+1}}\right] + (1-\pi)\, E_t\left[\beta_{t+1}^* R\, \alpha \frac{\partial u(s_{t+1})}{\partial s_{t+1}}\right]$$

Appendix B: Estimation of Income Profiles and Target Moments

In order to estimate a realistic model, the first stage exogenous parameters are obtained using the same representative sample we already used for the regression analysis: the DHS waves from 1996 to 2013. Official data source have also been used to recover information on unemployment rate (OECD), rate of substitution (Social Security Programs Throughout the World Publication - Social Security Administration) and asset returns (Yahoo Finance and OECD).

For each group of interest we have to calibrate 19 exogenous parameters, among which only 15 are actually estimated on sample data. The parameters we take directly from official statistics' source are considered to be exact, and therefore they are not associated with a standard error. The unemployment rate is set to the average unemployment rate observed in the Netherlands during the same years covered by the DHS survey (4.3%). As for the corresponding replacement rate, 0.7 is an estimation of the unemployment benefit for the fist year of unemployment for an individual that has been working for the last nine years before being unemployed (minimum requirement to receive the unemployment benefit for a whole year). The conditional survival probability is set to be 0.9886, in order to ensure a life expectancy of 75 years. The asset return is group specific and it is computed with the following formula:

$$r = (1 - \lambda)r_f + \lambda(0.5\, r_S + 0.5\, r_B)$$

where λ is the average share of risky assets in the sample; r_f is the risk-free asset return, approximated with the average return of 3-month interbank interest rate (source: OECD - short term interest rate); r_S is the return to the risky assets, approximated with the Dutch stock market return (the average yearly return of the AEX index over the last 20 years[43]); r_B is the return on bond approximated with the 10-year Dutch State Loan (DSL) (source: OECD – long term interest rate). The standard errors are computed accordingly. The retirement age is set to the average retirement age in the sample (63 year old) and it is generally in line with the date reported by Statistics Netherlands for the corresponding period. The degree of altruism is set equal to zero in order to generate a 100% marginal propensity of consumption in the last year of life. This implies that all bequests are accidental and generated by an uncertain lifespan (as suggested by Hurd 1989). Finally, we proceed with the estimation of the income profile. The definition of household income

[43] We limit the computation of the asset return to be equal to the sample period coverage in order to have return that are as close as possible to the real situation in the recent years.

includes income from both the head of the household and the spouse (if present). It is comprehensive of social security, pension income, but net of taxes and it is converted to 2005-level euros[44]. The sample for the estimation is also restricted to households' head older than 25, either employed or retired. We then assume that the deterministic part of the income in the log form ($\log(Y_i) = y_i$) is a linear function of family size, an age polynomial of degree three for workers and degree one for retirees, the log-unemployment rate (as a proxy for year-specific business cycle effects), and cohort dummies:

$$y_i^W = \phi_0 + \phi_1 age_i + \phi_2 \frac{{age_i}^2}{100} + \phi_3 \frac{{age_i}^3}{10{,}000} + \phi_4 Hsize_i + \phi_5 lunemp_i + cohortD + \varepsilon_i^W$$

$$y_i^R = \phi_0 + \phi_1 age_i + \phi_4 Hsize_i + \phi_5 lunemp_i + cohortD + \varepsilon_i^R$$

The results are in line with income regressions estimated in the literature (e.g., Cocco, Gomes, and Maenhout, 2005; Bucciol, 2012); the coefficients and their relative standard errors are reported in Table 4. Moreover, to depurate the profile from year and cohort effects we use the estimated coefficients to compute the log-income prediction for a household of typical age-dependent family size, facing the average log-unemployment rate and whose head is born in the middle of the cohort. The formulas used for the computation are:

$$\hat{y}_{age}^W = \hat{\phi}_0 + \hat{\phi}_1 age + \hat{\phi}_2 \frac{age^2}{100} + \hat{\phi}_3 \frac{age^3}{10{,}000} + \hat{\phi}_4 \overline{Hsize}_{age} + \hat{\phi}_5 \overline{lunemp}_{age}$$

$$\hat{y}_{age}^R = \hat{\gamma}_0 + \hat{\gamma}_1 age_i + \hat{\gamma}_2 \overline{Hsize}_{age} + \hat{\gamma}_3 \overline{lunemp}_{age}$$

We then derive the income growth rate as:

$$\hat{G}_t = 1 + \hat{y}_t - \hat{y}_{t-1}$$

The computation of the permanent and transitory income shocks is based on GLS random effect regression, with a specification that is nearly identical to the previous one. A GMM estimation on the models' residuals allow us to obtain an estimation of the shocks and relative standard errors. In details, we assume that the underlying model for the income process can be represented as:

[44] For monetary amount collected before the year 2003, the official survey currency was the Dutch Guilders. All the amounts were converted to Euro with the official change rate of 2.20371 before correcting for inflation.

$$y_{it} = \beta_0 + \beta_1 age_{it} + \beta_2 \frac{age_{it}^{\ 2}}{100} + \beta_3 \frac{age_{it}^{\ 3}}{10{,}000} + \beta_4 Hsize_{it} + \beta_5 lunemp_{it} + yearD + \varepsilon_{it}$$

$$\varepsilon_{it} = u_{it} + \eta_{it}$$

$$\eta_{it} = \delta \eta_{it-1} + v_{it}$$

$$\begin{matrix} u_{it} \\ v_{it} \end{matrix} \sim iid \left(\begin{matrix} 0 \\ 0' \end{matrix} \begin{pmatrix} \sigma_u^2 & 0 \\ 0 & \sigma_v^2 \end{pmatrix} \right)$$

where σ_u^2 is the transitory shock and σ_v^2 is the permanent one. For the estimation of the shocks and the relative covariance matrix, we employ moments' condition based on:

$$E[\varepsilon_{it}\varepsilon_{it-k}] = \begin{cases} \sigma_u^2 + \dfrac{\sigma_v^2}{1-\delta^2} & k = 0 \\ \delta^k \dfrac{\sigma_v^2}{1-\delta^2} & k > 0 \end{cases}$$

The last step in the calibration process is the estimation of the target moments. Different targets can be exploited to carry out the estimation. In this paper, we choose to concentrate on the ratio of financial asset holdings to permanent income. We selected 7 indicators that will reflect the age profile of the ratio: the average over 5-year groups during the working age depurated from the cohort effects. We define financial wealth as the sum of checking accounts, savings or deposits accounts, savings certificates, insurance policies, bonds, stocks and mutual funds. Similarly to the definition of household's income, the total financial wealth is the sum of the financial wealth holdings of both partners in case of married individuals. Finally, in order to depurate the targets from the year and cohort effect, we apply here the same procedure we detailed before for the income process. We estimate the following regression analysis separately for the four groups of interests:

$$a_i = \varphi_0 + \varphi_1 age_i + \varphi_2 \frac{age_i^{\ 2}}{100} + \varphi_3 \frac{age_i^{\ 3}}{10{,}000} + \varphi_4 Hsize_i + \varphi_5 lunemp_i + cohortD + \varepsilon_i$$

We then eliminate the cohort and year effects by computing the predicted ratio, plugging the estimated coefficient in the following formula[45]:

$$\hat{a}_{age} = \hat{\phi}_0 + \hat{\phi}_1 age + \hat{\phi}_2 \frac{age^2}{100} + \hat{\phi}_3 \frac{age^3}{10{,}000} + \hat{\phi}_4 \overline{Hsize}_{age} + \hat{\phi}_5 \overline{lunemp}_{age}$$

[45] The definition of the variables in the formula is identical to the one we used in the estimation of the income profile.

Finally, we obtain the typical group-specific age profile of asset holding by computing the average of the predictions over five consecutive years:

$$\hat{a}_{\overline{age}} = (\hat{a}_{age-2} + \hat{a}_{age-1} + \hat{a}_{age} + \hat{a}_{age+1} + \hat{a}_{age+2})/5$$

The resulting targets are the average of the ratio of financial asset to income for the age groups 28-32, 33-37, 38-42, 43-47, 48-52, 53-57 and 58-62.

Table 1. Risk Aversion and Time Horizon Questions

Risk Aversion Items								
The following statements concern saving and taking risks. Please indicate for each statement to what extent you agree or disagree, on the basis of your personal opinion or experience.								
1	*"I think it is more important to have safe investments and guaranteed returns, than to take a risk to have a chance to get the highest possible returns."*							
2	*"I would never consider investments in shares because I find this too risky."*							
3	*"I want to be certain that my investments are safe."*							
4	*"If I think an investment will be profitable, I am prepared to borrow money to make this investment."*							
5	*"I get more and more convinced that I should take greater financial risks to improve my financial position."*							
6	*"I am prepared to take the risk to lose money, when there is also a chance to gain money."*							
Totally disagree	1	2	3	4	5	6	7	Totally agree

Time Horizon Question
People use different time-horizons when they decide about what part of the income to spend, and what part to save. Which of the time-horizons mentioned below is in your household MOST important with regard to planning expenditures and savings?
1 The next couple of months
2 The next year
3 The next couple of years
4 The next 5 to 10 years
5 More than 10 years from now

Note: risk aversion items 4-6 are reversed.

Table 2. Summary statistics (8,695 observations)

Variable	Mean	Std. dev.	Min.	Max.
Controls				
Age	54.812	13.63	24	80
Household Member	2.339	1.229	1	8
College	0.480	0.499	0	1
Employed	0.581	0.493	0	1
Log(Income)	10.215	0.615	0	13.984
Hold Risky Assets (t-1)	0.406	0.491	0	1
Financially knowledgeable (t-1)	0.274	0.446	0	1
Professional Advice (t-1)	0.224	0.417	0	1
Media Advice (t-1)	0.352	0.478	0	1
Gender and Marital Status				
Single Male	0.134	0.341	0	1
Single Female	0.131	0.337	0	1
Married Male	0.681	0.466	0	1
Married Female	0.054	0.225	0	1
Risk and Time preferences				
Risk Aversion index	5.189	1.088	1	7
Time Horizon	2.388	1.147	1	5

Table 3. Regression Analysis – Bivariate OLS

	(1) Risk Aversion	(2) Time Horizon	(3) Risk Aversion	(4) Time Horizon
Single Male	-0.173*	-0.119	-0.186**	-0.105
	(0.089)	(0.075)	(0.076)	(0.076)
Single Female	0.366***	-0.045	0.295***	-0.005
	(0.083)	(0.080)	(0.072)	(0.077)
Married Female	0.341***	-0.011	0.313***	0.008
	(0.079)	(0.079)	(0.068)	(0.076)
Age	0.025**	0.071***	0.028***	0.071***
	(0.011)	(0.010)	(0.009)	(0.010)
Age2/100	-0.012	-0.067***	-0.013	-0.067***
	(0.010)	(0.010)	(0.009)	(0.009)
Household Member	-0.046**	-0.017	-0.048**	-0.016
	(0.021)	(0.026)	(0.019)	(0.026)
College	-0.049	0.176***	0.017	0.146***
	(0.058)	(0.044)	(0.051)	(0.042)
Employed	0.001	-0.043	-0.005	-0.039
	(0.057)	(0.054)	(0.049)	(0.055)
Log(Income)	-0.146***	0.140***	-0.048*	0.094***
	(0.031)	(0.028)	(0.029)	(0.028)
Hold Risky Assets			-0.623***	0.259***
			(0.044)	(0.041)
Financially knowledgeable			-0.174***	0.146***
			(0.059)	(0.043)
Professional Advice			-0.076**	0.057
			(0.033)	(0.040)
Media Advice			-0.102***	0.034
			(0.031)	(0.034)
Constant	5.898***	-0.864**	5.102***	-0.519
	(0.400)	(0.409)	(0.369)	(0.409)
Year dummies	YES	YES	YES	YES
Observations	8,695	8,695	8,695	8,695
R^2	0.089	0.039	0.176	0.056

Note: Standard errors clustered at the household level in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 4. First Stage Calibration

Description	Couple Male	Couple Female	Single Male	Single Female
Degree of altruism	0	0	0	0
Survival probability	0.9886	0.9886	0.9886	0.9886
Retirement age	63	63	63	63
	(0.084)	(0.084)	(0.084)	(0.084)
Asset return	1.0273	1.0266	1.0282	1.0270
	(0.017)	(0. 015)	(0. 021)	(0. 016)
Income process - Workers				
Constant	6.1743	5.7712	5.4493	6.0440
	(0.852)	(1.819)	(1.306)	(1.206)
Age	0.2474	0.3019	0.2728	0.2483
	(0.060)	(0.136)	(0.094)	(0.088)
$Age^2/100$	-0.5212	-0.6380	-0.5444	-0.5113
	(0.139)	(0.326)	(0.221)	(0.208)
$Age^3/1000$	0.3433	0.4133	0.3648	0.3499
	(0.104)	(0.252)	(0.169)	(0.159)
Family size	-0.0300	-0.0774	0.0393	-0.0348
	(0.007)	(0.023)	(0.030)	(0.018)
Log(unemployment rate)	0.2397	0.1022	0.0224	0.0594
	(0.029)	(0.079)	(0.047)	(0.050)
Permanent shock	0.0101	0.0101	0.0145	0.0145
	(0.001)	(0.001)	(0.002)	(0.002)
Transitory shock	0.0624	0.0624	0.0404	0.0404
	(0.008)	(0.008)	(0.004)	(0.004)
Unemployment prob.	0.043	0.043	0.043	0.043
Replacement rate	0.7	0.7	0.7	0.7
Income process - Retirees				
Constant	11.1509	10.8279	10.2326	10.7277
	(0.130)	(0.601)	(0.222)	(0.209)
Age	-0.0157	-0.0149	-0.0021	-0.0113
	(0.002)	(0.008)	(0.002)	(0.003)
Family size	-0.0455	0.1150	-0.0533	0.0193
	(0.017)	(0.107)	(0.067)	(0.040)
Log(unemployment rate)	0.0868	-0.0350	-0.0222	-0.0968
	(0.035)	(0.166)	(0.080)	(0.071)
Asset Initial value	0.4255	0.1095	0.5437	0.1042
	(0.096)	(0.191)	(0.043)	(0.058)

Note: Standard errors in parentheses.

Table 5. Target Moments

Age Group	Couple Male	Couple Female	Single Male	Single Female
28-32	0.6445	0.2807	0.5532	0.2775
	(0.074)	(0.151)	(0.141)	(0.099)
33-37	0.8648	0.7237	0.6363	0.4925
	(0.056)	(0.123)	(0.116)	(0.092)
38-42	1.0805	1.1528	0.8844	0.6604
	(0.046)	(0.111)	(0.097)	(0.076)
43-47	1.3444	1.5423	1.2290	0.8574
	(0.041)	(0.108)	(0.082)	(0.061)
48-52	1.6849	1.8780	1.6764	1.0915
	(0.046)	(0.109)	(0.083)	(0.066)
53-57	2.2228	2.2161	2.1463	1.4288
	(0.053)	(0.115)	(0.096)	(0.079)
58-62	3.0109	2.5551	2.5792	1.8433
	(0.063)	(0.130)	(0.106)	(0.103)

Note: Targets describe the ratio of financial asset holdings to permanent income. Estimates are obtained from the DHS survey, waves 1996-2013. Standard errors in parentheses.

Table 6. MSM Estimation – Robust estimation

Variable	Estimate	Std. dev.	Conf. Interval	Adapt. Index
Couple				
Male				
ρ	2.0968	0.00572	[2.0855 2.1080]	0.2033
β	0.9909	0.00025	[0.9904 0.9914]	
Female				
ρ	2.3294	0.04605	[2.2391 2.4197]	0.0436
β	0.9825	0.00088	[0.9808 0.9843]	
Single				
Male				
ρ	1.9581	0.01602	[1.9266 1.9894]	0.1594
β	0.9942	0.00065	[0.9929 0.9954]	
Female				
ρ	2.5162	0.02594	[2.4653 2.5671]	0.0686
β	0.9737	0.00069	[0.9724 0.9751]	

Note: The results are based on 1,000 simulations. The adaptation index is built as the squared root of the average quadratic distance of the simulated moments from the respective target moments.

Table 7. Actualized Consumption – Fixed ρ, Changing β

	Couple Male ϱ_{CM}=2.0968	**Couple Female** ϱ_{CF}=2.3294	**Single Male** ϱ_{SM}=1.9581	**Single Female** ϱ_{SF}=2.5162
β_{CM}= 0.9909	34.6967 (0.043)	35.4166 (0.063)	34.1881 (0.031)	34.7792 (0.048)
β_{CF}= 0.9825	34.3727 (0.038)	34.7727 (0.052)	34.0527 (0.028)	34.3462 (0.039)
β_{SM}= 0.9942	34.8688 (0.046)	35.7074 (0.068)	34.2800 (0.033)	34.9744 (0.052)
β_{SF}= 0.9737	34.1693 (0.036)	34.2903 (0.044)	34.0054 (0.027)	34.0032 (0.034)

Note: The results are based on 1,000 simulations of the life-cycle model without mortality risk.

Table 8. Actualized Consumption – Changing ρ, Changing β

	Couple Male	**Couple Female**	**Single Male**	**Single Female**
β_{CM}=0.9909; ϱ_{CM}=2.0968	34.6967 (0.043)	35.2311 (0.059)	34.2226 (0.032)	34.5347 (0.042)
β_{CF}=0.9825; ϱ_{CF}=2.3294	34.4381 (0.040)	34.7727 (0.052)	34.1109 (0.030)	34.2369 (0.037)
β_{SM}=0.9942; ϱ_{SM}=1.9581	34.8254 (0.045)	35.4341 (0.062)	34.2800 (0.033)	34.6663 (0.044)
β_{SF}=0.9737; ϱ_{SF}=2.5162	34.2580 (0.038)	34.4161 (0.047)	34.0517 (0.028)	34.0032 (0.034)

Note: The results are based on 1,000 simulations of the life-cycle model without mortality risk.

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