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Biased Survival Beliefs, Psychological and Cognitive Explanations, and the Demand for Life Insurances

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Biased Survival Beliefs, Psychological and Cognitive Explanations, and the Demand for Life Insurances

March 1, 2015

Very Preliminary and Incomplete

Abstract

This paper presents new findings on biased survival beliefs by constructing their individual-level objective counterparts. We find that biases can be modelled through age-dependent probability weighting functions as known in cumulative prospect theory. The dynamics of these probability weighting functions over age suggest that misconception is increasingly driven by pessimism and likelihood insensitivity. These findings are in line with rationalizations in the literature using structural behavioral learning models with psychological biases. Exploiting newly available data from the Health and Retirement Study (HRS) on psychological factors we provide further empirical evidence supporting these explanations. Finally, we show that misconception is relevant for the demand for life insurance.

JEL Classification: D12, D83, I10.

Keywords: Subjective survival beliefs, Probability Weighting Functions, Psychosocial Explanations, Cognitive Explanations

1 Introduction

Models of inter-temporal decision making rely on forward looking behavior of economic agents. Fundamental decisions on retirement, consumption and saving, and the purchase of insurance against late-life risks are all based on subjective survival probabilities (SSP). In line with the rational expectations paradigm, in dynamic household decision models it is common to consider expected utility maximizing agents whose updated subjective beliefs coincide with objective conditional survival probabilities. Only recently, it has been shown that on average, individuals underestimate their survival chances when young, and overestimate it at older ages (Ludwig and Zimper, 2013). This has motivated researchers to incorporate subjective assessments of survival probabilities into dynamic models (Gan et al. (2005), and Groneck et al. (2013)).

In this paper, we study the deviation of subjective survival probabilities from the objective counterpart from a micro-perspective with the aim to shed light on the causes of misconception of survival probabilities and their economic consequences. We make four main contributions. First, we estimate objective survival probabilities on an individual level and compare these to data on subjective survival probabilities from the Health and Retirement Study (HRS). We find a systematic survival misconception which behaves in accordance with the inverted-S-shape that has been elicited from probability weighting functions in cumulative prospect theory (Kahneman and Tversky, 1979; Tversky and Kahneman, 1992). In addition, we show that the shape of the probability functions is not constant across age but implying increasing pessimism and likelihood insensitivity. Increasing likelihood insensitivity describes the diminishing sensitivity for probabilistic sophistication. With regards to this cognitive interpretation individuals do not sufficiently distinguish between probabilities when they report their beliefs.

Second, we illustrate that our findings are in line with a theory of biased bayesian learning proposed by Ludwig and Zimper (2013) and Groneck et al. (2013) that is consistent with the age-dependent data pattern.

Third, we find empirical evidence for the importance of psychological (i.e optimism / pessimism) and cognitive effects for the formation of subjective survival probabilities using newly available data from the HRS which started eliciting information on psychosocial dispositions in 2006. Our results suggest that psychological and cognitive variables are an important explanation for subjective survival probability formation which further validates rationalizations of age-dependent probability weighting in the literature. We find that optimism (pessimism) has a positive (negative) level effect on subjective survival probabilities. Furthermore, we find that higher cognitive ability is associated both with more accurate survival assessments and use of objective information.

Fourth, we explore the economic importance of the biases in survival probability assessments. In particular, we study whether misconception of survival probabilities has an impact on life insurance decisions of households. Controlling for a variety of socio-economic and health factors, we find that individuals who overestimate their survival probability are less likely to hold life-insurances.

Literature

Our paper bridges the empirical literature on survival probability formation with the literature on the importance of subjective survival assessments on economic decision making.

Economic literature on subjective survival probabilities starts with the pioneering work of Hamermesh (1985)¹. The literature generally finds that SSPs broadly coincide with actuarial ones and co-vary with other factors in the same way OSPs vary with these factors (Hurd and McGarry, 1995; Perozek, 2008; Edwards and Zulkarnain, 2012; Liu et al., 2007). However, taking into account a more complete age range several authors have pointed out a systematic and age-dependent bias, i.e. relatively young individuals underestimate their probability to survive whereas relatively old individuals overestimate their probabilities to survive (cf. Elder (2013); Hamermesh (1985); Ludwig and Zimmer (2013); Peracchi and Perotti (2012)). Along the panel dimension it was shown that SSPs serve as predictors of actual mortality (Hurd and McGarry (2002) and Smith et al. (2001b)) and that individuals revise their SSPs in response to new adverse (health) shocks (cf. Viscusi (1985); Liu et al. (2007)).² The latter fact has been interpreted as evidence for rational bayesian learning.

We extend this literature by, first, explicitly estimating individual objective survival rate as done by Khwaja et al. (2007, 2009)³. This allows us to study *individual* misconceptions of survival probabilities.

Second, highlighting how psychological and cognitive factors contribute to the formation of subjective survival probabilities we extend previous research in economics which has been mainly concerned with objective determinants of the formation of SSPs. Psychometric measures were long not available in large-scale surveys, thus empirical studies trying to test the impact of psychological factors on economic variables are scarce. For example, in the HRS, psychometric measures did not start until 2006. To circumvent this

¹Apart from economists, sociologist and psychologists have studied subjective life expectancies (instead of survival probabilities). Early contributions are (Handal, 1969; Robbins, 1988; Joubert, 1992; Tolor and Murphy, 1967; Denes-Raj and Ehrlichman, 1991). See Mirowsky (1999); Mirowsky and Ross (2000); Ross and Mirowsky (2002) and Kastenbaum (2000, 2012) for literature reviews.)

²See also Benitez-Silva and Dwyer (2005), Benitez-Silva and Ni (2007), Smith et al. (2001b) and Hurd and McGarry (2002) who generally find that some health shocks, like newly diagnosed cancer, exert a negative influence on SSPs.

³Winter and Wuppermann (2014) use a similar method but in a different context. They estimate individual objective probabilities of having a certain disease within a given time period.

lack of data, Puri and Robinson (2007) take the difference between subjective and objective life-table survival probabilities as a measure of dispositional optimism. However, this is only an approximation since any deviation from average life-table estimates might simply reflect private information. Thus, with the relatively new data available, we will explicitly explore to what extent subjective belief formation is depending on psychological measures. There are only a few studies that have employed the psychosocial information of the HRS. Some medical studies examine the link between psychosocial dispositions and health shocks (Kim et al., 2011) or biases in subjective body weights (Sutin, 2013). Using HRS data economists investigated the interaction of personality traits and retirement (Hurd et al., 2012) and labor force transitions (Angrisani et al., 2013). To the best of our knowledge, Griffin et al. (2013) and Mirowsky and Ross (2000) are the only studies incorporating psychological influences associated with subjective life expectancy. Griffin et al. (2013) use a sub-sample of the "45 and Up Study" of the Australian population. Mirowsky and Ross (2000) use a small sample on American adults. We extend their studies by using subjective survival probabilities and the impact of psychosocial factors once objective information is taken into account.

Our study is related to recent decision theoretic contributions, in particular *cumulative prospect theory*. One of its main concepts is depicted in probability weighting functions which capture deviations of subjective probabilities from its objective counterparts. Experiments generally show that the descriptive power of CPT clearly outperforms expected utility theory, c.f. Abdellaoui et al. (2011) and Wakker (2010) and references therein. Ludwig and Zimmer (2013) and a refined version in Groneck et al. (2013) explicitly model biased survival probabilities in a dynamic setting with age-dependent biases. This study is the first attempt to present microeconomic evidence on this age pattern.

Finally, our paper extends the literature studying the economic importance of misconception in assessing risk (Rutledge et al., 2014; Salm, 2010)

The paper proceeds as follows. The next Section 2 presents our data set and the variables used for all models. Section 3 presents stylized facts on subjective survival probabilities. In Section 4 we present theory that is consistent with these stylized facts while Section 5 studies important drivers of misconception of subjective survival probabilities (SSPs). In Section 6 we estimate economic consequences of biased survival probabilities and Section 7 concludes.

2 Data

The Health and Retirement Study (HRS) is a national representative panel study on biennial basis administered by the University of Michigan for individuals older than 50.

The first cohort started in 1992. In subsequent waves, more cohorts were included, by 2010 the HRS included six cohorts. Since 2006 the HRS is complemented with a rich set of psychosocial information. These data are collected in each biennial wave from an alternating (at random) 50% of all core panel participants who were visited for an enhanced face-to-face interview (EFTF). Thus, longitudinal data are available in four-year intervals and the first panel with psychosocial variables is provided in 2010. In addition, we use variables of a data set provided by RAND. The RAND Center for the Study of Aging creates a streamlined and user-friendly version of a subset of the HRS. The advantage is that variables are already cleaned and consistent across waves. An overview of the structure of the data set is provided in Appendix 6.

2.1 Sample

The sample contains psychosocial variables from wave 8 onwards. We restrict our baseline analyses to waves 8,9 and 10 (2006-2010). Individuals who did not report their SSPs were automatically dropped from the sample. By survey design these include proxy interviews as well as interviewees older than 89. Moreover, we exclude individuals younger than 65 from our analyses since we do not have information about their OSPs, cf. section 2.3 for details.

As a result the pooled sample of the HRS waves 2006-2010 (wave 8-10) comprises 32,053 observations of which 18,267 (57%) are women and 13,786 (43%) are men. In an empirical updating model – although using the same set of individuals – we will additionally make use of wave 7 for two reasons. First, we need to construct a lagged version of the subjective survival probabilities, SSP_{t-1} . Second, we need two subsequent observations of the same individual to create shock variables (see below for details).

2.2 Subjective Survival Probability

Subjective survival probabilities (SSPs) can be directly elicited from the HRS. In the questionnaire, interviewees of age h are asked about their $SSP_{h,m}$ to live to at least a certain target age m . The exact wording of the question is as follows:

“What is the percent chance that you will live to be [target age] or more”?

A value of 0 means ‘absolutely no chance’ and a value of 100 means ‘absolutely certain’. The assigned target age depends on the age h at the time of the interview. The mapping of ‘interview age’ and ‘target age’ is not consistent across waves. Generally, the target age is meant to reflect the chance of living about another 10 years. The pattern of the

target ages m used from wave 2006 onwards is displayed in Table 1.⁴

Table 1: Interview and Target Age

Interview age h	Target Age m
50-64	85
65-69	80
70-74	85
75-79	90
80-84	95
85-89	100

Source: HRS (2013), waves 2008-2010

2.3 Objective Survival Rates

In order to study individual survival misconceptions we need to determine objective survival probabilities (OSP) on an individual level as a direct comparison. Of course, this data is generally not available and has to be estimated. Previous studies have used data from (cohort) life-tables as comparison, cf. Ludwig and Zimmer (2013), Groneck et al. (2013), Perozek (2008) and Peracchi and Perotti (2012) or death rates elicited directly from the survey. While this approach is well suited for aggregate analysis of subjective survival probabilities, average objective survival rate data is ill-suited for studying individual decision making. The reason is simply that individual (objective) life expectancies generally deviate from averages given in life-tables. Hence, we have to estimate the objective probability on an individual level. To this end, we adapt the methods described in Winter and Wuppermann (2014); Khwaja et al. (2009, 2007). In order to get the OSPs, we estimate duration models for each survival distance, 11-15 years. We estimate hazard rates for mortality conditioning on several individual-level characteristics. These hazard rates are then used to estimate objective survival probabilities.

In order to compute the duration model one has to pick a baseline year. However, that year is earlier than the time of collection of the SSPs because we need to at least account for the prediction horizon. Thus, we assume that the conditional relationships between individual characteristics and mortality do not change over these time spans. Obviously, this assumption might be violated. For instance, if a new health technology significantly changes the treatment of serious diseases the conditional relationship between mortality, and say, cancer might change. Thus, in order to minimize the possibility of technological changes that alter these conditional relationships we try to pick the most recent years

⁴Note that the pattern of target ages of age group '50-64' has changed over time. However, this does not affect our analysis as we focus on individuals aged between 65 and 89 only.

as a baseline year. Considering that we have prediction horizons of between 11 – 15 years, we choose a baseline year depending on the prediction distance. For instance, if the time horizon is 15 years and given the last interview year is 2010 (wave 10) we choose as a baseline year interviews conducted in year 1995. Generally, we do not believe our assumption to be too strong. The reason is simply that usual life-table estimates are subject to the same problem. We are confident that our data are superior to these as we include much more information. Besides information on age, gender, and race we include numerous variables on health (-history), family, and socioeconomic status. A full list of the variables used and a detailed description of the method applied can be found in Appendix B.

2.4 Psychological and Cognitive Variables

We study the impact of psychological and cognitive variables for the assessment of subjective survival probabilities.

Table 2: Vector of Psychological Variables

Psychological Variables (psycho_{i,t})	Explanation	Mean	SD	α^*
Dispositional Optimism	Range 1-6	4.53	1.16	0.80
Dispositional Pessimism	Range 1-6	2.60	1.30	0.77
Cognitive Variable (cog_{i,t})	Explanation	Mean	SD	
Cognitive Ability	Range 0-35	21.47	5.16	n.a.

Notes: * Cronbrach's α

From wave 8 onwards the HRS contains variables measuring the degree of optimism and pessimism of the respondents. Statements to measure this form of *dispositional optimism (pessimism)* were the same as in the well-known Life Orientation Test-Revised (LOT-R) (e.g. "In uncertain times I usually expect the best").^{5 6}

⁵The Life Orientation Test-Revised questionnaire (LOT-R) was developed to measure dispositional optimism, i.e. a generalized expectation of good outcomes in one's life' (Scheier and Carver, 1987; Scheier et al., 1994). Kaniel et al. (2009) find dispositional optimism as measured with LOT-R to be related to various expectations about events in a labor market setting.

⁶Dispositional optimism and pessimism are measured separately as these two concepts were found to show some bi-dimensionality (Herzberg et al., 2006). Some authors neglect the possibility of bi-dimensionality in their empirical investigation (Liu et al., 2007). In our empirical analyses we use separate variables for each concept although in our theoretical analysis we speak of increasing pessimism and decreasing optimism interchangeably.

Respondents are given various statements regarding a specific latent variable. For most variables they were asked "please say how much you agree or disagree with the following statements". Each statement was rated on a scale from one (*strongly disagree*) to six (*strongly agree*). Therefore, a higher score reflects more agreement. Average scores are taken to create indices for each psychological construct. The index score is set to missing if responses on more than half of the statements are missing.

In addition, we include a variable indicating the cognitive ability of the respondent. We use this variable to proxy the respondents sophistication to distinguish sufficiently between probabilities. Our measure of cognitive ability is a composite score directly taken from RAND and combines the results of several cognitive tests. For instance, respondents were asked to recall a list of random words, to count backwards and to name the (Vice) President. In total there are 35 questions and results are summarized in our score. Generally, a higher score indicates higher cognitive ability.

2.5 Financial Decision Variables

For our later analysis of the impact of misconception on economic behavior we use a question on whether the individual holds any life insurances ("*Do yo have any life insurance, including individual or group policies?*").

Table 3: Financial Variables

Variables	Explanation	Mean	SD
Life Insurance Holding	1 if any life insurance	0.61	0.49

2.6 Control Variables

All summary statistics below refer to the pooled sample of waves 8-10. General control variables are listed in Table 4. As demographic characteristics we choose current age of the respondent as well as the distance from current age to the next target age, $m - age$, which was shown to have an independent and significant effect, cf. Wu et al. (2013). For race a dichotomous indicator is used. The family situation is captured by marital status, *Married*, or whether the partner died, *widowed*. Furthermore, indicator variables of whether the parents are still alive or not are created. Since the (genetic) effect is likely to be dependent of whether the parent is of the same sex or not, we include two separate variables. The variables are one if the respective parent is still alive and zero if the parent has deceased. Finally, we include a dichotomous variable indicating whether a respondent has children or not.

Table 4: General Control Variables

Variable	Explanation	Mean	SD
Age	Age in years	74.42	6.51
$m - age$	Distance to Target age (m)	13.07	1.41
Male	1 if male	0.43	0.50
Black	1 if black	0.14	0.35
Married	1 if married	0.59	0.49
Widowed	1 if widowed	0.27	0.44
Children	1 if children	0.93	0.23
Dad alive	1 if dad alive	0.01	0.10
Mom alive	1 if mom alive	0.06	0.23
College	1 if college degree	0.19	0.39
Individual wealth (excluding second. housing)	Real wealth in \$-US	-1617	571090
Individual wealth (including second. housing)	Real wealth in \$-US	316902	788298
Bequest $\geq 100,000$ \$-US	Subj. Prob.	46.80	43.88

Variables measuring the nominal household net wealths are adjusted⁷. The impact of education is measured by a binary variable indicating whether an individual does at least hold a college degree. Additionally, we include a measure that is thought to capture a motive for bequest. People are asked about their subjective probability to leave a bequest of at least 100,000 \$-US dollars.

⁷Deflation to 1990 US-dollar values was done using the Consumer Price Index - All Urban Consumers. Data were downloaded in November 2014 on <http://www.bls.gov/cpi/>.

Table 5: Health Variabels

Variable	Explanation	Mean	SD
Health behavior			
Self Reported Health	1 if excellent, or (very) good	0.36	0.48
ADL Index	Range 0 - 3	0.28	0.69
Mobility Index	Range 0 - 5	1.42	1.62
Large Muscle Index	Range 0 - 4	1.48	1.33
Obesity	1 if obese, i.e. $BMI \geq 30$	0.28	0.45
Currently Smoker	1 if currently smoker	0.095	0.29
Drink Alcohol	1 if ever drinks alcohol	0.46	0.50
Vigorous Exercises	1 if at least once a week	0.28	0.45
Moderate Exercises	1 if at least once a week	0.63	0.48
Diagnosed diseases			
High Blood pressure	1 if ever diagnosed	0.67	0.47
Diabetes	1 if ever diagnosed	0.25	0.43
Cancer	1 if ever diagnosed	0.19	0.40
Lung disease	1 if ever diagnosed	0.12	0.33
Heart disease	1 if ever diagnosed	0.32	0.47
Stroke	1 if ever diagnosed	0.12	0.32
Psycho	1 if ever diagnosed	0.17	0.37
Arthritis	1 if ever diagnosed	0.70	0.46

As health factors we choose diagnosed diseases, other health measures and health behavior which are listed in Table 5. Eight different diagnoses are used: High blood pressure, diabetes, cancer, lung disease, heart disease, stroke, psychological/emotional and arthritis. As additional health measures we use self reported health as well as three indices indicating the individuals need of long-term care. These are the ADL index (Activities of Daily Living)⁸, the mobility index⁹ and the large muscle index¹⁰. Each 'yes' answer increases the respective index by one unit.

As health behavior we choose obesity, smoking behavior (whether a person has ever been or is currently a smoker) as well as a dummy variable indicating whether the person ever drinks alcohol. Also, we display measures to reflect physical activity. Two binary

⁸three activities: bathing, dressing, eating

⁹five activities: walking several blocks, walking one block, walking across the room, climbing several flights of stairs, climbing one flight of stairs.

¹⁰four activities: sitting for two hours, getting up from a chair, stooping or kneeling or crouching, and pushing or pulling a large object

variables measuring whether the responded engages in vigorous or moderate exercises at least once a week are created.¹¹ It must be stated that we do not use the variables on exercise behavior in our estimation of OSPs since the variables were not available before wave 6.

Table 6: Dummy variables

Variable	Explanation	Mean	SD
Wave dummies			
Wave8	1 if obs. of wave 8, 0 otherwise	0.34	0.47
Wave9	1 if obs. of wave 9, 0 otherwise	0.34	0.47
Wave10	1 if obs. of wave 10, 0 otherwise	0.32	0.32
Target Age-interview age			
m-65-69	1 if age within age interval 65-69	0.28	0.49
m-70-74	1 if age within age interval 70-74	0.28	0.45
m-75-79	1 if age within age interval 75-79	0.21	0.40
m-80-84	1 if age within age interval 80-84	0.14	0.35
m-85-89	1 if age within age interval 86-89	0.09	0.30

Additionally, we include a set of dummy variables. Note that the dummy variables listed in Table 6 give a good overview of the sample composition with regards to age as target ages in our sample are unambiguously linked to a certain age range.

¹¹*vigorous* exercises include running, jogging, swimming, cycling, aerobics or gym workout, tennis, or digging with a spade or shovel. *Moderate* exercises include gardening, cleaning the car, walking at a moderate pace, dancing, floor or stretching exercises.

Table 7: (Health) Shock Variables

Variable, (θ_i)	Explanation	Mean	SD
Activity Restrictions			
Δ ADL	1 if newly diagnosed	0.11	0.31
Δ Mobility	1 if newly diagnosed	0.27	0.44
Δ Large Muscle	1 if newly diagnosed	0.29	0.46
Health Shocks			
High Blood pressure	1 if newly diagnosed	0.10	0.31
Diabetes	1 if newly diagnosed	0.06	0.24
Cancer	1 if newly diagnosed	0.05	0.22
Lung disease	1 if newly diagnosed	0.04	0.19
Heart disease	1 if newly diagnosed	0.08	0.28
Stroke	1 if newly diagnosed	0.04	0.18
Psycho	1 if newly diagnosed	0.04	0.20
Arthritis	1 if newly diagnosed	0.08	0.28
Family Shocks			
Father died	1 if newly diagnosed	0.02	0.15
Mother died	1 if newly diagnosed	0.01	0.08

Lastly, we construct several shock variables as follows: A (health) shock is an event that occurs between two interviews. For instance, if a respondent reports to currently suffer from lung cancer but in previous wave did not indicate to suffer from lung cancer, the individual is defined to have experienced a cancer shock. Likewise parental death is defined. Additionally, we include changes in activity limitations. For example, Δ ADL indicates if the number of activities that pose at least 'some difficulty' have increased between two waves. All shock variables are summarized in Table 7.

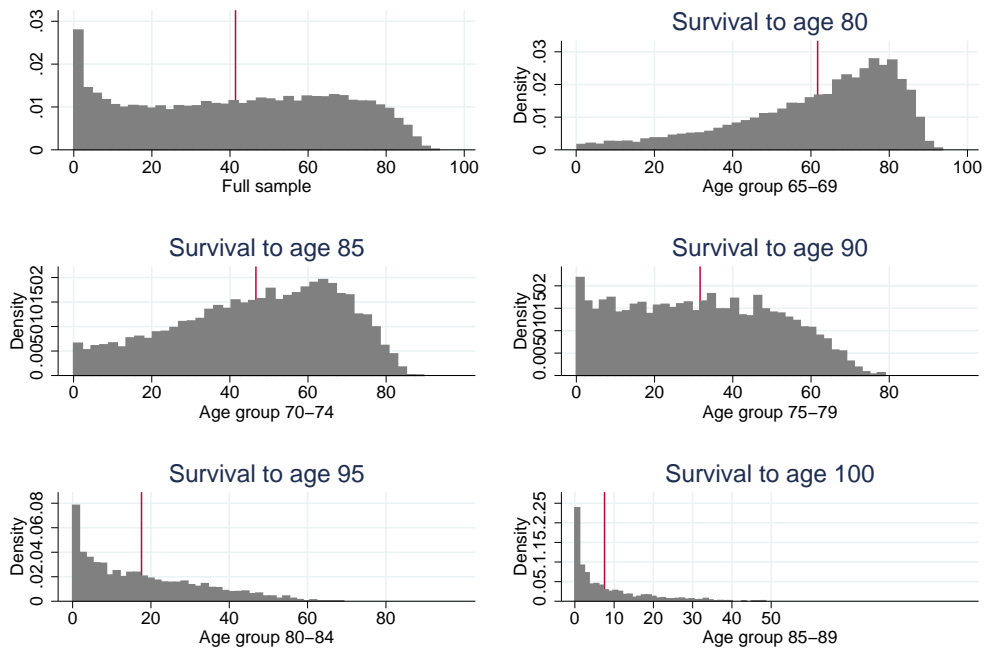
3 Stylized Facts

3.1 Subjective and Objective Survival Probabilities

The next two Figures 1 and 2 are intended to better understand our estimates of OSPs. For this we present two figures with six sub-figures each. Five focus on a certain age range and one shows results for the full sample. Each sub-figure is composed of a histogram highlighting distributional patterns and a vertical red line which marks the average value. The estimated age-specific objective survival probabilities (OSP) are depicted in Figure 1.

The OSP are unconditional probabilities to survive to some target age in accordance with the questionnaire on subjective survival in the HRS. Two facts emerge: First, there is significant heterogeneity of OSPs within each age group – something which is ignored by simply looking at average values. Second, with rising age the probability mass is moving to the left.

Figure 1: Distributions of Objective Survival Probabilities (OSP)



Source: HRS and Own Calculation

Survival misconception, i.e., the difference between the subjective survival probabilities question elicited from the HRS and the corresponding estimated individual objective survival probability is depicted in Figure 2. Note that comparing average subjective survival probabilities with their estimated objective counterparts (vertical red lines) we replicate well-established results as in Ludwig and Zimmer (2013). On average individuals in our youngest age group underestimate their probability to survive and older people overestimate their probability to survive. This pattern clearly contradicts standard economic theory which states that there should be no difference between objective and subjective survival probabilities¹². In particular, it contradicts the theory of rational bayesian learn-

¹²Note, that Ludwig and Zimmer (2013) find underestimation of survival probabilities of younger age groups that is even more pronounced. We cannot make a statement about this as we lack respective estimated OSP data.

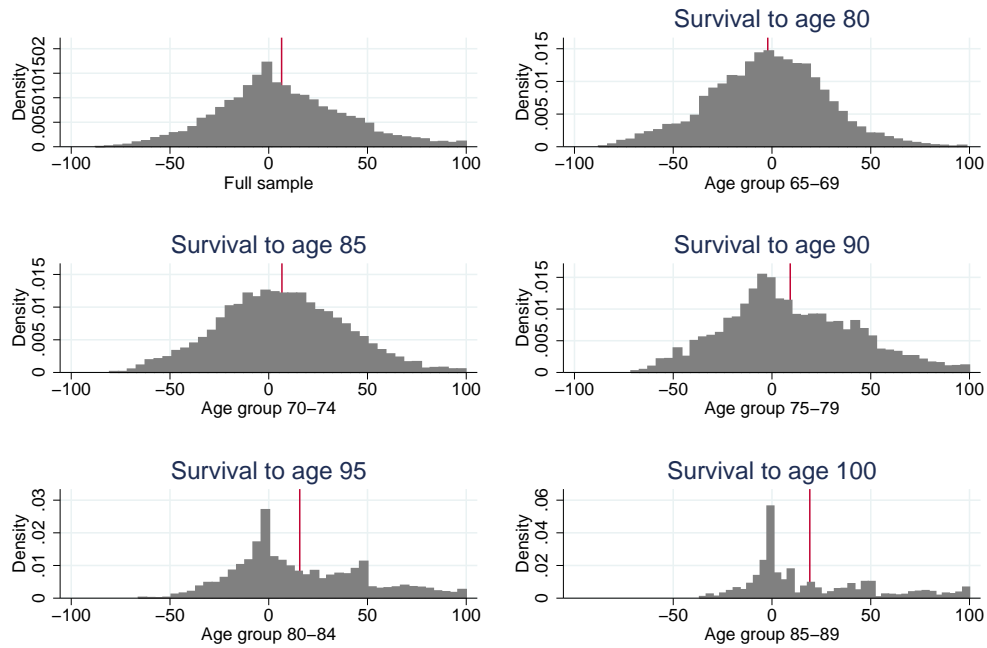
ing which predicts convergence of SSPs and OSPs. In the data, however, SSP start to depart from their true probabilities after age 70.

For the age range 65 – 69 – when average OSPs are approx. 60 percent – average misconception is approximately normally distributed around zero. On the contrary, for the oldest age group – when average OSPs are below 10 percent – average misconception is around 20 percentage-points – the distribution of misconception is highly skewed. Furthermore, note that although on average overestimation is very high there still seems to be a large fraction of individuals with misconceptions around zero. This highlights one potential problem of our data structure, which we label the '*censoring effect*'. The '*censoring effect*' stands for the fact that the range of possible misconception is dependent on the level of OSP. If the OSP is 50 percent, the range of possible over- and underestimation is the same. But for lower (higher) objective probabilities, the possible range for understimation (overestimation) becomes smaller.

When we later study the impact on psychological factors like optimism and pessimism for the formation of survival belief, it is hard to disentangle whether a potential misconception of survival belief stems from, e.g., pessimism, or from the above censoring effect. For example, it is not clear whether the peak around zero for e.g. the oldest age group 85 – 89 in Figure 2 indicates a precise estimation or whether it is driven by the fact that (old) pessimists cannot underestimate¹³.

¹³On the one hand, consider a group of very old people of which everyone is, say 100 years old. Let OSPs for everyone be of around 1%. Obviously, no one can significantly underestimate her probability to survive – even though she might be very pessimistic. On the contrary, the possible range of overestimation is very large, so that only a few (very) optimistic individuals can significantly drive mean misconception for the group upwards, i.e. due to OSP-level dependent range of misconception only overestimators count. On the other hand, considering the group of teenagers of which everyone has very high OSPs of, say 98%, the possible range of overestimation is limited and only a few (very) pessimistic individuals drive the average misconception downwards.

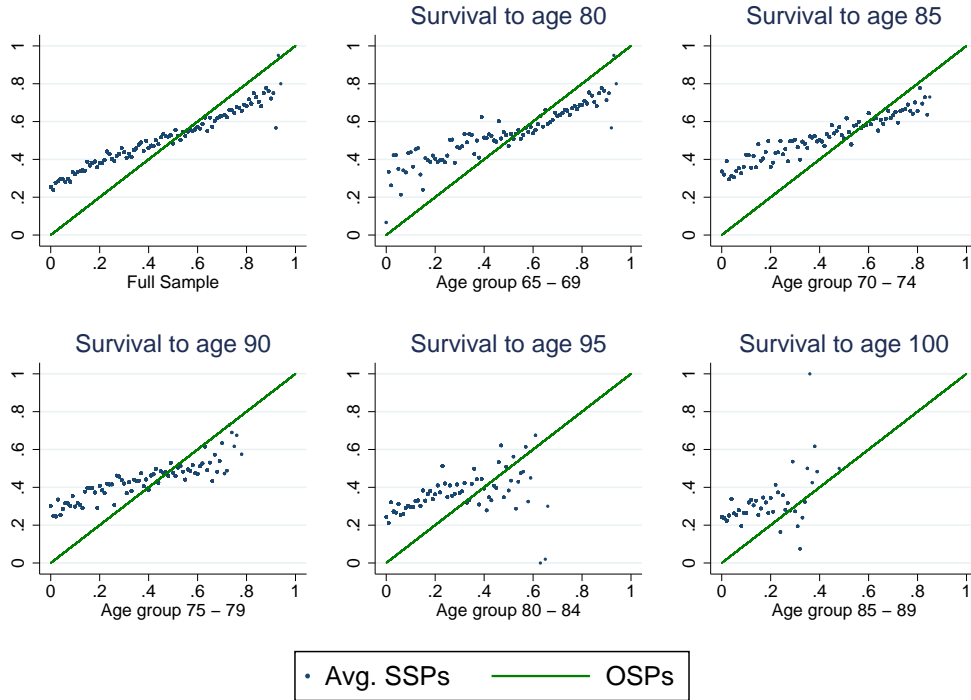
Figure 2: Distribution of Misconceived Survival Probabilities ($SSP - OSP$)



Source: HRS and Own Calculation

Figure 3 depicts a scatterplot of pairs of subjective survival probabilities and the corresponding objective probability. For each objective probability the corresponding average subjective belief is depicted. The 45-degree line implies that the subjective belief coincides with the objective counterpart. The figure shows a positive correlation between subjective and objective probabilities. More importantly, for lower objective probabilities the corresponding subjective belief is above the 45-degree line while for probabilities close to one, the points are below the 45-degree line. The pattern implies an overestimation of small survival probabilities and an underestimation of high survival probabilities.

Figure 3: Subjective and Objective Probabilities

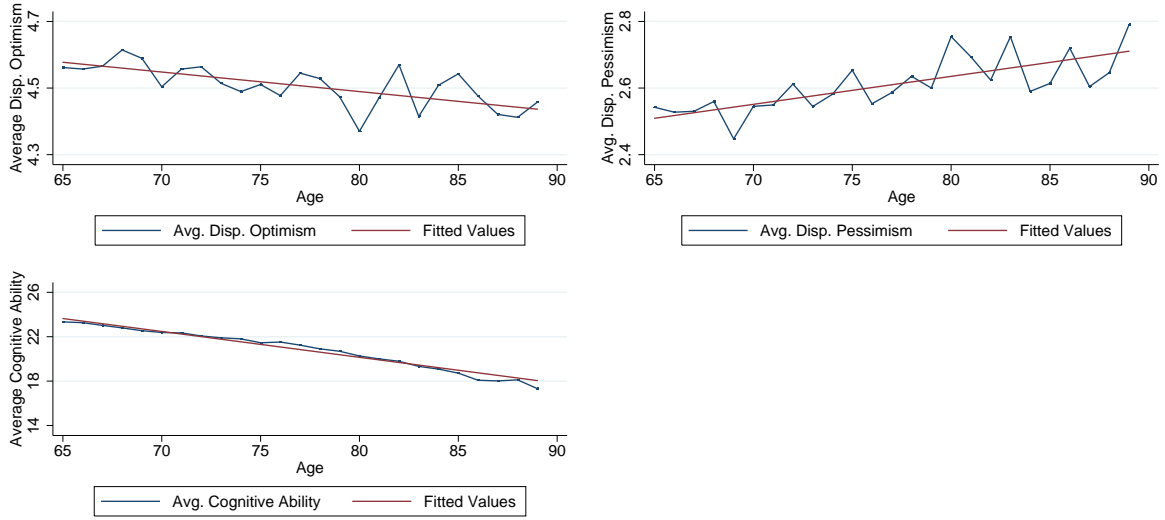


Source: HRS and Own Calculation

3.2 Psychological and Cognitive Measures over the Life Cycle

Owing to its importance for our theoretical model (see below) and later empirical analyses in Figure 4 we display how average values of our psychological and cognitive abilities measures evolve over age. On the right hand side we display 'cognitive ability' which is key for our interpretation of 'likelihood insensitivity' being a cognitive phenomenon. Between age 65 and age 89 the average value of cognitive ability is decreasing from 23.4 to 17.9 (-23.5%). On the left hand side it is illustrated how average values of optimism and pessimism evolve over age. Over age optimism decreases by 2.9% and pessimism increases by 12.2%. The fact that pessimism increases much more than optimism decreases supports the notion of bi-dimensionality of these two measures. In sum, on average age-dependence is more pronounced for our cognitive measure than for our psychological measures.

Figure 4: Psychological and Cognitive Variables Across Age



Source: HRS

4 Theory on Subjective Beliefs

This section presents theory that is in line with the stylized facts on subjective survival probabilities shown in previous figures. Further, we estimate the models to the aforementioned data on survival misperception.

In this Section 4 we present probability weighting functions from cumulative prospect theory that can account for the general pattern of subjective survival misconception for the full sample. Additionally, we refer to a theoretical model that is able to rationalize our findings.

(Cumulative) Prospect Theory

(Cumulative) prospect theory is a descriptive decision model for individual belief formation under risk (Tversky and Kahneman, 1992; Kahneman and Tversky, 1979). One of its main concepts is depicted in *probability weighting functions* which capture the notion that people focus (too) much on extreme probabilities. In many different scenarios people were shown to overweigh low probabilities near zero and underweigh high probabilities near one (Hamermesh, 1985; Ludwig and Zimmer, 2013; Peracchi and Perotti, 2012). Several authors have tried to fit empirically probability weighting functions. These were commonly found to exhibit an inverse S-shaped form (Preston and Baratta, 1948; Wu and Gonzalez,

1996; Tversky and Kahneman, 1992).

Wakker (2010) illustrates two components that help explaining non-linear probability weighting. As a motivational concept Wakker (2010) introduces *optimism-pessimism* which leads to general overestimation/underestimation. Besides that he refers to *likelihood insensitivity* as a cognitive component which reflects the idea that individuals do not sufficiently distinguish between probabilities when they report their beliefs.¹⁴ Note that we have variables accounting for both components separately. Our measures on dispositional optimism/pessimism take up the information of the psychological component whereas our measure of cognitive ability is thought to proxy the sensitivity for probabilistic sophistication.

Wakker (2010) presents an overview of parametric forms of weighting functions. We focus on the function proposed by Prelec (1998) – as it allows for disentangling optimism/pessimism and likelihood insensitivity – and present a linearized version of the Prelec-function which corresponds to the neo-additive family. The latter is then used for the dynamic model of probability weighting described thereafter.

Prelec’s Probability Weighting Function

We assume a non-linear weighting function in the spirit of Prelec (1998) which is given by

$$\overline{{}_iSSP}_{h,m} = \left(\exp \left(- \left(- \ln ({}_iOSP_{h,m}) \right)^\xi \right) \right)^\vartheta, \quad (1)$$

Let ${}_iOSP_{h,m}$ and $\overline{{}_iSSP}_{h,m}$ denote the objective and estimated subjective probability to survive from age h to m of individual i . ϑ controls for the elevation (i.e. optimism) and ξ governs the curvature of the weighting function (i.e. likelihood-insensitivity). Using our individual-level data on subjective and objective probabilities we can estimate the parameters ξ and ϑ that best match the data. More precisely, we pin down the parameter by minimizing the Euclidean distance, where N^m denotes the number of people in respective target-age group.

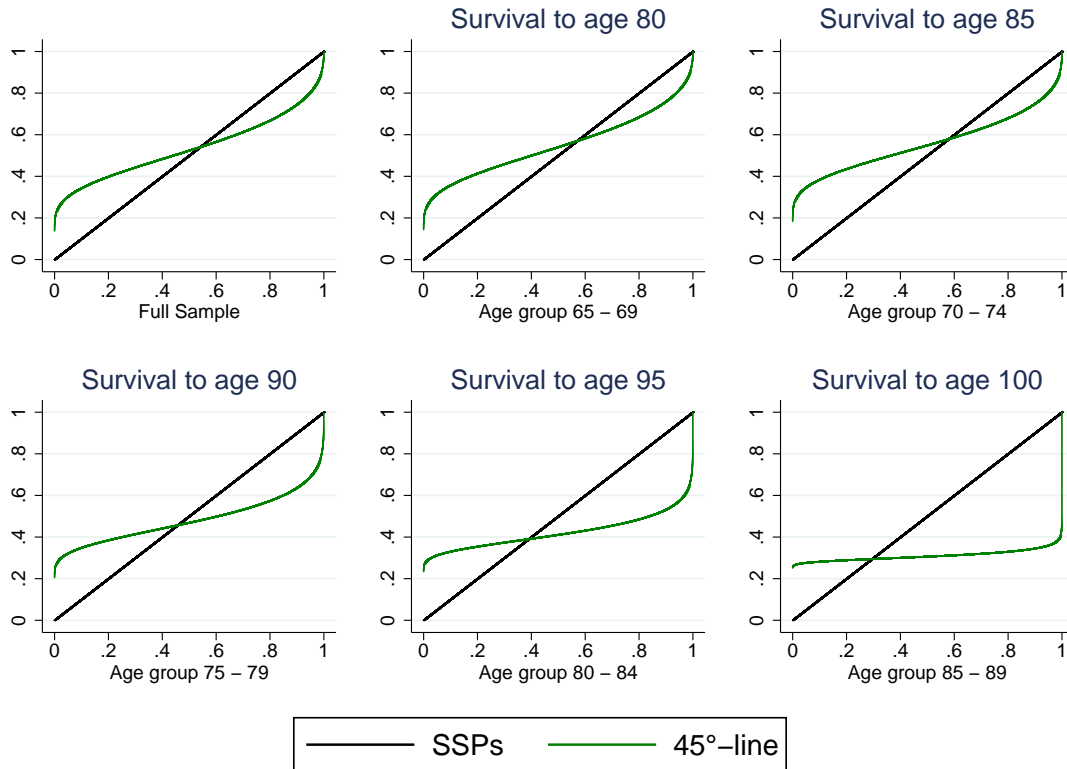
$$\min_{\xi, \vartheta} \left\{ \sum_{i=1}^{N^m} \left[\overline{{}_iSSP}_{h,m} - {}_iSSP_{h,m} \right]^2 \right\}. \quad (2)$$

Figure 5 shows the corresponding inverted S -shaped probability weighting function using the estimated parameters compared to our data.¹⁵

¹⁴For a textbook treatment of these two concepts and its illustration in probability weighting functions c.f. Wakker (2010)

¹⁵Abdellaoui et al. (2011) elicit parameter values for this probability weighting function. For a scenario in which objective probabilities are unknown to the subjects, the authors obtain $\xi = 0.64$ and $\vartheta = 1.03$

Figure 5: Probability Weighting Function



Source: HRS and Own Calculation

The estimated parameters for the full sample are almost half the size of the estimation results from Abdellaoui et al. (2011). Also, we do not find a general tendency for pessimism. Wakker (2010) describes a probability function with an intersection of the 45-degree line at around one third as a common finding. However, our result for the full age range show an intersection at 0.55 suggesting overall optimism instead of pessimism. This might be due to the fact that our agents start with age 65 where questions on survival chances 11-15 years in advance are already well below one. What is important to note is that the probability weighting function is not stable over age. We will return to this point further below.

Rationalization in the Literature

Ludwig and Zimmer (2013) and Groneck et al. (2013) rationalize the findings with a structural behavioral learning model with psychological biases. In their structural model generating the inverse *S*-shaped probability weighting function which is typically found in experiments about CPT decision weights (cf., e.g., Wakker (2010) and references therein).

they use a linear version of a probability weighting function which is given by

$$SSP = \delta\lambda + (1 - \delta)OSP \quad (3)$$

The parameters of the weighting function can be interpreted as follows. Denote by $\delta \in [0, 1]$ a degree of 'likelihood insensitivity' and by $\lambda \in [0, 1]$ an optimism parameter which measures whether the agent resolves her likelihood insensitivity through an optimistic versus pessimistic attitude. Ludwig and Zimper (2013) and Groneck et al. (2013) derive the linearized version as a parsimonious approximation of the Prelec weighting function. For further details we refer to Ludwig and Zimper (2013) and Groneck et al. (2013) and references therein.

We get age-dependent estimates of δ and λ by linearly approximating the Prelec probability weighting functions we estimated previously. Given the intercept and the slope parameter of our linear approximation we back out age-dependent δ and λ . Table 8 shows the corresponding values δ and λ for each of the five age groups and the full sample.

Table 8: Estimated Parameters of Linearized Probability Weighting Function

Coefficient-Age	65-69	70-74	75-79	80-84	85-89	Full sample
λ	0.580	0.586	0.460	0.404	0.308	0.547
δ	0.527	0.575	0.653	0.694	0.833	0.481

Our estimates again show that the parameters are age specific. Two main observations stand out: First, degree of likelihood insensitivity, measured by the parameter δ is increasing with age from a value of 0.5 for the age-bin 65 – 69 to 0.8 at ages 85 – 89. Second, the parameter λ measuring the degree of (relative) optimism is decreasing with age from a value of 0.6 to 0.3 for the same age bins.

To account for the possibility of a 'censoring effect' and results that are driven by 'focal points' we conduct a robustness check where the parameters of the PWFs are estimated with a restricted sample. In this sample we discard observations that have OSPs $> 50\%$, OSPs $< 5\%$ and focal point answers at 0%, 50% and 100%. Respective results confirm notions of increasing likelihood insensitivity and pessimism with age and can be found in Appendix D.

5 Psychological and Cognitive Factors in Survival Assessments

In this section we intend to find empirical evidence for the impact of psychological and cognitive components on the formation on subjective survival probabilities. Moreover, we illustrate how our measure of cognitive ability is related to accurate formation of SSPs.

5.1 Level Effects of Psychological and Cognitive Factors

We estimate a simple updating model which takes up the idea of rational bayesian updating similar to (e.g. (Smith et al., 2001b), Smith et al. (2001a), Liu et al. (2007)) which we extend by psychological and cognitive factors. Generally, our empirical updating model is thought to capture how individuals adjust their subjective survival probabilities in response to new adverse shocks. Our extension allows us to test for psychological and cognitive influences.

$$SSP_{i,t} = \beta_0 + \beta_1 SSP_{i,t-1} + \beta_2 x_{i,t}^I + \beta_3 cog_{i,t} + \beta_4 psycho_{i,t-1} + \left(\sum_{k=1}^K \beta_{k+5} d_{k,t} \right) + \epsilon_{i,t} \quad (4)$$

where β_0 is an intercept and x_i^I ¹⁶ is a vector of control variables as outlined in Section 2. $psycho_i$ and cog_i are our measures of psychological (optimism/pessimism) and cognitive (cognitive ability) effects. $\{d_k\}_{k=1}^K$ denote the (health) shocks. We run several specifications, i.e. we do not simply run the model as outlined in (4) but perform regressions in a stepwise fashion. First, we exclude all variables on cognitive ability and psychological factors. Then we go on including these variables step by step. Note that we use lagged variables for our psychological measures. This is done to cope with potential reverse causality biases.

We find independent and statistically significant effects of psychological variables. Coefficients show expected signs. For instance, those individuals with higher levels of optimism have higher SSPs. The effect of cognitive ability is less pronounced. We find 'Cognitive Ability' to exert a positive influence on SSPs, however – particularly after accounting for psychological variables – the effect remains statistically weak. Interestingly, in the updating model SSPs are revised in response to adverse (health) shocks when excluding psychological variables. Once psychological variables are included we fail to detect statistically significant effects of the shock variables. We find this to be a sample size effect. If including psychological variables we have less observations, and thus, less

¹⁶All regression tables of Sections 5 and 6 including the full list of variables can be found in Appendix F

statistical power.

Table 9: Model: Empirical Updating Model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	SSP	SSP	SSP	SSP	SSP	SSP	SSP
LagSSB	0.500 *** (0.010)	0.499 *** (0.010)	0.483 *** (0.018)	0.485 *** (0.017)	0.483 *** (0.018)	0.486 *** (0.017)	0.479 *** (0.018)
Δ Mobile	-0.995 (0.613)	-0.963 (0.614)	-1.416 (1.122)	-1.343 (1.120)	-1.341 (1.124)	-1.292 (1.122)	-1.343 (1.122)
Δ Muscle	-1.830 *** (0.571)	-1.822 *** (0.571)	-0.688 (1.052)	-0.730 (1.050)	-0.610 (1.050)	-0.669 (1.050)	-0.608 (1.050)
Δ ADL	-1.918* (1.102)	-1.719 (1.105)	-2.274 (2.044)	-2.277 (2.030)	-1.959 (2.052)	-2.036 (2.036)	-2.001 (2.043)
High Blood Pressure Shock	0.671 (0.787)	0.684 (0.786)	0.120 (1.459)	0.186 (1.472)	0.108 (1.459)	0.163 (1.472)	0.155 (1.468)
Diabetis Shock	0.456 (1.057)	0.428 (1.054)	-0.855 (1.730)	-0.588 (1.731)	-0.972 (1.722)	-0.676 (1.725)	-0.883 (1.723)
Cancer Shock	-1.070 (1.071)	-1.147 (1.076)	-2.624 (1.962)	-2.721 (1.969)	-2.688 (1.958)	-2.766 (1.966)	-2.857 (1.962)
Lung Shock	-2.354* (1.265)	-2.452* (1.263)	-1.676 (2.056)	-1.695 (2.035)	-1.735 (2.067)	-1.749 (2.043)	-1.711 (2.074)
Heart Shock	-1.799 ** (0.911)	-1.806 ** (0.912)	-2.442 (1.644)	-2.417 (1.657)	-2.522 (1.653)	-2.470 (1.662)	-2.574 (1.659)
Stroke Shock	-1.109 (1.737)	-0.873 (1.746)	-1.060 (3.364)	-1.639 (3.324)	-0.767 (3.392)	-1.423 (3.346)	-0.797 (3.379)
Psycho Shock	0.818 (1.423)	0.920 (1.423)	2.552 (2.285)	2.543 (2.296)	2.694 (2.316)	2.645 (2.320)	2.712 (2.307)
Arthritis Shock	0.864 (0.861)	0.777 (0.864)	-1.448 (1.746)	-1.431 (1.734)	-1.482 (1.747)	-1.457 (1.736)	-1.551 (1.742)
Mom Died	2.078 (1.459)	2.019 (1.456)	0.826 (2.501)	0.858 (2.500)	0.714 (2.492)	0.775 (2.494)	0.760 (2.474)
Dad Died	1.457 (2.616)	1.702 (2.644)	-0.486 (4.520)	-0.224 (4.492)	-0.664 (4.563)	-0.393 (4.525)	-0.276 (4.525)
Cognitive Ability		0.191 *** (0.067)			0.255 ** (0.122)	0.192 (0.123)	0.208* (0.123)
Lagged Optimism			1.315 *** (0.422)		1.291 *** (0.421)		1.080 ** (0.438)
Lagged Pessimism				-1.285 *** (0.402)		-1.179 *** (0.407)	-1.021 ** (0.424)
adj. R ²	0.406	0.407	0.409	0.410	0.410	0.411	0.410
No. covariates	34	35	34	34	35	35	36
No. observations	9943	9937	2988	2995	2988	2995	2984

Clustered standard errors in parentheses. Dummy and additional control variables not displayed.

* p<0.10, ** p<0.05, *** p<0.01

Our second model seeks to further highlight the interplay of cognitive ability and the usage of objective information. For this we estimate the following factor model:

$$SSP_i = \beta_0 + \beta_1 OSP_{i,t} + \beta_2 x_{i,t}^{II} + \beta_3 psycho_{i,t-1} + \beta_4 cog_{i,t} + \beta_5 (OSP_{i,t} \times cog_{i,t}) + \varepsilon_{i,t} \quad (5)$$

Note that here we include a slightly different vector of control variables, x^{II} . This model stresses that cognitive ability is positively associated with the usage of objective information. The coefficient on the interaction effect is positive and statistically different

from zero at the 1% significance level. The higher cognitive ability the more an individual's SSP associated with the movement of OSPs.

Table 10: Model: Factor Model Cognitive Factor

	(1)	(2)	(3)
	SSP	SSP	SSP
Lagged Optimism	2.196 *** (0.334)	2.197 *** (0.334)	2.184 *** (0.332)
Lagged Pessimism	-1.589 *** (0.323)	-1.671 *** (0.328)	-1.665 *** (0.327)
OSP	0.119 ** (0.060)	0.202 *** (0.067)	-0.189* (0.099)
Cognitive Ability		-0.238 ** (0.100)	-0.752 *** (0.160)
Cognitive Ability X OSP			0.0150 *** (0.003)
adj. R ²	0.240	0.240	0.243
No. covariates	35	36	37
No. observations	6549	6549	6549

Bootstrapped and clustered standard errors in parentheses. Dummy and addtioanl control variables not displayed.

* p<0.10, ** p<0.05, *** p<0.01

5.2 Degree of Misconception

In this section we seek to further de-mask the effect of cognitive ability. As in the previous ordinary least squares regression, we bootstrap standard errors (200) in order to account for the estimation variance of the OSPs. In this specification we create a dummy variable D_i which = 1 if $SSB > OSP$ and = 0 if $SSP \leq OSP$. Let x^{III} be a vector of control and dummy variables then the regression equation is given by:

$$SSP_i = \beta_0 + \beta_1 x_{i,t}^{III} + \beta_2 psycho_{i,t-1} + \beta_3 cog_{i,t} + \beta_4 D_{i,t} + \beta_5 (cog_{i,t} \times D_{i,t}) \quad (6)$$

Table 11: Misconception and Cognitive Ability

	(1)	(2)	(3)	(4)
	SSP	SSP	SSP	SSP
OSP	0.202 *** (0.067)	0.546 *** (0.047)	0.538 *** (0.048)	
Lagged Optimism	2.197 *** (0.334)	1.300 *** (0.225)	1.323 *** (0.223)	1.382 *** (0.224)
Lagged Pessimism	-1.671 *** (0.328)	-0.646 *** (0.196)	-0.657 *** (0.195)	-0.679 *** (0.199)
Cognitive Ability	-0.238 ** (0.100)	-0.192 *** (0.069)	0.400 *** (0.076)	0.873 *** (0.070)
Dummy Overestimator		43.90 *** (0.411)	66.57 *** (2.366)	66.51 *** (2.381)
Dummy Overestimator × Cognitive Ability			-1.015 *** (0.100)	-1.036 *** (0.100)
R-squared	0.240	0.676	0.681	0.673
No. covariates	36	37	38	37
No. observations	6549	6549	6549	6549

Bootstrapped and clustered standard errors in parentheses. Dummy and additional control variables not displayed.

* p<0.10, ** p<0.05, *** p<0.01

Again, we find lagged optimism (pessimism) to have a significant positive (negative) level effect on SSPs. Not surprisingly over-estimators have significantly higher SSPs. Our interaction effect indicates that overestimation is less pronounced for individuals the higher their cognitive abilities. We consider it as empirical evidence that people with higher cognitive abilities are able to assess their SSPs more accurately.

6 The Economic Importance of Survival Misconception

In this section we analyze whether misconception of ones survival probabilities affect economic decision making. In particular, we estimate the impact of survival misconception on the probability to hold life-insurances. We hypothesize that agents who strongly overestimate their survival are less likely to buy life-insurances. Important to note that in the analysis we focus on single-households only.

We estimate a probit regression for the following equation:

$$LI_i = \beta_0 + \beta_2(SSP_{i,t} - OSP_{i,t}) + \beta_3x_{i,t}^{IV} + \varepsilon_{i,t} \quad (7)$$

where LI_i is a binary variable indicating whether the person owns a life insurance (=1)

or not (=0). x^{IV} is a vector of control variables (including several health variables and dummies).

Our results for life-insurance are given in Table 12.

Table 12: Probit: Survival Misconception and Life-Insurance Decision

	(1)	(2)	(3)	(4)
OSP	0.00492 *** (0.001)	0.00486 *** (0.001)	0.00619 *** (0.002)	0.00602 *** (0.002)
SSB-OSP	-0.000559 ** (0.000)	-0.000633 ** (0.000)	-0.000132 (0.000)	-0.000213 (0.000)
Children	0.0693 ** (0.028)	0.0639 ** (0.027)	0.0676 ** (0.028)	0.0619 ** (0.027)
Prob. Bequest of 100k		0.000415 ** (0.000)		0.000369* (0.000)
SSB-OSP ²			-0.0000156 *** (0.000)	-0.0000153 *** (0.000)
OSP ²			-0.0000132 (0.000)	-0.0000117 (0.000)
adj. R ²				
No. covariates				
No. observations	5675	5478	5675	5478

Marginal effects; Clustered bootstrapped (200) standard errors in parentheses

(d) for discrete change of dummy variable from 0 to 1

* p<0.10, ** p<0.05, *** p<0.01

Note that we display marginal effects at means. In all specifications we find misconception, $SSP - OSP$, to be negatively and significantly associated with the probability of holding a life insurance. However, effects are relatively small in magnitude. For instance, in specification (2) at mean values a 1 percentage point decrease in $SSP - OSP$ is associated with an increase of holding any life insurance by 0.000633 percentage points. In specification (3) and (4) we include squared variables of $SSP - OSP$ and OSP and find some evidence for non-linearity. Interestingly, all effects remain statistically different from zero when – in addition to an indicator of whether individuals have children or not – we include a measure that captures the self-reported probability to leave a bequest of at least 100,000 \$-US. Thus, besides the usual argument of holding a life insurance in order to protect dependents from financial risks associated with one's own death we find an effect which is induced by misconception of one's own survival probabilities.

7 Conclusion

[TBC] Subjective survival probabilities (SSPs) elicited from household panel data can not be solely explained by objective information about an individual. We estimate individual-level objective survival probabilities (OSPs) and show that biases in subjective beliefs can be explained with probability weighting functions. We show that the shape of the probability weighting function is age-dependent. Over age people become more pessimistic and have increasing biases to objective probabilities (likelihood insensitivity). Our findings are in line with rationalizations in the literature. Furthermore, we provide empirical evidence for increasing pessimism and likelihood insensitivity using newly available psychological data of the Health and Retirement Study (HRS). Psychological variables are key for explaining the formation of subjective survival probabilities and individual's decreasing cognitive ability are associated with likelihood insensitivity at old ages.

Appendices

A Overview of HRS study

Figure 6: Overview HRS Study

Hand contains 10 waves of the cohorts according to the following schema

HRS	HRS	HRS in 1994	HRS in 1996	HRS	HRS	HRS	HRS	HRS	HRS	HRS	HRS	HRS	HRS
	HRS/AHEAD overlaps only	AHEAD* in 1993	AHEAD* in 1995	AHEAD	AHEAD	AHEAD	AHEAD	AHEAD	AHEAD	AHEAD	AHEAD	AHEAD	AHEAD
AHEAD													
CODA				CODA	CODA	CODA	CODA	CODA	CODA	CODA	CODA	CODA	CODA
WB				WB	WB	WB	WB	WB	WB	WB	WB	WB	WB
EBB								EBB	EBB	EBB	EBB	EBB	EBB
MBB								MBB**	MBB**	MBB**	MBB**	MBB**	MBB**
26													
Wave	1	2	3	4	5	6	7	8	9	10			
N° of core respondents								10881	10805	10367			
LBSubsample								A	B	A			

HRS	born 1931 to 1941, baseline 1992	HRS cohort
AHEAD	born before 1924, baseline 1993	The Study of Assets and Health Dynamics Among the Oldest Old,
CODA	born 1924 to 1930, added 1998	Children of Depression
WB	born 1942 to 1947, added 1998	War Baby
EBB	born 1948 - 1953, added 2004	Early Baby Boomer
MBB	born 1954-1959, added 2010	Mid Baby Boomer

* 1998 (AHEAD) data and 1994 (HRS) data treated as wave 2; 1995 (AHEAD) and 1996 (HRS) treated as wave 3 not included in RAND L dataset as HRS has not released the 2010 data for the new cohort

** Psychosocial Variables Available with alternating sampling structure, i.e. only 50% in each wave

Waves used

Some of the HRS and AHEAD entry cohort respondents were spouses of HRS- and AHEAD-eligible individuals who are age-eligible for the CODA or WB cohorts. These HRS and AHEAD spouses are given weights beginning in 1998 (Wave 4) so that they contribute to the representation of the CODA/WB birth year population. Some spouses of the initial HRS entry cohort respondents were age 70 or older and were subsequently included in the AHEAD study. These so-called HRS/AHEAD overlap cases may thus have been interviewed in 1992, 1993, 1995, and from 1998 forward.

B Estimation of Objective Survival Probabilities (OSP)

Given our vector of explanatory variables, \mathbf{x} (cf. below for a list of all explanatory variables used), we estimate the relationship between individual level observables and mortality using a hazard function. A hazard function is modelled by:

$$\lambda(t|\mathbf{x}'_i, \eta_i) = \lambda_0(t) \exp(\mathbf{x}'_i\beta)\eta_i \quad (8)$$

$\lambda_0(t)$ is the so called baseline hazard which allows for various possible forms. A specific model predicts a specific choice for the baseline hazard. We opt for the specification given by the Weibull hazard model. The reason is that this model allows for duration dependence (as opposed to e.g. exponential duration models). Our baseline hazard is given by

$$\lambda_0(t) = \alpha t^{\alpha-1} \quad (9)$$

A $\alpha > 1$ it means positive duration dependence. In our setting it means that living longer it becomes more likely to die. So, in our setting positive duration dependence would actually make some sense. $\exp(\mathbf{x}'\beta)$ is the proportional hazard. With η we allow for multiplicative unobserved heterogeneity assuming that individuals differ randomly not fully captured by our vector of explanatory variables. To identify α and β we need a normalization of η . We use the most common one of $\mathbb{E}(\eta_i) = 1$ and $\text{Var}(\eta_i) = \delta$. Time to failure is defined as the number of years to death. Survivors were treated as censored. We estimate Function (8) using maximum likelihood. As outlined in Section 2.3 we try to keep the most recent data for each prediction horizon $t \in [11, 12, 13, 14, 15]$. For instance, for the prediction horizon of 15 years we take interviews from 1995 to predict survival to 2010 and for the prediction horizon of 14 years we take interviews from 1996 to predict survival to 2010. Thus, we estimate five models. The vector of explanatory variables is the same for each model. The results for each model are very similar. Note that α is always larger than one. Values are 1.74, 1.75, 1.83, 1.90, 1.92 for the models of duration length 11 to 15. Therefore, in all models the likelihood of dying is increasing in survival length. Given our hazard model objective survival probabilities (OSPs) are given by:

$$OSP_i(t) = [1 + \delta \exp(\mathbf{x}'_i\beta)t^\alpha]^{-\frac{1}{\delta}} \quad (10)$$

As a consequence, we have $OSP(t)$ for all prediction horizons, $t \in [11, 12, 13, 14, 15]$, for each individual. Lastly, in accordance with Table 1 we attach respective OSFs to all

individual observations.

The vector of characteristics, \mathbf{x}_i includes the following variables:

- Age
- Male
- Black
- Subjective Health Measure
- College
- Married
- Widowed
- Mom Alive
- Dad Alive
- Obesity
- Currently Smoker
- Ever Smokes
- Ever Drinks
- ADLs
- Mobility Index
- Large Muscle Index
- Total Wealth (excluding second. resid.)
- Cognitive Ability
- Ever Have Diagnoses
 - High Blood Pressure
 - Diabetes
 - Cancer
 - Lung

- Heart
- Stroke
- Arthritis

C Psychometric Measures

Please say how much you agree or disagree with the following statements

1=Strongly disagree, 2=Somewhat disagree, 3=Slightly disagree,
4=Slightly agree, 5=Somewhat agree 6=Strongly agree

- **Dispositional optimism**

1. I am always optimistic about my future
2. In uncertain times I usually expect the best
3. Overall, I expect more good things to me than bad

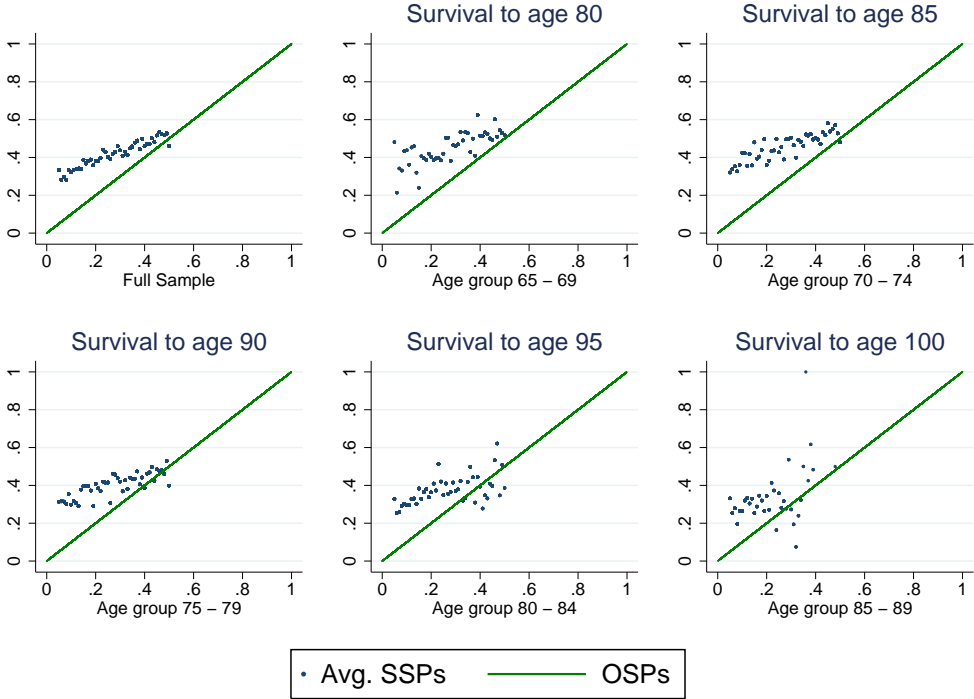
- **Dispositional pessimism**

1. If something can go wrong it will
2. I hardly ever expect things to go my way
3. I rarely count on good things happening to me

D Robustness Check 'Censoring Effect' and 'Focal Points'

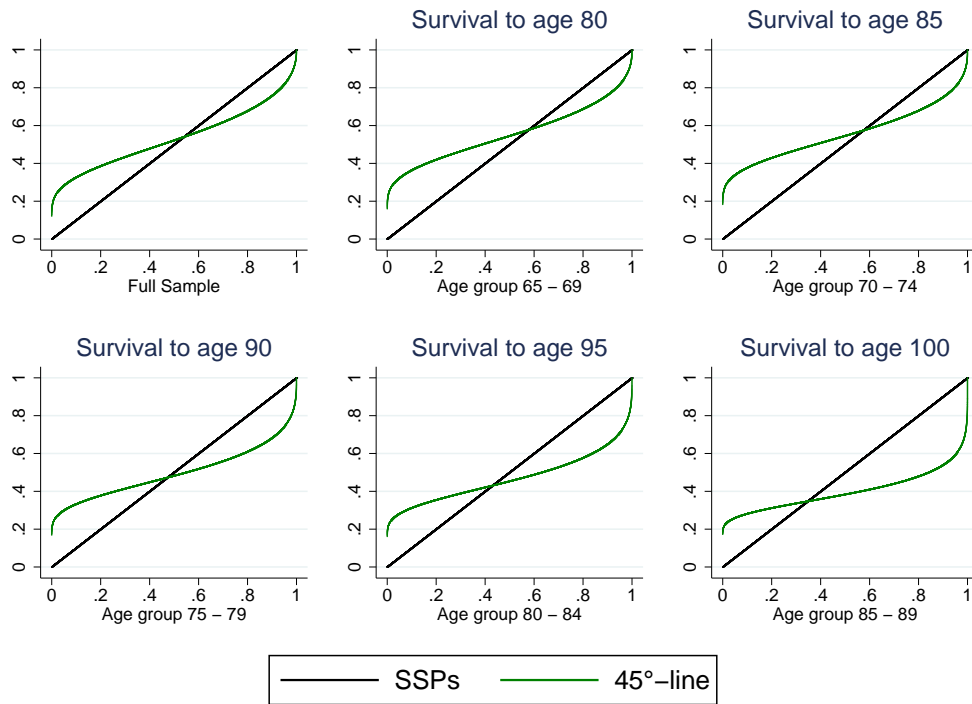
In Figures and Tables below we excluded observations with focal point SSPs = 0%, = 50% and = 100%. In order to check for the censoring effect we additionally excluded observations with OSPs > 50% and *OSP*s < 5%

Figure 7: Probability Weighting Function



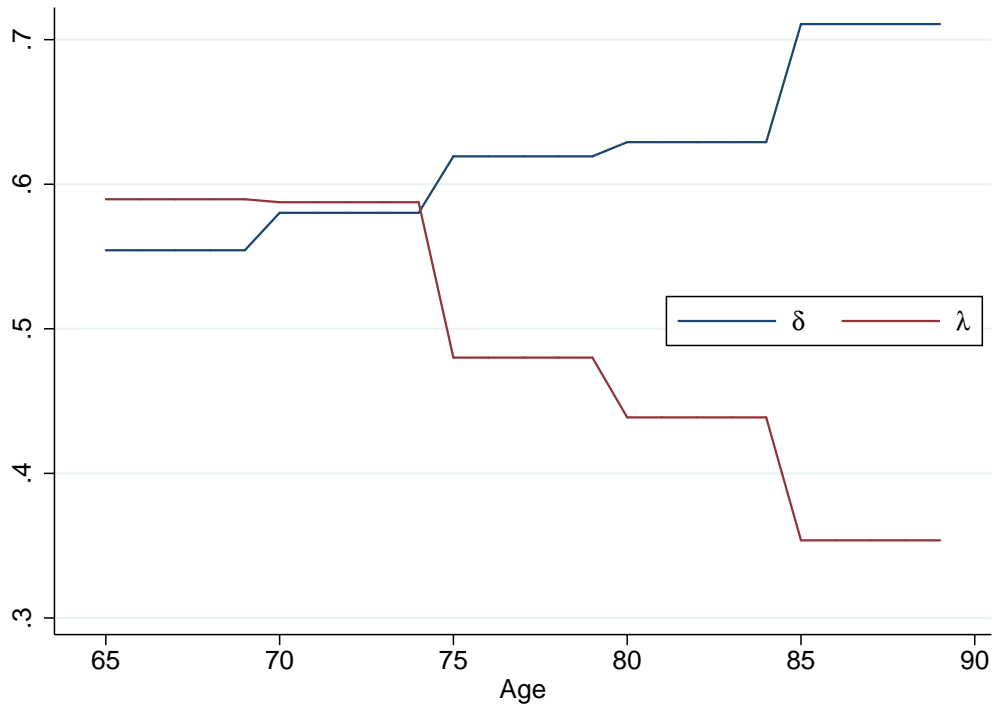
Source: HRS and Own Calculation

Figure 8: Probability Weighting Function



Source: HRS and Own Calculation

Figure 9: Probability Weighting Function



Source: HRS and Own Calculation

Table 13: Estimated Parameters of Neo-Additive Capacity

Coefficient-Age	65-69	70-74	75-79	80-84	85-89	Full sample
λ	0.590	0.588	0.480	0.439	0.354	0.47
δ	0.554	0.580	0.620	0.630	0.711	0.68

E OSP: Validity Check

OSP and movement with covariates

Run regressions of the form

$$OSP = \beta_0 + \beta_1 \times regressor \quad (11)$$

to check whether the regressor has an impact in a reasonable direction

Table 14: Regressor Check I

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OSP	OSP	OSP	OSP	OSP	OSP	OSP	OSP	OSP
Male	-11.28 *** (0.328)								
Black		0.716 (0.497)							
Married			9.717 *** (0.337)						
Widowed				-10.19 *** (0.383)					
Mom alive					21.78 *** (0.674)				
Dad alive						23.65 *** (1.634)			
College							8.980 *** (0.410)		
Total Wealth (excl. sec. resid.)								0.000000563 *** (0.000)	
Total Wealth (incl. sec. resid.)									0.00000384 *** (0.000)
adj. R ²	0.047	0.000	0.034	0.029	0.042	0.009	0.020	0.000	0.014
No. covariates	1	1	1	1	1	1	1	1	1
No. observations	23910	23910	23910	23910	23910	23910	23910	23910	23910

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Table 15: Regressor Check II

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OSP	OSP	OSP	OSP	OSP	OSP	OSP	OSP	OSP
Subjective Health Measure	21.84 *** (0.312)								
Obesity		3.517 *** (0.367)							
Currently Smoker			-14.03 *** (0.565)						
Ever Smokes				-12.42 *** (0.328)					
Ever Drinks					9.669 *** (0.327)				
Moderate Exercises						14.64 *** (0.340)			
Vigorous Exercises							12.46 *** (0.352)		
Lagged Optimism								2.532 *** (0.271)	
Lagged Pessimism									-3.927 *** (0.237)
adj. R ²	0.171	0.004	0.025	0.057	0.035	0.072	0.050	0.012	0.038
No. covariates	1	1	1	1	1	1	1	1	1
No. observations	23910	23910	23910	23910	23910	23892	23876	6930	6938

Standard errors in parentheses
 * p<0.10, ** p<0.05, *** p<0.01

Table 16: Regressor Check III

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OSP	OSP	OSP	OSP	OSP	OSP	OSP	OSP
High Blood Pressure Ever Diagnosed	-11.84 *** (0.342)							
Diabetes Ever Diagnosed		-17.00 *** (0.375)						
Cancer Ever Diagnosed			-15.02 *** (0.410)					
Lung Ever Diagnosed				-25.82 *** (0.482)				
Heart Ever Diagnosed					-21.83 *** (0.331)			
Stroke Ever Diagnosed						-21.78 *** (0.540)		
Psycho Ever Diagnosed							-8.308 *** (0.467)	
Arthritis Ever Diagnosed								-7.416 *** (0.357)
adj. R ²	0.048	0.079	0.053	0.107	0.154	0.064	0.013	0.018
No. covariates	1	1	1	1	1	1	1	1
No. observations	23910	23910	23910	23910	23910	23910	23893	23910

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.01

OSP and acutal survival

Take individuals who are alive in 1995. Take this sample as a baseline. Now, we look who of these individuals still lives in 2010 and run a few simple tests. Note that we have OSPs of everyone in 1995 and of those who survived until 2010 the objective probability in 2010:

Generally, one should assume that on average the OSP in 2010 should be lower than of the same individuals in 1995 (as it captures the same prediction horizon). For a useful comparison – and to take out sample selection effects – look at the sample of individuals that are alive in 1995 and 2010. We get that:

$$OSP_{I,1995} = 46.28 > 14.61 = OSP_{2010}$$

If we look of the average of the people who simply were alive in 1995, we find an average value of

$$OSP_{II,1995} = 31.33$$

Thus, we find that

$$OSP_{II,1995} = 31.33 < OSP_{I,1995} 46.28$$

This makes sense as $OSP_{II,1995}$ contains those individuals who do not survive until 2010. Thus, if OSP is a correct measure and has predictive power it should be captured in the average.

Next, one might ask how OSPs behave on the individual level over time. We calculate the change of OSP as $\Delta OSP = OSP_{I,1995} - OSP_{2010}$. We find an average value of 46.64 with values ranging between 6.29 and 78.38. Although surviving to the target age, for no individual i has its OSP_i increased.

Lastly, we run a probit regression, checking whether OSP has predictive power of survival. We run two regressions which are given by

$$Survival_i = \beta_0 + \gamma OSP_i + \varepsilon_i \tag{12}$$

$$Survival_i = \beta_0 + \gamma OSP_i + \beta_1 male_i + \beta_2 college_i + \beta_3 black_i + \varepsilon_i \tag{13}$$

Table 17 presents the results, providing 'Average Marginal Effects (AME)'.

Table 17: Probit Regression: OSP and Survival

	(1) Survival	(2) Survival
OSP	0.0348 * ** (0.005)	0.0326 * ** (0.004)
Male		-0.160 (0.168)
Black		-0.00811 (0.235)
College		0.0619 (0.228)
adj. R ²		
No. covariates	2	4
No. observations	396	396

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Interpretation: **TBC** Positive effect, however it is not too large in magnitude.

F Full Regression Tables

Updating Model

Table 18: Updating Model (1/3)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	SSP	SSP	SSP	SSP	SSP	SSP	SSP
LagSSB	0.500 *** (0.010)	0.499 *** (0.010)	0.483 *** (0.018)	0.485 *** (0.017)	0.483 *** (0.018)	0.486 *** (0.017)	0.479 *** (0.018)
Wave 9 Dummy	4.226 *** (0.608)	4.145 *** (0.608)	3.312 *** (0.920)	3.425 *** (0.919)	3.166 *** (0.921)	3.312 *** (0.921)	3.219 *** (0.921)
m70	0.254 (0.604)	0.192 (0.603)	1.803 (1.108)	1.581 (1.105)	1.689 (1.109)	1.500 (1.105)	1.651 (1.110)
m75	-2.182 ** (0.869)	-2.242 ** (0.870)	-1.453 (1.550)	-1.606 (1.548)	-1.553 (1.547)	-1.671 (1.546)	-1.670 (1.550)
m80	-0.992 (1.221)	-1.033 (1.223)	0.451 (2.206)	0.472 (2.207)	0.420 (2.202)	0.458 (2.204)	0.329 (2.211)
Age	-0.709 *** (0.071)	-0.675 *** (0.072)	-0.814 *** (0.129)	-0.800 *** (0.129)	-0.771 *** (0.131)	-0.767 *** (0.131)	-0.774 *** (0.132)
TA_age	-0.846 *** (0.299)	-0.848 *** (0.299)	-0.835 (0.517)	-0.809 (0.516)	-0.830 (0.516)	-0.805 (0.516)	-0.809 (0.518)
Male	-0.659 (0.534)	-0.402 (0.540)	-2.229 ** (0.962)	-1.970 ** (0.963)	-1.899 ** (0.968)	-1.741* (0.968)	-1.752* (0.970)
Black	4.999 *** (0.976)	5.548 *** (0.994)	3.144* (1.850)	3.829 ** (1.832)	3.873 ** (1.873)	4.347 ** (1.854)	4.085 ** (1.885)
Married	-0.235 (0.794)	-0.286 (0.793)	0.172 (1.448)	0.274 (1.453)	0.0469 (1.445)	0.186 (1.451)	-0.0336 (1.447)
Widowed	0.170 (0.939)	0.154 (0.939)	-0.487 (1.773)	-0.481 (1.775)	-0.614 (1.773)	-0.576 (1.775)	-0.622 (1.773)

Continued next page. Wave 8 dummy and m65 dropped due to collinearity.

Table 19: Updating Model (2/3)

	(1) SSP	(2) SSP	(3) SSP	(4) SSP	(5) SSP	(6) SSP	(7) SSP
College	1.714 *** (0.560)	1.299 ** (0.576)	2.096 ** (0.983)	1.454 (0.992)	1.542 (1.003)	1.084 (1.010)	1.168 (1.011)
Total Wealth (excl. sec. resid.)	1.49e - 08 (0.000)	7.87e - 09 (0.000)	-0.000000433 (0.000)	-0.000000518 (0.000)	-0.000000453 (0.000)	-0.000000544 (0.000)	-0.000000588 (0.000)
Subjective Health Measure	7.657 *** (0.574)	7.521 *** (0.576)	6.331 *** (1.014)	6.325 *** (1.015)	6.212 *** (1.016)	6.255 *** (1.016)	5.988 *** (1.019)
Obesity	1.148 ** (0.581)	1.071* (0.581)	0.657 (1.026)	0.790 (1.028)	0.554 (1.024)	0.701 (1.026)	0.708 (1.026)
Currently Smoker	-1.731* (0.972)	-1.703* (0.974)	-3.182* (1.795)	-3.215* (1.798)	-3.071* (1.798)	-3.148* (1.800)	-3.020* (1.794)
Ever Smokes	0.0106 (0.541)	0.0275 (0.541)	0.794 (0.977)	0.810 (0.974)	0.832 (0.978)	0.831 (0.975)	0.862 (0.977)
Ever Drinks	0.975* (0.519)	0.800 (0.521)	1.603* (0.923)	1.522* (0.922)	1.381 (0.926)	1.370 (0.925)	1.284 (0.926)
Moderate Exercises	1.826 *** (0.609)	1.727 *** (0.609)	2.689 ** (1.104)	2.421 ** (1.105)	2.528 ** (1.101)	2.317 ** (1.103)	2.309 ** (1.105)
Vigorous Exercises	1.451 *** (0.552)	1.426 *** (0.552)	0.487 (1.037)	0.410 (1.037)	0.474 (1.033)	0.411 (1.034)	0.431 (1.034)

Continued next page. Wave 8 dummy and m=65 dropped due to collinearity.

Table 20: Updating Model (3/3)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	SSP	SSP	SSP	SSP	SSP	SSP	SSP
Δ Mobile	-0.995 (0.613)	-0.963 (0.614)	-1.416 (1.122)	-1.343 (1.120)	-1.341 (1.124)	-1.292 (1.122)	-1.343 (1.122)
Δ Muscle	-1.830 *** (0.571)	-1.822 *** (0.571)	-0.688 (1.052)	-0.730 (1.050)	-0.610 (1.050)	-0.669 (1.050)	-0.608 (1.050)
Δ ADL	-1.918* (1.102)	-1.719 (1.105)	-2.274 (2.044)	-2.277 (2.030)	-1.959 (2.052)	-2.036 (2.036)	-2.001 (2.043)
High Blood Pressure Shock	0.671 (0.787)	0.684 (0.786)	0.120 (1.459)	0.186 (1.472)	0.108 (1.459)	0.163 (1.472)	0.155 (1.468)
Diabetis Shock	0.456 (1.057)	0.428 (1.054)	-0.855 (1.730)	-0.588 (1.731)	-0.972 (1.722)	-0.676 (1.725)	-0.883 (1.723)
Cancer Shock	-1.070 (1.071)	-1.147 (1.076)	-2.624 (1.962)	-2.721 (1.969)	-2.688 (1.958)	-2.766 (1.966)	-2.857 (1.962)
Lung Shock	-2.354* (1.265)	-2.452* (1.263)	-1.676 (2.056)	-1.695 (2.035)	-1.735 (2.067)	-1.749 (2.043)	-1.711 (2.074)
Heart Shock	-1.799 ** (0.911)	-1.806 ** (0.912)	-2.442 (1.644)	-2.417 (1.657)	-2.522 (1.653)	-2.470 (1.662)	-2.574 (1.659)
Stroke Shock	-1.109 (1.737)	-0.873 (1.746)	-1.060 (3.364)	-1.639 (3.324)	-0.767 (3.392)	-1.423 (3.346)	-0.797 (3.379)
Psycho Shock	0.818 (1.423)	0.920 (1.423)	2.552 (2.285)	2.543 (2.296)	2.694 (2.316)	2.645 (2.320)	2.712 (2.307)
Arthritis Shock	0.864 (0.861)	0.777 (0.864)	-1.448 (1.746)	-1.431 (1.734)	-1.482 (1.747)	-1.457 (1.736)	-1.551 (1.742)
Mom Died	2.078 (1.459)	2.019 (1.456)	0.826 (2.501)	0.858 (2.500)	0.714 (2.492)	0.775 (2.494)	0.760 (2.474)
Dad Died	1.457 (2.616)	1.702 (2.644)	-0.486 (4.520)	-0.224 (4.492)	-0.664 (4.563)	-0.393 (4.525)	-0.276 (4.525)
Cognitive Ability		0.191 *** (0.067)			0.255 ** (0.122)	0.192 (0.123)	0.208* (0.123)
Lagged Optimism			1.315 *** (0.422)		1.291 *** (0.421)		1.080 ** (0.438)
Lagged Pessimism				-1.285 *** (0.402)		-1.179 *** (0.407)	-1.021 ** (0.424)
adj. R ²	0.406	0.407	0.409	0.410	0.410	0.411	0.410
No. covariates	34	35	34	34	35	35	36
No. observations	9943	9937	2988	2995	2988	2995	2984

Continued next page. Wave 8 dummy and m=65 dropped due to collinearity.

Clustered standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Factor Model

Table 21: Factor Model (1/3)

	(1)	(2)	(3)
	SSP	SSP	SSP
Wave 8 Dummy	0 (0.000)	0 (0.000)	0 (0.000)
Wave 9 Dummy	3.150 * ** (0.701)	3.247 * ** (0.702)	3.326 * ** (0.702)
m65	24.07 * ** (6.619)	17.27 * * (6.928)	22.50 * ** (6.872)
m70	20.54 * ** (5.070)	15.58 * ** (5.280)	19.90 * ** (5.250)
m75	9.803 * ** (3.416)	6.748* (3.557)	9.894 * ** (3.510)
m80	6.723 * ** (2.150)	5.369 * * (2.211)	7.054 * ** (2.156)
Age	0.0789 (0.256)	-0.120 (0.260)	-0.00237 (0.259)
Male	-1.257 (1.030)	-0.658 (1.060)	-1.023 (1.052)
Black	10.65 * ** (1.281)	9.869 * ** (1.312)	10.27 * ** (1.306)
Married	-2.164* (1.298)	-2.575 * * (1.287)	-2.333* (1.293)
Widowed	-3.142 * * (1.433)	-3.366 * * (1.428)	-3.197 * * (1.439)
Mom alive	2.595* (1.332)	2.325* (1.343)	2.337* (1.331)
Dad alive	11.47 * ** (2.424)	11.53 * ** (2.419)	11.08 * ** (2.456)
College	0.975 (0.791)	1.199 (0.790)	0.953 (0.794)

Continued next page. m-age dropped due to collinearity.

Table 22: Factor Model (2/3)

	(1)	(2)	(3)
	SSP	SSP	SSP
Total Wealth (excl. sec. resid.)	-0.000000532 (0.000)	-0.000000523 (0.000)	-0.000000561 (0.000)
Subjective Health Measure	7.835 *** (0.916)	7.283 *** (0.950)	7.430 *** (0.956)
ADL Index	-0.758 (0.808)	-0.762 (0.808)	-1.297 (0.821)
Mobility Index	-0.760* (0.426)	-0.516 (0.447)	-0.756* (0.445)
Large Muscle Index	-0.774 ** (0.363)	-0.841 ** (0.366)	-0.753 ** (0.364)
Obesity	1.332 (0.891)	1.022 (0.882)	1.372 (0.872)
Currently Smoker	-3.468 ** (1.494)	-2.462 (1.583)	-3.151 ** (1.566)
Ever Smokes	1.604* (0.903)	2.099 ** (0.915)	1.784* (0.919)
Ever Drinks	1.631 ** (0.797)	1.412* (0.800)	1.638 ** (0.807)
Moderate Exercises	2.569 *** (0.847)	2.643 *** (0.850)	2.696 *** (0.841)
Vigorous Exercises	2.415 *** (0.849)	2.406 *** (0.850)	2.238 *** (0.854)
High Blood Pressure Ever Diagnosed	-1.757 ** (0.800)	-1.392* (0.799)	-1.590 ** (0.797)
Diabetes Ever Diagnosed	-0.902 (1.093)	-0.130 (1.121)	-0.752 (1.120)
Cancer Ever Diagnosed	-3.188 *** (0.969)	-2.476 ** (0.983)	-2.790 *** (0.978)
Lung Ever Diagnosed	-1.067 (1.415)	0.0685 (1.483)	-0.530 (1.471)
Heart Ever Diagnosed	-2.708 *** (0.941)	-2.074 ** (0.961)	-2.571 *** (0.954)
Stroke Ever Diagnosed	3.046 ** (1.407)	3.300 ** (1.400)	2.897 ** (1.388)
Psycho Ever Diagnosed	0.733 (1.080)	0.655 (1.080)	0.665 (1.082)
Arthritis Ever Diagnosed	1.473* (0.860)	1.499* (0.859)	1.560* (0.858)

Continued next page. m-age dropped due to collinearity.

Table 23: Factor Model (3/3)

	(1)	(2)	(3)
	SSP	SSP	SSP
Lagged Optimism	2.196 * ** (0.334)	2.197 * ** (0.334)	2.184 * ** (0.332)
Lagged Pessimism	-1.589 * ** (0.323)	-1.671 * ** (0.328)	-1.665 * ** (0.327)
OSP	0.119 * * (0.060)	0.202 * ** (0.067)	-0.189* (0.099)
Cognitive Ability		-0.238 * * (0.100)	-0.752 * ** (0.160)
Cognitive Ability X OSP			0.0150 * ** (0.003)
adj. R ²	0.240	0.240	0.243
No. covariates	35	36	37
No. observations	6549	6549	6549

Clustered and bootstrapped (200) standard errors in parentheses. m-age dropped due to collinearity.

* p<0.10, ** p<0.05, *** p<0.01

Model Misconception

Table 24: Misconception (1/3)

	(1) SSP	(2) SSP	(3) SSP	(4) SSP
Wave 9 Dummy	3.247 * ** (0.702)	1.221 * ** (0.459)	1.296 * ** (0.456)	1.398 * ** (0.467)
TA65	17.27 * * (6.928)	4.723 (4.867)	5.155 (4.910)	49.80 * ** (3.180)
TA70	15.58 * ** (5.280)	3.175 (3.693)	3.636 (3.723)	36.57 * ** (2.452)
TA75	6.748* (3.557)	0.492 (2.517)	0.800 (2.528)	21.46 * ** (1.765)
TA80	5.369 * * (2.211)	0.552 (1.564)	0.548 (1.552)	9.843 * ** (1.325)
Age	-0.120 (0.260)	-0.147 (0.174)	-0.127 (0.175)	0.978 * ** (0.157)
Male	-0.658 (1.060)	-0.834 (0.730)	-0.908 (0.723)	-6.096 * ** (0.538)
Black	9.869 * ** (1.312)	4.885 * ** (0.888)	4.710 * ** (0.876)	6.992 * ** (0.866)
Married	-2.575 * * (1.287)	-1.730 * * (0.793)	-1.942 * * (0.793)	1.013 (0.785)
Widowed	-3.366 * * (1.428)	-1.915 * * (0.868)	-2.107 * * (0.873)	-0.230 (0.884)

Continued next page. Dropped m-age and dummy wave 8 due to collinearity

Table 25: Misconception (2/3)

	(1) SSP	(2) SSP	(3) SSP	(4) SSP
Mom alive	2.325* (1.343)	1.926* (0.984)	2.078 ** (0.964)	4.237 *** (0.910)
Dad alive	11.53 *** (2.419)	5.087 *** (1.893)	5.182 *** (1.847)	5.490 *** (1.928)
College	1.199 (0.790)	0.0434 (0.523)	0.0706 (0.505)	0.662 (0.500)
Total Wealth (excl. sec. resid.)	-0.000000523 (0.000)	0.000000116 (0.000)	0.000000107 (0.000)	-1.79e - 08 (0.000)
Subjective Health Measure	7.283 *** (0.950)	3.734 *** (0.640)	3.770 *** (0.645)	7.628 *** (0.515)
ADL Index	-0.762 (0.808)	1.012* (0.572)	0.954* (0.574)	0.162 (0.596)
Mobility Index	-0.516 (0.447)	-0.466 (0.295)	-0.509* (0.292)	-2.175 *** (0.227)
Large Muscle Index	-0.841 ** (0.366)	-0.336 (0.256)	-0.303 (0.250)	0.0551 (0.247)
Obesity	1.022 (0.882)	0.823 (0.606)	0.846 (0.601)	3.255 *** (0.574)
Currently Smoker	-2.462 (1.583)	-1.420 (1.163)	-1.504 (1.154)	-8.314 *** (0.971)
Ever Smokes	2.099 ** (0.915)	0.296 (0.559)	0.470 (0.565)	-2.855 *** (0.508)
Ever Drinks	1.412* (0.800)	0.427 (0.518)	0.412 (0.525)	2.663 *** (0.492)
Modereate Exercises	2.643 *** (0.850)	0.851 (0.555)	0.885 (0.549)	0.938* (0.555)
Vigorous Exercises	2.406 *** (0.850)	1.704 *** (0.483)	1.622 *** (0.482)	1.780 *** (0.499)

Continued next page. Dropped m-age and dummy wave 8 due to collinearity

Table 26: Misconception (3/3)

	(1)	(2)	(3)	(4)
	SSP	SSP	SSP	SSP
High Blood Pressure Ever Diagnosed	-1.392*	-1.084 **	-1.017*	-3.391 ***
	(0.799)	(0.512)	(0.525)	(0.492)
Diabetis Ever Diagnosed	-0.130	0.151	0.0975	-5.202 ***
	(1.121)	(0.780)	(0.774)	(0.592)
Cancer Ever Diagnosed	-2.476 **	-2.000 ***	-1.926 ***	-6.320 ***
	(0.983)	(0.696)	(0.702)	(0.576)
Lung Ever Diagnosed	0.0685	0.309	0.335	-6.691 ***
	(1.483)	(1.058)	(1.046)	(0.819)
Heart Ever Diagnosed	-2.074 **	-1.582 **	-1.559 **	-5.655 ***
	(0.961)	(0.663)	(0.668)	(0.527)
Stroke Ever Diagnosed	3.300 **	1.256	1.038	-1.226
	(1.400)	(0.997)	(1.001)	(1.000)
Psycho Ever Diagnosed	0.655	0.0586	0.209	0.0783
	(1.080)	(0.624)	(0.608)	(0.620)
Arthrtis Ever Diagnosed	1.499*	0.796	0.760	0.791
	(0.859)	(0.552)	(0.547)	(0.553)
Lagged Optimism	2.197 ***	1.300 ***	1.323 ***	1.382 ***
	(0.334)	(0.225)	(0.223)	(0.224)
Lagged Pessimism	-1.671 ***	-0.646 ***	-0.657 ***	-0.679 ***
	(0.328)	(0.196)	(0.195)	(0.199)
Cognitive Ability	-0.238 **	-0.192 ***	0.400 ***	0.873 ***
	(0.100)	(0.069)	(0.076)	(0.070)
Dummy Overestimator		43.90 ***	66.57 ***	66.51 ***
		(0.411)	(2.366)	(2.381)
Dummy Overestimator × Cognitive Ability			-1.015 ***	-1.036 ***
			(0.100)	(0.100)
R-squared	0.240	0.676	0.681	0.673
No. covariates	36	37	38	37
No. observations	6549	6549	6549	6549

Clustered and bootstrapped (200) standard errors in parentheses.

Dropped m-age and dummy wave 8 due to collinearity.

* p<0.10, ** p<0.05, *** p<0.01

If Life Insurance

Table 27: If Life Insurance (1/3)

	(1)	(2)	(3)	(4)
Wave 8 Dummy	0.0316 ** (0.014)	0.0297 ** (0.015)	0.0317 ** (0.014)	0.0303 ** (0.015)
Wave 9 Dummy	0.0117 (0.013)	0.0128 (0.013)	0.0113 (0.013)	0.0127 (0.013)
TA65	-0.355 *** (0.116)	-0.338 ** (0.134)	-0.362 *** (0.117)	-0.346 ** (0.135)
TA70	-0.243 *** (0.090)	-0.226 ** (0.100)	-0.252 *** (0.091)	-0.235 ** (0.101)
TA75	-0.154 ** (0.063)	-0.146 ** (0.070)	-0.161 ** (0.064)	-0.153 ** (0.071)
TA80	-0.0405 (0.037)	-0.0334 (0.041)	-0.0453 (0.038)	-0.0378 (0.041)
Age	-0.00702 (0.005)	-0.00632 (0.005)	-0.00682 (0.005)	-0.00616 (0.005)
Male	0.149 *** (0.023)	0.143 *** (0.021)	0.150 *** (0.024)	0.145 *** (0.022)
Black	0.142 *** (0.024)	0.154 *** (0.024)	0.149 *** (0.024)	0.160 *** (0.024)
Married	0.0440 (0.052)	0.0462 (0.052)	0.0434 (0.052)	0.0454 (0.051)
Widowed	0.0201 (0.020)	0.0198 (0.021)	0.0204 (0.021)	0.0204 (0.021)

Continued next page. m-age dropped due to collinearity.

Table 28: If Life Insurance (2/3)

	(1)	(2)	(3)	(4)
Mom alive	-0.0307 (0.042)	-0.0372 (0.040)	-0.0320 (0.042)	-0.0382 (0.040)
Dad alive	0.153 (0.107)	0.145 (0.100)	0.157 (0.107)	0.150 (0.099)
College	-0.0605 *** (0.022)	-0.0692 *** (0.025)	-0.0628 *** (0.022)	-0.0706 *** (0.025)
Total Wealth (excl. sec. resid.)	-8.03e - 09 (0.000)	-7.46e - 09 (0.000)	-7.49e - 09 (0.000)	-6.97e - 09 (0.000)
Subjective Health Measure	-0.0217 (0.019)	-0.0220 (0.020)	-0.0204 (0.019)	-0.0210 (0.020)
ADL Index	-0.00751 (0.016)	-0.0104 (0.017)	-0.00461 (0.016)	-0.00791 (0.017)
Mobility Index	0.00378 (0.008)	0.00560 (0.009)	0.00460 (0.008)	0.00631 (0.009)
Large Muscle Index	0.00210 (0.007)	0.00303 (0.008)	0.00253 (0.007)	0.00333 (0.008)
Obesity	0.0276 (0.020)	0.0328 (0.022)	0.0268 (0.020)	0.0318 (0.022)
Currently Smoker	0.0328 (0.031)	0.0302 (0.033)	0.0359 (0.031)	0.0335 (0.033)
Ever Smokes	0.0200 (0.020)	0.0241 (0.022)	0.0189 (0.020)	0.0231 (0.022)
Ever Drinks	-0.0418 ** (0.018)	-0.0469 ** (0.019)	-0.0428 ** (0.018)	-0.0475 ** (0.019)
Modereate Exercises	0.0192 (0.018)	0.0155 (0.017)	0.0189 (0.018)	0.0152 (0.017)
Vigorous Exercises	-0.0429 ** (0.018)	-0.0444 ** (0.019)	-0.0431 ** (0.018)	-0.0443 ** (0.018)
High Blood Pressure Ever Diagnosed	0.0555 *** (0.021)	0.0566 *** (0.020)	0.0552 *** (0.021)	0.0565 *** (0.020)
Diabetis Ever Diagnosed	0.0251 (0.022)	0.0242 (0.026)	0.0278 (0.022)	0.0267 (0.026)
Cancer Ever Diagnosed	0.0516 ** (0.023)	0.0515 ** (0.023)	0.0520 ** (0.023)	0.0520 ** (0.023)
Lung Ever Diagnosed	0.0750 *** (0.028)	0.0795 *** (0.028)	0.0807 *** (0.028)	0.0851 *** (0.029)
Heart Ever Diagnosed	0.0274 (0.020)	0.0266 (0.022)	0.0290 (0.020)	0.0283 (0.022)
Stroke Ever Diagnosed	0.0212 (0.031)	0.0267 (0.032)	0.0255 (0.031)	0.0310 (0.032)
Psycho Ever Diagnosed	-0.0617 ** (0.024)	-0.0547 ** (0.023)	-0.0611 ** (0.024)	-0.0543 ** (0.023)
Arthrtis Ever Diagnosed	0.0335* (0.019)	0.0294 (0.021)	0.0319 (0.019)	0.0280 (0.021)

Continued next page. m-age dropped due to collinearity.

Table 29: If Life Insurance (3/3)

	(1)	(2)	(3)	(4)
OSP	0.00492 *** (0.001)	0.00486 *** (0.001)	0.00619 *** (0.002)	0.00602 *** (0.002)
SSB-OSP	-0.000559 ** (0.000)	-0.000633 ** (0.000)	-0.000132 (0.000)	-0.000213 (0.000)
Children	0.0693 ** (0.028)	0.0639 ** (0.027)	0.0676 ** (0.028)	0.0619 ** (0.027)
Prob. Bequest of 100k		0.000415 ** (0.000)		0.000369* (0.000)
SSB-OSP ²			-0.0000156 *** (0.000)	-0.0000153 *** (0.000)
OSP ²			-0.0000132 (0.000)	-0.0000117 (0.000)
adj. R ²				
No. covariates				
No. observations	5675	5478	5675	5478

Marginal effects; Clustered bootstrapped (200) standard errors in parentheses

(d) for discrete change of dummy variable from 0 to 1

* p<0.10, ** p<0.05, *** p<0.01

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