What Age Do You Feel? - Subjective Age Identity and Economic Behaviors

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What age do you feel? – Subjective age identity and economic behaviors ☆

Zihan Ye [a], Thomas Post [b,c,*]

[a] *Zhejiang University, School of Economics, 38 Zheda Road, 310027 Hangzhou, China*
[b] *Maastricht University, School of Business and Economics, Department of Finance, Tongersestraat 53, 6211 LM Maastricht, the Netherlands*
[c] *Network for Studies on Pensions, Aging and Retirement (Netspar), P.O. Box 90153, 5000 LE Tilburg, the Netherlands*

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ABSTRACT

Building on recent findings in psychology, we study the impact of subjective age identity (feeling younger or older than one's chronological age) on economic behaviors. Using data from the Health and Retirement Study we find: Individuals with a younger age identity have higher work engagement, and their savings profile, as a function of the subjective age gap, is hump-shaped. The effects are economically significant, for example, increasing the subjective age gap by one standard deviation increases an individual's likelihood to be employed in a subsequent HRS wave by 1.1% (about 21% of the conditional mean). The relationships found are consistent with an interplay of two subjective age channels: *Ability* (self-perceived abilities to perform certain economic behaviors) and *Preference* (choosing (avoiding) "young" ("old") behaviors). Our results have implications for policy and financial advice that traditionally target individuals based on chronological age. That is, for example, allowing more flexibility with respect to retirement decisions as well as aligning financial products and services with subjective age identities.

1. Introduction

Chronological age is one objective metric that has long been recognized as a major driver of economic decisions like working, saving, consumption, and portfolio choice (e.g., Rhodes, 1983; Cocco et al., 2005; Betermier et al., 2017; Fagereng et al., 2017). Not surprisingly, many economic policies, as well as financial advice, are formulated as a function of chronological age, for example, mandatory retirement ages or target date mutual funds. Recent research in psychology, however, emphasizes that subjective age identity (i.e. how old an individual *feels*) plays an important role in predicting health (Westerhof et al., 2014), mortality (Rippon and Steptoe, 2015), organizational performance (Kunze et al., 2015) and consumer behaviors (Moschis and Mathur, 2006).

Using data from the U.S. Health and Retirement Study (HRS) we find that for economic behaviors subjective age identity has explanatory power beyond chronological age, specifically for individuals' working, saving, and portfolio choice decisions. The impact of subjective age identity on decisions is consistent with an interplay of two channels: The *Ability* channel represents the ability to perform certain behaviors. The *Preference* channel reflects the choice of behaviors that relate with a subjective age identity. Our findings have implications for understanding heterogeneity in individual decision making as well as for economic policies and financial advice, which could include implementing policies reflecting not just chronological ages but also subjective ages, or even inducing shifts in subjective age identities to trigger desired behavioral outcomes.

We contribute to the literature studying the impact of psychological factors like optimism (Puri and Robinson, 2007), happiness (Kaplanski et al., 2015), self-efficacy (Kuhnen and Melzer, 2018), and identity (Akerlof and Kranton, 2000) on economic decisions. With respect to explaining heterogeneity in (chronological) age-related economic behaviors the literature has studied, for example, subjective life expectancy and cognitive aging. Subjective life expectancy has been found to impact, among other aspects, an individual's consumption, savings or bequests (e.g., Hurd, Smith, and Zissimopoulos, 2004; Bloom et al., 2007; Salm, 2010; Post and Hanewald, 2013; Spaenjers and Spira, 2015). Likewise, cognitive aging, driven by an interplay of changes in crystallized and fluid intelligence, has been found to explain economic decision making quality (Bruine de Bruin et al., 2007; Korniotis and Kumar, 2011; Li et al., 2013; Bruine de Bruin, 2016; Eberhardt et al., 2019).

At the most basic level, chronological age indicates an individual's standing in the life cycle (Montepare, 2009). It offers an objective reference point that guides an individual's economic choices or behaviors. For instance, a mandatory or suggested retirement age is the chronological age at which individuals tend to leave the labor force. Entering this stage of the life cycle might come with adjustments to consumption, savings, and portfolio composition.

Research in psychology, however, has pointed out that chronological age does not fully reflect an individual's developmental standing or position in the aging process (MacDonald et al., 2011). Age is a subjective variable reflecting an individual's personal interpretation of aging (Diehl et al., 2014). Subjective age identity influences behaviors, physiological functioning and longevity (Kotter-Grühn et al., 2016). For example, Rippon and Steptoe (2015) find that subjective age identity predicts mortality hazard in individuals even after objective health status is accounted for. Feeling older is related to worse cognitive performance and a marker of subsequent cognitive impairment and dementia (Stephan et al., 2016). Moreover, how old a person feels is related to characteristic ways of feeling, thinking, and behaving (Stephan et al., 2015).

The fact that subjective age identity influences the ability as well as the motivation to act or perform (Kooij et al., 2008), makes it a vital personal characteristic to explore in the domain of economic behaviors. Yet, little is known within this domain. Previous studies have mainly focused on decisions at the workplace: A younger age identity is found to enhance occupational attitudes, performance ratings (Cleveland and Shore, 1992), workplace attachment (Rioux and Mokounkolo, 2013), goal accomplishment. and organizational achievement (Kunze et al., 2015). Likewise, it moderates the relationship between idiosyncratic deals and organizational commitment (Ng and Feldman, 2010). With respect to savings decisions Huang et al. (2017) develop a theoretical life cycle model accounting for both chronological and biological age. Within their model they demonstrate that the gap between those ages creates heterogeneity in saving rates. Note, however, that their definition of biological age differs from subjective age in that biological age exclusively incorporates factors related to mortality.

In the HRS data we find empirical support consistent with subjective age identity influencing behavior through both the *Ability* and *Preference* channels. Through both channels individuals with a younger age identity are more likely to be employed (vs. retired). Through the *Ability* channel individuals with a younger age identity are more likely to save, while through the *Preference* channel we find the opposite effect. The overall effect of subjective age identity on savings depends on the relative strength of either channel within an individual.

Even after controlling for a variety of demographic characteristics, health evaluation, survival expectations, optimism, and life satisfaction, subjective age identity predicts not only statistically but also economically significant behaviors. For example, a one standard deviation increase in the percentage gap between chronological age and subjective age (feeling about 11 years younger for respondents aged 60) increases the likelihood of having reentered the labor force in a subsequent wave of our data by 1.1% (about 20.8% of the conditional mean), and decreases the probability of being retired in a subsequent wave by 1.4% (about 7.5% of the conditional mean).

Robustness checks show that the patterns we document exist both in individuals who are single or married, as well as in an UK sample (ELSA[1]). Results are stronger (coefficient magnitude and significance) in subsamples where labor market decisions are more relevant (i.e., age below 70 years). Moreover, our results are robust to different dependent variable definitions, sample selection criteria, sets of control variables, and interactions between the decisions to save and work.

Our findings improve our understanding of an individual's economic decisions over the life cycle and have implications for economic policies and financial advice. We show that responses to a simple single-item survey question on subjective age are statistically and economically significant in explaining variation in individuals' economic decisions. Our results are consistent with the observation that older Americans represent the fastest-growing segment in the labor force (Benz et al., 2013), while showing generally low saving rates and stock market participation. Our findings challenge economic policies

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[1] The results for the UK ELSA sample are available on request.

and financial advice that are based only on chronological age, and indicate that subjective age should be taken into account as well.

The remainder of the paper is structured as follows. In Section 2, we review the literature and formulate hypotheses. In Section 3, we describe the data and analyze heterogeneity in subjective age identity. The relation between subjective age identity and economic decisions we test in Section 4. In Section 5 we present additional survey results and several robustness checks, and conclude in Section 6.

2. Background and hypotheses

Starting with the seminal work of Akerlof and Kranton (2000), identity, that is, an individual's sense of self has been shown to matter for economic decision making and outcomes, for example, for gender discrimination at the workplace, household division of labor, work incentives, and social preferences (e.g., Akerlof and Kranton, 2000, 2005; Chen and Li, 2009). Subjective age identity is one facet of an individual's identity.

Subjective age and age identity are terms that the literature mostly uses interchangeably (see, e.g., Diehl et al., 2014; Barrett and Montepare, 2015) and in a broad sense to include social, physical, and other aspects of aging. Some studies make further distinctions: First, according to Diehl et al. (2014), age identity places more emphasis on sociological perspectives (e.g., social categorization and identification based on social experiences) than on psychological or physical states. Second, subjective age is viewed as one dimension of age identity. In that view, age identity is more inclusive than subjective age, encompassing further dimensions like desired longevity (i.e., "to what age do you hope to live to?") and perceptions of what being old means (i.e., "at what age does the average man or woman become old?") (Kaufman and Elder, 2002). Throughout our paper and framework we use the term subjective age identity defining an individual's subjective evaluation of his or her age with respect to both social constructions as well as psychological and physical states.

Early studies on subjective age identity found that older adults on average feel younger than their chronological ages (Barak et al., 2001). Maintaining a young subjective age identity reflects a denial of aging, and serves as a coping mechanism (Bultena and Powers, 1978). Subsequent analyses that included younger individuals led to the development of a dynamic lifespan framework to describe the formation of subjective age identity. Accordingly, individuals typically feel first older and after a certain age they feel younger than their chronological age. Subjective age identity derives from a process of anchoring, adjusting and adapting to internal developmental models and external age-symbolic markers where personal views like fear of aging (Barrett and Montepare, 2015) and social comparisons with same-age peers (Hughes and Lachman, 2016) are also considered as sources of variation.

We propose that subjective age identity impacts an individual's economic behaviors through two channels – the *Preference* and *Ability* channels. In the following, we explain the rationale for each channel and derive hypotheses regarding each channel's relation with economic behavior.

According to the *Preference* channel individuals first sort (economic) behaviors into categories according to being perceived as young or old behaviors. Then, in the spirit of Akerlof and Kranton (2000)'s model, individuals take up behaviors corresponding to their subjective age identity while avoiding other behaviors. In particular, that means when aging individuals may develop a sense of helplessness and dependency, or a fear of loss (Heckhausen, 1997; Weiss and Lang, 2012), and become confronted with old-age stereotypes. As a coping mechanism, individuals identify themselves with younger ages (Meisner, 2011; Kotter-Grühn and Hess, 2012) and take up behaviors associated with being younger (e.g., trying new brands, see Stephens, 1991), and eschew behaviors associated with the elderly (e.g., refusing to participate in programs like Meals on Wheels, see Levy and Schlesinger, 2005; Chopik and Giasson, 2017).

Giles et al. (2010) find that middle-aged and older adults identified recreational pursuits, including physical, creative, and travel activities, as youthful age triggers. With respect to economic behaviors, so far there has been little research on the age categorization. A survey finds that 55% of older Americans who continued working after retirement had done so to stay active and involved (New York Times, 2012). In our context, we expect that being employed is a youthful age trigger as retirement is a common sign of being old and involves a loss in vitality. We expect that saving is subsumed into an older age category while consuming and spending money is considered to be part of a young lifestyle. We present supporting evidence for such age categorization of economic behaviors in Section 5.1 where we analyze data from a self-developed survey distributed among Americans. Overall, we expect that those who feel younger than their chronological age have higher work engagement and lower savings than those who feel older.

According to the *Ability* channel, as implied by the lifespan framework, individuals feeling younger than their chronological age have a more positive evaluation of their abilities compared to a reference group. This evaluation may reflect objectively higher abilities or subjective beliefs of self-efficacy (Bowling et al., 2005; Boehmer, 2007) that underlie an individual's motivation (initiation, effort and persistence) to act or perform (Bandura, 1977). Age underestimation is also a form of a self-enhancement process (Montepare, 2009). The feeling of remaining in a favorable stage of one's life correlates with optimism (Myers and Diener, 1995), or even an overestimation of one's abilities (Teuscher, 2009). Consequently, feeling younger has a positive effect on the utility of effort and results in higher behavioral motivations. As a result, expending effort causes less emotional exhaustion or stress (Kooij et al., 2008). Also, feeling younger can create a positive illusion with a potential self-fulfilling prophecy by increasing, for example, mental power. In consequence, a younger subjective age identity positively affects physical and psychological health (Cleveland et al., 2016). In this vein, we expect that individuals who feel
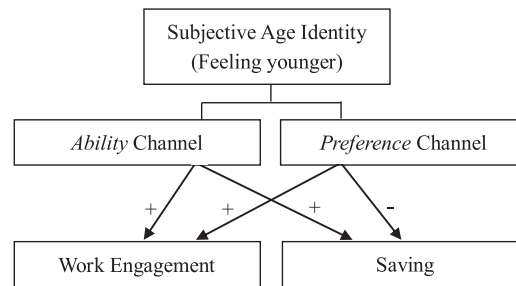
Fig. 1. Subjective age identity and economic behaviors.
This figure illustrates how subjective age identity affects economic behaviors through two channels.

younger are more likely to be employed because of higher self-perceived work-related abilities and work motivation. Also, such individuals will save more and invest more riskily because of higher saving-related (or financial management-related) abilities, like self-efficacy in controlling the amount of consumption (thus saving more for future needs) and engaging in sophisticated financial management.

In summary, both the *Ability* channel and the *Preference* channel predict that individuals with a younger age identity will be more likely to be employed (vs. retired). But the channels differ in their impact on saving behavior in that the former channel predicts that a younger age identity increases savings, while the latter channel predicts the opposite. Therefore, we expect that the impact on saving behavior will depend on the relative strength of either channel within an individual. Fig. 1 summarizes the predictions of the two channels for economic behaviors.

3. Data

3.1. Data and sample selection

Beginning in 2008, the Health and Retirement Study (HRS) introduced a subjective age question in the Participant Lifestyle Questionnaire. A rotating (random) 50% of the core panel participants completes this enhanced face-to-face interview. The question used: "Many people feel older or younger than they actually are. What age do you feel?", is the most widely used operationalization of eliciting subjective age (Kotter-Grühn et al., 2016).[2] We use data from four waves of the HRS (2008, 2010, 2012 and 2014). According to the rotating sampling strategy, a respondent takes part in this survey every four years so that each respondent has at most two observations in our sample. We focus on heads of households because wealth variables are measured at the household level. Based on marital status, we define all single respondents and all married (including living in a partnership) male respondents as household heads.[3]

For our analyses, we select from the full HRS sample respondents according to the following criteria: First, we select respondents who answer the subjective age question (28,557 observations). Then, we keep respondents who answer the questionnaire themselves, as subjective age identity is a subjective item (reducing our sample to 25,956 observations). We restrict the subjective age range from 0 to 150 to reduce the influence of outliers[4] (25,928 observations). Next, we exclude respondents with missing values on wealth variables (24,316 observations) and control variables (19,939 observations), and keep only household heads (12,702 observations). Most of the participants in the HRS survey are among the elderly in the United States (the age range is 26–90 years, the mean (median) age is 68.5 (69)). Because the HRS includes all members of a family that has an eligible old member, there are several participants who are of a relatively young age. We drop those under 45 (0.4% of the total sample) because the limited number of observations makes our subsequent classification of respondents into the groups Young, Old, Same too noisy.[5] Thus, we focus on individuals who have passed into adulthood and their internal models of subjective age identity are relatively stable (Galambos et al., 2005; Barrett and Montepare, 2015). Finally, we have 12,662 observations taken from 9284 survey participants for our analyses.

We complement the HRS data in a robustness check by analyzing data from a self-developed survey eliciting the sorting of economic behaviors into "young" or "old" categories (see Section 5.1).

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[2] The literature on subjective age identity also uses single item, multi-item, ratio, semantic, numerical, decade etc. elicitation methods. This literature finds advantages for statements that are easy to administer (e.g., single item measures) especially when respondents are of older age to avoid confusion. Furthermore, this literature finds that most measures obtained by the different methods are positively correlated (Stephens, 1991; Van Auken and Barry, 1995; Barak 2009; Kotter-Grühn et al., 2016).

[3] We also tested alternative definitions of the household head, that is, being the financial respondent or family respondent. Robustness checks show that our results are not driven by different definitions of the household head (available on request).

[4] Our results hold for narrower subjective age ranges, e.g., [20, 110], [30, 110], [40, 110] (available on request).

[5] Dropping respondents under age 50 or keeping all the observations yields results that are in line with our main specification. The exclusion primarily helps to produce more meaningful graphical representations of the data.

Table 1
Variable definitions and summary statistics.

Variable	Definition	N	Mean	Std.
Age	Chronological age in years	12,662	68.55	9.96
Subjective age	Responses to the question: "What age do you feel?"	12,662	58.28	14.48
Percentage gap	(Age – Subjective age)/ Age	12,662	0.15	0.18
Young	Indicator variable taking the value 1 if Subjective age < Age; 0 otherwise	12,662	0.75	0.43
Same	Indicator variable taking the value 1 if Subjective Age = Age; 0 otherwise	12,662	0.15	0.35
Old	Indicator variable taking the value 1 if Subjective Age > Age; 0 otherwise	12,662	0.10	0.30
Female	Gender: 1 = female, 0 = male	12,662	0.37	0.48
White	Race: 1 = white, 0 otherwise	12,662	0.80	0.40
Partner	Indicator variable taking the value of 1 if respondent is married or partnered; 0 otherwise	12,662	0.51	0.50
Child	Indicator variable taking the value 1 if respondent has children; 0 otherwise	12,662	0.91	0.28
College	Indicator variable taking the value of 1 if respondent has college degree: 0 otherwise	12,662	0.26	0.44
Retire	Indicator variable taking the value of 1 if respondent is (partly) retired; 0 otherwise	12,662	0.53	0.50
Employed	Indicator variable taking the value of 1 if respondent works for pay; 0 otherwise	12,662	0.37	0.48
Self-employ	Indicator variable taking the value of 1 if respondent is self-employed; 0 otherwise	12,662	0.08	0.27
Income	Household income in $ 100,000	12,662	0.66	1.16
Financial wealth	Sum of safe (checking, savings, or money market accounts, CD, government savings bonds, T-bills), retirement (IRAs and Keoghs), bond (corporate, municipal and foreign bonds, bond funds), and stock (stock or stock mutual funds) assets in $ 100,000	12,662	2.02	5.27
Wealth	Net worth of household total wealth including financial wealth, net worth of non-financial assets in real estate, vehicles, businesses, (primary and second) residence, and net worth of other assets (other savings as well as financial debts) in $ 100,000	12,662	4.74	10.85
Risky share	Stock assets / (safe assets + bond assets + stock assets) (conditional on positive denominator)	10,893	0.19	0.33
Health	Self-perceived health status based on responses to the question: "Would you say your health is excellent, very good, good, fair, or poor?" 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent.	12,662	3.19	1.05
Life expect	Self-reported life expectancy of living to 80–100 based on responses to the question: "What is the percent chance that you will live to be [85/80/90/95/100] or more?" 0 = "Absolutely no chance" and 100 = "Absolutely certain".	12,662	0.45	0.32
Optimism	Average score of dispositional optimism based on responses to a six-item version of the Life Orientation Test: respectively "If something can go wrong for me it will", "I'm always optimistic about my future", "In uncertain times, I usually expect the best", "Overall, I expect more good things to happen to me than bad", "I hardly ever expect things to go my way", "I rarely count on good things happening to me". 1 = Strongly disagree … 6 = Strongly agree. Reverse coded items are 1, 5, 6.	12,662	4.21	0.95
Satisfaction	Self-reported life satisfaction based on responses to the question: "Please think about your life as a whole. How satisfied are you with it?" 1 = "Completely satisfied" and 6 = "Not at all satisfied"; reverse coded.	12,662	3.87	0.84
Work for pay	Self-reported probability of working for pay in the future conditional on being unemployed currently based on responses to the question: "What are the chances that you will be working for pay at some time in the future?" 0 = "Absolutely no chance" and 100 = "Absolutely certain".	7934	0.11	0.23
Work62	Self-reported probability of working full-time after 62 based on responses to the following question: "What do you think the chances are that you will be working full-time after you reach age 62?" 0 = "Absolutely no chance" and 100 = "Absolutely certain".	3736	0.50	0.39
Work65	Same definition as Work 62, which the respective age 65	4777	0.34	0.36
Work70	Same definition as Work 62, which the respective age 70	4752	0.14	0.26
Remain	Remaining working years calculated as: Planned retirement year – current year. If respondent reports never to stop working, maximum value of Remain in the data is assigned.	4364	24.68	18.11
Forward employed	Indicator variable taking the value of 1 if respondent works for pay in the next wave; 0 otherwise conditional on Work = 0.	5170	0.05	0.22
Forward retire	Indicator variable taking the value of 1 if respondent is (partly) retired in the next wave; 0 otherwise conditional on Retire = 0.	4223	0.19	0.39
Work ability	Self-perceived work ability based on response to the question: "How many points would you give your current ability to work?" (0–10).	4620	8.56	1.51
For money	Indicator variable taking the value of 1 if respondent reports needing money based on the response to the question: "Right now, would you like to leave work altogether, but plan to keep working because…?"; 0 otherwise	4578	0.57	0.50

Table 1 (*continued*).

Variable	Definition	N	Mean	Std.
For insurance	Indicator variable taking the value of 1 if respondent reports needing health insurance based on the response to the question: "Right now, would you like to leave work altogether, but plan to keep working because…?"; 0 otherwise	4067	0.75	0.43
Risk tolerance	Financial risk tolerance based on responses to the question: "How willing are you to take risks in financial matters?" 0 to 10 scale where 0 = "Not at all willing" and 10 = "Very willing".	3330	3.25	2.68
Planning horizon	Financial planning horizon based on responses to the question: "In planning your (family's) saving and spending, which of the following time periods is most important to you [and your [husband/wife/partner]], the next few months, the next year, the next few years, the next 5–10 years, or longer than 10 years?" 1 = The next few months … 5 = Longer than 10 years.	3667	3.22	1.25
Financial control	Self-efficacy over financial situation based on responses to the question: "How would you rate the amount of control you have over your financial situation these days?" (0–10).	12,530	7.44	2.49
Control change	Self-efficacy change over financial situation based on responses to the question: "Has the amount of control you have over your financial situation changed in the last year?" -1 = "YES, I have less control now"; 0 = NO, the amount of control I have has stayed the same"; 1 = "YES, I have more control now".	9418	-0.02	0.56

This table presents variable names, definitions, and summary statistics for the HRS data. Losses of observations in some variables are due to (i) questions being asked to a fraction of the whole sample; (ii) conditions on variables, e.g., risky share; (iii) questions being asked only in some waves; (iv) missing values.

As our central subjective age variable we define is the percentage gap, that is, (chronological age – subjective age)/chronological age, which is more theoretically neutral and comparable between different ages (Rubin and Berntsen, 2006).[6] As dependent variables we include several indicators of working, saving, and portfolio choice behaviors. The former contains work and retirement expectations, and subsequent actual work and retirement decisions. We examine saving outcomes with two alternative indicators: total net wealth and financial wealth.[7] Financial wealth includes four categories: safe assets, retirement assets, bonds, and stocks (see Table 1 for a detailed definition). Total net wealth includes financial wealth, net worth of non-financial assets in real estate, vehicles, businesses, residence and other assets. The above definitions follow earlier literature studying wealth using HRS data (Rosen and Wu, 2004; Berkowitz and Qiu, 2006; Coile and Milligan, 2009; De Nardi et al., 2010). Moreover, we define as risky assets the stock share of financial wealth (excluding retirement assets).

To account for demographic characteristics and socioeconomic status (SES) that might influence both subjective age identity and economic choices, we include a variety of controls (e.g., gender, race, education and income) (Barrett and Montepare, 2015). We control for health as it is both an antecedent and outcome of subjective age identity and explains a sizable fraction of the variation in subjective age (Hubley and Russell, 2009). We also control for subjective survival expectations. Subjective age identity reflects an evaluation at present, whereas subjective survival expectations express beliefs about the future. Although these two beliefs are conceptually distinct, subjective survival expectations may contain additional health information as well as influence retirement decisions (Van Solinge and Henkens, 2009), saving behaviors (Post and Hanewald, 2013) and portfolio choice (Spaenjers and Spira, 2015). Last, we control for optimism and life satisfaction as they can be related to subjective age identity (Chua et al., 1990; Teuscher, 2009; Rioux and Mokounkolo, 2013). Although the inclusion of variables like health, optimism, and life satisfaction will consume some of the explanatory power of subjective age it can alleviate concerns of omitted variable problems.[8] Variable definitions and summary statistics are given in Table 1.

3.2. Variation in subjective age identity

In Panel A of Fig. 2 we plot subjective age and chronological age for the selected sample. Most respondents feel younger than their chronological ages. Over 85% report a different subjective age than chronological age, with about 75% feeling younger (see Panel B of Fig. 2). The median and mean gap between the two ages are very close, both around 10 years. While a younger subjective age identity is more prevalent, there is still substantial variation in the degree to which subjective age differs from chronological age.

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[6] Our results hold if we use the absolute gap between subjective age and chronological age (available on request).

[7] We exclude observations with negative wealth because later we take the natural logarithm of these values. Observations with zero wealth are still included as we add to all wealth values a 1. Taking the logarithm reduces the skewness in the wealth variables. Our results hold if we use all observations including those with negative wealth variables and with untransformed wealth variables (available on request).

[8] We do not include financial literacy and cognition in our models. Like life satisfaction those variables might be related to subjective age and economic behaviors. Those variables are, however, only available for a subset of our respondents. Results using the small subset including those variables are consistent with our main specifications (available on request).

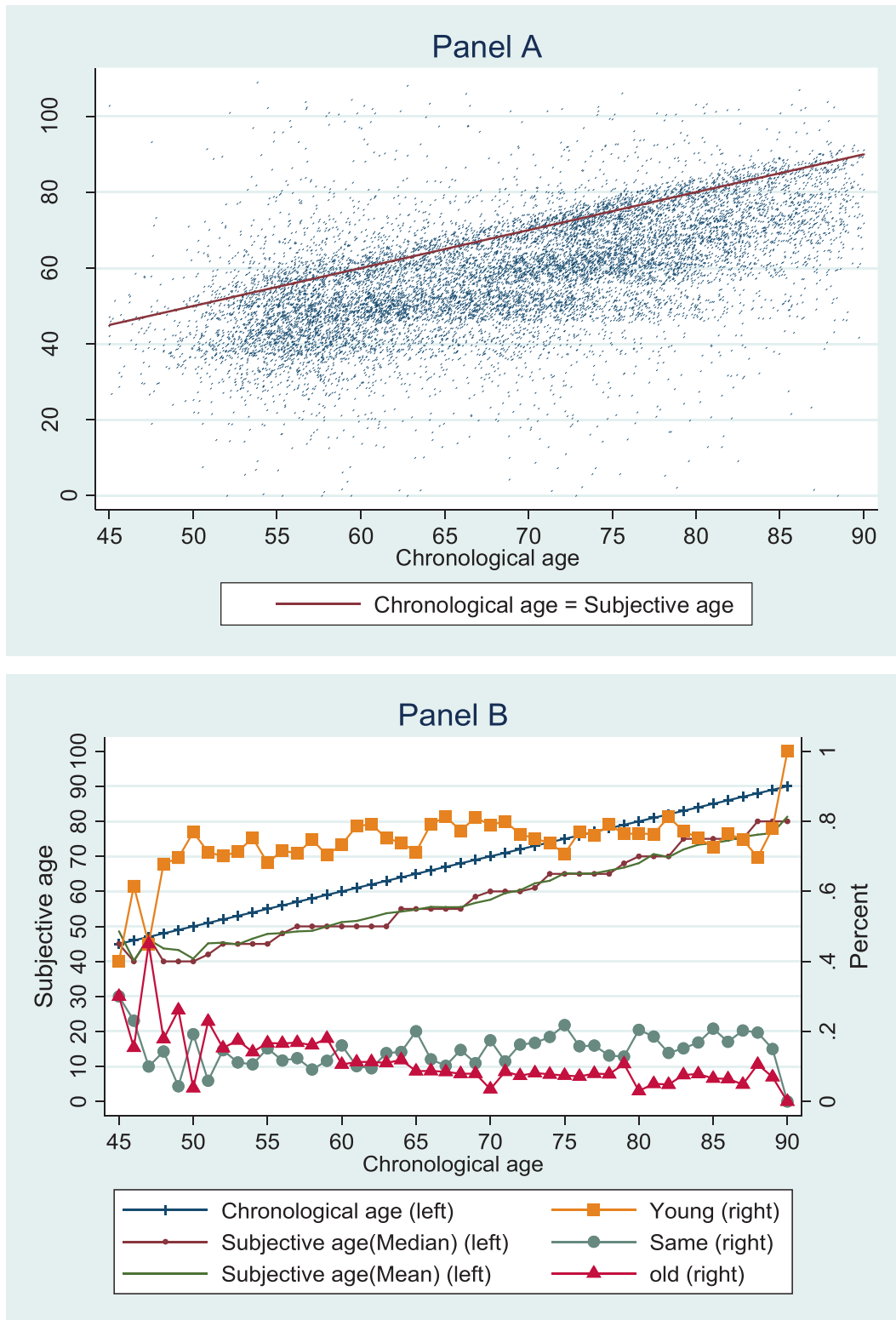**Fig. 2.** Subjective age in the HRS.
This figure shows a scatterplot of subjective age and chronological age (Panel A), mean and median subjective age for each chronological age and proportions of the groups Young, Same and Old (Panel B). In Panel A, the points are jittered to reduce overlaying. To make the figure more compact two observations with subjective ages larger than 110 are not shown in Panel A.

Table 2
Explaining the subjective age percentage gap.

	Percentage gap OLS (1)	Percentage gap OLS (2)	Percentage gap OLS (3)	Percentage gap OLS (4)	Percentage gap FE (5)
Age	0.002***	0.002***	0.002***	0.002***	0.009
	(0.000)	(0.000)	(0.000)	(0.000)	(0.005)
Female	0.006	0.002	−0.006	0.001	
	(0.006)	(0.005)	(0.005)	(0.006)	
White	−0.033***	−0.039***	−0.030***	−0.023***	
	(0.005)	(0.005)	(0.005)	(0.005)	
Partner	−0.013**	−0.011**	−0.016***	−0.018***	−0.018
	(0.006)	(0.005)	(0.005)	(0.005)	(0.014)
Child	−0.005	−0.006	−0.006	−0.004	−0.047
	(0.007)	(0.006)	(0.006)	(0.006)	(0.084)
College	0.017***	0.005	0.001	0.003	
	(0.004)	(0.004)	(0.004)	(0.004)	
Retire	−0.019***	−0.014**	−0.016***	−0.016***	−0.012
	(0.006)	(0.006)	(0.006)	(0.006)	(0.010)
Employed	0.037***	0.020***	0.020***	0.021***	−0.003
	(0.007)	(0.007)	(0.006)	(0.007)	(0.011)
Self-employ	−0.005	−0.006	−0.013**	−0.013**	−0.012
	(0.006)	(0.006)	(0.006)	(0.006)	(0.017)
ln(Income)	0.005***	0.003	0.002	0.004**	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
ln(Wealth)	0.002**	−0.002**	−0.002**	−0.003***	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Health		0.048***	0.035***		0.023***
		(0.002)	(0.002)		(0.004)
Life expect			0.071***	0.084***	0.022*
			(0.006)	(0.006)	(0.011)
Optimism			0.021***	0.023***	0.009**
			(0.002)	(0.002)	(0.004)
Satisfaction			0.009***	0.015***	0.000
			(0.002)	(0.002)	(0.004)
Objective health controls	No	No	No	Yes	No
Wave FE	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.027	0.098	0.126	0.117	0.026
Observations	12,662	12,662	12,662	11,721	12,662

This table presents the results from OLS regressions (Column 1–4) and individual FE regression (Column 5) of the determinants of the percentage gap between subjective age and chronological age. Objective health controls include lifestyle like smoke, drink, physical exercise and BMI, ADL, IADL as well as eight doctor-diagnosed health problems (i.e. hypertension, diabetes, cancer, chronic lung disease, heart problems, stroke, psychiatric problems, arthritis). Ln(X) is the natural logarithm of X plus 1. Variables are defined in Table 1. Household-level clustered standard errors are given in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Next, we examine variation in subjective age by regressing the percentage gap on different sets of explanatory variables. Results in Table 2 (Column 1) show that some demographic characteristics and SES are correlated with the percentage gap. For example, the tendency to feel younger than one's chronological age increases with age, consistent with the lifespan framework. Individuals in partnerships have a higher subjective age than single individuals. Possibly, this is caused by the aging signs of and feedback from partners about one's own subjective age (Barrett and Montepare, 2015). After including subjective health evaluation (Column 2), we find an increase in R^2. When we include all the control variables (Column 3) we find that a younger age identity is associated with higher survival expectations, optimism and life satisfaction. When we control for objective health status (including lifestyle choices like smoking, drinking alcohol, degree of physical exercise and ADL, IADL, BMI as well as eight doctor-diagnosed health problems), instead of subjective health evaluation, we get consistent results (Column 4).

In Column 5, we present the results of an individual fixed-effects model. We find that there is little time-variation of subjective age within individuals with health shocks being a major source of variation. These results are consistent with the lifespan framework and previous empirical findings (Kleinspehn-Ammerlahn et al., 2008; Montepare, 2009; Ward, 2013) that suggest that internal models of subjective age identity formation tend to be stable. Individuals possess implicit theories that they use to interpret stability and change within themselves (Ross, 1989). After they have reached the developmental stage of "grown up", they continue to think of themselves being in this stage despite aging, unless external age markers signal a salient change (Kotter-Grühn and Hess, 2012; Kotter-Grühn, 2015). Supporting evidence, we obtain when calculating respondents' four year correlation coefficients for the percentage gap which is 0.48 (*p*-value = 0.000). Likewise, the average cross-sectional standard deviation of the percentage gap (0.14) is larger than the average within-respondent's time-series standard deviation (0.08). Because subjective age identity is, to a large extent, a time-invariant individual characteristic, in the following sections we employ identification by ordinary least squares (OLS) estimations; corresponding individual fixed effects results are given in Tables A1 to A4 in the Appendix.

4. Subjective age identity and economic behaviors

4.1. Subjective age identity and work engagement

Both the *Ability* channel and the *Preference* channel predict that a younger age identity increases work engagement. To test this prediction, we estimate the following linear model:

$$\text{Work choice}_i = \alpha + \beta \times \text{Percentage gap}_i + \theta^T \times X_i + \varepsilon_j \tag{1}$$

where Work choice is an indicator of work engagement variables, that is, employment and retirement expectations as well as future actual employment and retirement decisions based on employment status indicators in subsequent waves. β is the coefficient of interest; X is a vector of control variables including the same as in Table 2 (Column 3),[9] except that we also include a squared age term to mitigate a potential concern that the percentage gap merely captures non-linear effects of chronological age. We first analyze expectations, and then whether or not they predict actual decisions in subsequent survey waves. All regression models are estimated using ordinary least squares (OLS) consistent with the results of Section 3.2.

4.1.1. Subjective age identity and work and retirement expectations

We use several survey questions that elicit respondents' work intentions. Work for pay is the self-reported probability to work in the future conditional on being currently unemployed. Having a young age identity is positively related to the likelihood of expecting to rejoin the labor force. An one standard deviation (OSD)[10] increase in the percentage gap increases Work for pay by 1.6% using the full set of controls (Table 3, Column 1), which constitutes 15.2% of its conditional mean. Work(X) in Columns 2 – 4 represents the chance to work full-time after age X regardless of the current employment status. We find that with those measures there is also a positive and significant relationship with the percentage gap. Individuals who feel younger are more likely to think of rejoining or remaining active in the labor force.

Finally, we focus on those individuals who currently work. The HRS asks those respondents when they plan to retire. The variable Remain measures the years a respondent plans to stay employed. If respondents answer that they plan to never stop working, values of Remain for them are censored at the maximum value of those who will retire some time (43 years). Results remain significant if we omit these censored observations. Feeling OSD younger results in a 0.67 years increase of Remain (about 2.7% of the conditional mean) (Table 3, Column 5).

4.1.2. Subjective age identity and subsequent work and retirement decisions

Next, we analyze whether or not subjective age identity predicts actual subsequent work and retirement decisions, and how much of the effect can be attributed to indirect effects through expectations. We use the indication of employment status in a subsequent wave conditional on not being currently employed. For example, we assign the employment status in 2010 for the 2008 observations denoted as Forward employed. Afterward, we run regression models with and without variable Work for pay and calculate direct and indirect effects by performing a mediation analysis (e.g., as in Das et al., 2017). We apply the same procedure for the retirement status conditional on not being currently retired.[11]

Results in Table 4, Column 1 give further insights into the economic importance of subjective age identity. Feeling OSD younger is related to a 1.1% increases in the probability of rejoining the labor force where the conditional mean is 5.3%, which is a similar effect size as an OSD increase in self-evaluated health status (1.8%). The indirect effect of the percentage gap on the choice to rejoin the labor force through work expectations constitutes 40% of the total effect size (see Table 5, first line). This expectation is an important mechanism through which subjective age identity impacts the decision to rejoin the labor force. We find similar results for retirement decisions in that feeling OSD younger decreases the probability of retiring by 1.4%. The indirect effect through expectations about the planned retirement age is only 6%. Feeling younger influences actual retirement decisions rather directly.

The relationships between subjective age identity and employment decisions are stronger (coefficient magnitude and significance) in subsamples of respondents who are at chronological ages at which it is easier to find employment (i.e., age < 70), and subsamples that report that their occupation requires less physical effort (results available on request).

Overall, our results show that even when we include a broad set of control variables, the relationship between subjective age and work engagement is statistically and economically significant. In addition, studying subsequent actual employment and retirement decisions conditional on a respondent's current subjective age alleviates concerns of reverse causality (i.e., being employed would impact subjective age identity formation).[12]

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[9] For all models we include self-perceived health status as a control variable. Alternative models that include objective health measures (see Section 3.2) and out of pocket medical expenses instead of (or in addition to) self-perceived health status yield results consistent with our main specification in terms of coefficient magnitude and significance for the percentage gap.

[10] The standard deviation is recalculated conditional on the sample used in each specific model. Thus, it slightly differs from the value reported in Table 1.

[11] For regressions with the binary dependent variables Forward employed and Forward retire, we use OLS models to ease the calculation of direct and indirect effects. A Probit model yields results in line with the OLS specification (available on request).

[12] In untabulated results, we also control for work tenure, occupation, industry and partner's work and retirement status. The results remain the same, i.e., the effects of subjective age identity on work-related decisions hold for different job types and are not impacted by partner side omitted variables.

Table 3
Subjective age identity and work and retirement expectations.

	Work for pay (1)	Work62 (2)	Work65 (3)	Work70 (4)	Remain (5)
Percentage gap	0.092***	0.060**	0.046**	0.051**	4.020**
	(0.016)	(0.027)	(0.023)	(0.021)	(1.700)
Age	−0.044***	−0.055	−0.113***	0.023***	−2.257***
	(0.005)	(0.042)	(0.027)	(0.005)	(0.484)
Age^2	0.000***	0.001	0.001***	−0.000***	0.016***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)
Female	−0.017**	−0.045**	−0.032**	−0.006	−2.843***
	(0.008)	(0.017)	(0.015)	(0.010)	(1.017)
White	0.005	0.112***	0.081***	0.038***	2.694***
	(0.007)	(0.013)	(0.011)	(0.009)	(0.727)
Partner	−0.006	−0.039**	−0.028*	0.010	−1.270
	(0.008)	(0.017)	(0.015)	(0.010)	(0.958)
Child	−0.013	0.029*	0.028*	−0.000	1.032
	(0.010)	(0.017)	(0.016)	(0.011)	(0.973)
College	0.009	0.037***	0.048***	0.024***	1.989***
	(0.006)	(0.014)	(0.012)	(0.008)	(0.656)
Retire	−0.188***	−0.276***	−0.202***	−0.103***	−4.206*
	(0.010)	(0.017)	(0.013)	(0.012)	(2.375)
Employed		0.225***	0.159***	0.134***	
		(0.018)	(0.015)	(0.015)	
Self-employ		0.092***	0.144***	0.189***	7.716***
		(0.018)	(0.018)	(0.019)	(0.714)
ln(Income)	0.008***	0.011***	0.006**	−0.002	−0.285
	(0.002)	(0.003)	(0.003)	(0.002)	(0.246)
ln(Wealth)	0.003***	−0.004*	−0.007***	−0.005***	−0.225
	(0.001)	(0.002)	(0.002)	(0.001)	(0.139)
Health	0.027***	0.032***	0.025***	0.011***	−0.037
	(0.003)	(0.006)	(0.005)	(0.003)	(0.350)
Life expect	0.047***	0.095***	0.140***	0.087***	1.345
	(0.008)	(0.020)	(0.017)	(0.011)	(1.030)
Optimism	0.004	−0.006	−0.007	0.002	0.394
	(0.003)	(0.006)	(0.006)	(0.005)	(0.346)
Satisfaction	−0.022***	−0.018***	−0.027***	−0.014***	−1.017***
	(0.003)	(0.007)	(0.006)	(0.004)	(0.389)
Wave FE	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.298	0.341	0.267	0.336	0.047
Observations	7934	3736	4777	4752	4364

This table presents the results from OLS regressions of work expectations and retirement planning on the percentage gap between subjective age and chronological age. Ln(X) is the natural logarithm of X plus 1. Variables are defined in Table 1. Household-level clustered standard errors are given in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

4.1.3. Subjective age identity and perceived work ability

The *Ability* channel predicts that individuals who feel younger think of themselves as having better abilities to handle work. The Participant Lifestyle Questionnaire asks respondents who currently work how they perceive their ability to work. Based on that variable we find that younger-feeling respondents have more positive beliefs about their own work ability, consistent with the *Ability* channel (Table 4, Column 5). We test the indirect effect through this channel and it accounts for about 14.6% of the retirement decision[13] (Table 5, third line), which implies that the *Preference* channel has a stronger influence. In other words, individuals who feel younger postpone retirement to stay active and involved and not primarily because of their self-perceived abilities. Note, as our specifications include control variables that are potentially related to ability (e.g., health, see the discussion in Section 3.1) the importance of the *Ability* channel might tend to be underestimated.

4.2. Subjective age identity and saving behavior

4.2.1. Subjective age identity and wealth accumulation

According to the *Ability* channel, feeling younger empowers an individual to save more because of higher saving-related abilities, like having more self-efficacy in financial management (or controlling the amount of consumption) and a longer planning horizon. However, the *Preference* channel predicts the opposite as saving and financial management are attributed to an older age category than consumption and recreational activities. Thus, we expect an interplay of the two channels. We

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[13] These questions are asked only to respondents who are currently working. Thus, there are not sufficient observations in the regression of Forward employed conditional on not working currently.

Table 4

Subjective age identity and actual work and retirement decisions.

	Forward employed (1)	Forward employed (2)	Forward retire (3)	Forward retire (4)	Work ability (5)	Forward retire (6)
Percentage gap	0.062***	0.036**	−0.079**	−0.094***	1.195***	−0.070**
	(0.017)	(0.017)	(0.033)	(0.033)	(0.154)	(0.032)
Work for pay		0.259***				
		(0.025)				
Remain				−0.001***		
				(0.000)		
Work ability						−0.014***
						(0.004)
Age	−0.030***	−0.017***	0.048***	0.051***	0.005	0.043***
	(0.006)	(0.006)	(0.009)	(0.011)	(0.042)	(0.011)
Age^2	0.000***	0.000***	−0.000***	−0.000***	−0.000	−0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female	−0.002	0.001	0.008	−0.007	0.205***	0.001
	(0.010)	(0.009)	(0.019)	(0.020)	(0.076)	(0.020)
White	0.010	0.008	−0.003	0.006	−0.124**	0.007
	(0.010)	(0.009)	(0.014)	(0.014)	(0.055)	(0.014)
Partner	0.004	0.004	−0.005	−0.016	0.019	−0.007
	(0.010)	(0.010)	(0.018)	(0.019)	(0.072)	(0.019)
Child	0.014	0.016	−0.000	0.014	0.005	−0.000
	(0.011)	(0.011)	(0.018)	(0.017)	(0.075)	(0.017)
College	0.008	0.007	−0.031***	−0.024**	0.007	−0.021*
	(0.009)	(0.008)	(0.012)	(0.012)	(0.047)	(0.012)
Retire	−0.101***	−0.056***			−0.366*	0.417***
	(0.012)	(0.011)			(0.208)	(0.068)
Employed			−0.271***			
			(0.019)			
Self-employ			−0.078***	−0.057***	−0.205***	−0.070***
			(0.013)	(0.014)	(0.055)	(0.013)
ln(Income)	0.006**	0.004	0.008*	−0.004	0.106***	−0.003
	(0.003)	(0.003)	(0.005)	(0.005)	(0.026)	(0.005)
ln(Wealth)	0.003***	0.002**	−0.000	0.001	0.003	−0.000
	(0.001)	(0.001)	(0.003)	(0.003)	(0.013)	(0.003)
Health	0.017***	0.010***	−0.034***	−0.032***	0.313***	−0.029***
	(0.003)	(0.003)	(0.007)	(0.007)	(0.029)	(0.007)
Life expect	0.022**	0.011	−0.003	0.013	0.425***	0.019
	(0.010)	(0.010)	(0.020)	(0.021)	(0.079)	(0.021)
Optimism	0.003	0.002	0.003	−0.002	0.118***	0.004
	(0.003)	(0.003)	(0.006)	(0.006)	(0.029)	(0.006)
Satisfaction	−0.009**	−0.003	0.023***	0.028***	0.142***	0.033***
	(0.004)	(0.004)	(0.008)	(0.008)	(0.031)	(0.008)
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.097	0.149	0.206	0.081	0.163	0.111
Observations	5170	5140	4223	3097	4620	3326

This table presents the results from OLS regressions of actual work (retirement) decisions on the percentage gap between subjective age and chronological age. Ln(X) is the natural logarithm of X plus 1. Variables are defined in Table 1. Household-level clustered standard errors are given in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

employ two alternative saving indicators: total net wealth and financial wealth. Fig. 3 shows hump-shaped profiles of the two wealth variables grouped by the subjective age gap.

To capture this shape in our OLS models we first include a squared term of the subjective age gap, and in later analyses and robustness checks we also use different specifications:[14]

$$\text{Saving level}_i = \alpha + \beta_1 \times \text{Percentage gap}_i + \beta_2 \times \text{Percentage gap}_i^2 + \beta_3 \times \text{Lag Saving level}_i + \theta^T \times X_i + \varepsilon_j \quad (2)$$

$$\text{Saving level}_i = \alpha + \beta_1 \times \text{Percentage gap}_i + \beta_2 \times \text{Percentage gap}_i^2 + \theta^T \times X_i + \varepsilon_j \quad (3)$$

Saving level represents total net wealth or financial wealth, and X is a vector of control variables as specified before.[15] The major difference between Model (2) and Model (3) is that the former includes the first lag of Savings level (i.e., from

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[14] Simonsohn (2018) argues that hypotheses of u-shapes are tested almost exclusively via quadratic regressions which may result in model misspecification. We employ two strategies to address this problem. First, we regress within subsamples of the groups Young and Old. Second, we include group dummies into regression models to detect group differences (Section 4.2.2).

[15] Again, for all models we include self-perceived health status as a control variable for health. Alternative models that include objective health measures (see Section 3.2) and out of pocket medical expenses instead of (or in addition to) self-perceived health status yield results consistent with our main specification in terms of coefficient magnitude and significance for the percentage gap.

Table 5

Mediation analysis: direct and indirect effects.

	Direct (1)	Indirect (2)	Total (3)	Indirect/Total (4)
Forward employed: Work for pay	0.036	0.024	0.060	40.00%
Forward retire: Remain	−0.094	−0.006	−0.100	6.00%
Forward retire: Work ability	−0.070	−0.012	−0.082	14.63%
Forward retire: For money	−0.071	−0.003	−0.074	4.05%

This table presents the results of a mediation analysis, i.e., estimating direct and indirect effects of the impact of the percentage gap between subjective age and chronological age on actual work and retirement decisions. The numerical input for this table is based primarily on Tables 3 and 4. For example, the direct effect of the percentage gap on the actual decision to take up work for pay is given in Table 4, column 2 (coefficient for percentage gap). The indirect effect of the percentage gap on the decision to take up work (i.e., indirect through an expectations channel) of 0.024 is calculated as the product of the coefficient of the percentage gap in the work for pay expectation regression (0.092, Table 3, column 1) and the coefficient of the work for pay expectations in the Forward employed regression (0.259, Table 4, column 2). The total effect in column 3 is the sum of column 1 and 2. Numbers in this table slightly differ from Table 4 because we re−run the regression model using the observations used for analyses in Table 4, column 2.
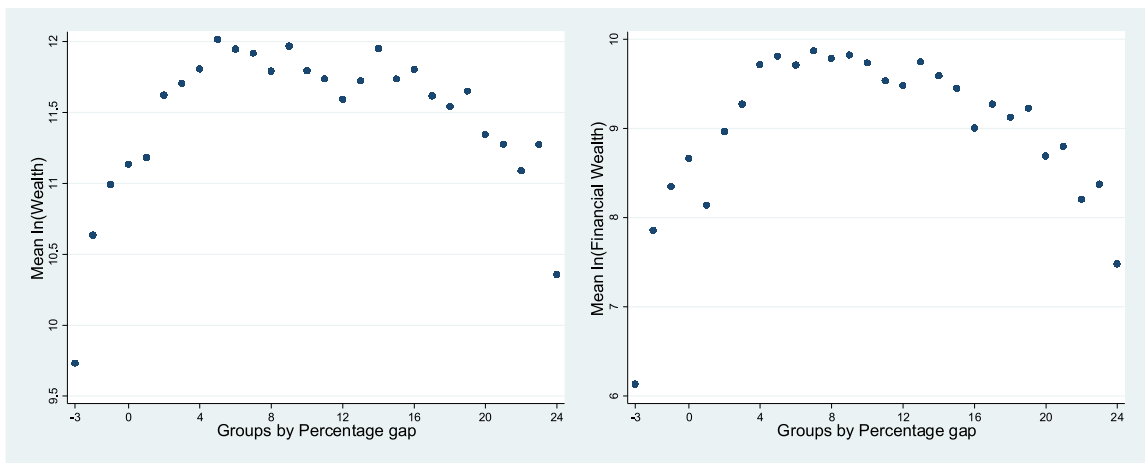

Fig. 3. Mean wealth and financial wealth grouped by percentage gap.
This figure shows the average wealth (left) and financial wealth (right) grouped by percentage gap. We group percentage gap to 28 bins and calculate the average for each variable within each bin. Observations with zero gap are in group 0. Variables are defined in Table 1.

the preceding survey wave). The specification of Model (2) allows us to capture the relation between the percentage gap and changes in Saving level (Wu, 2003; Berkowitz and Qiu, 2006), which we denote as short-term (two year) accumulation. Hereby, we assume within-individual stability of subjective age identity, which is in line with our earlier results Table 2, Column 5) where we found that within-individual variation in the percentage gap is not driven by within-individual variation in wealth. Consequently, when we control for lagged wealth, the estimated coefficients of the percentage gap are closer to exogeneity (if the formation of subjective age identity was indeed influenced by past wealth experience). Another benefit of the latter specification is that we are better able to distinguish the change in wealth (recent savings) from the total stock of wealth. Model (3) captures the long-term effect of the percentage gap on saving behaviors, which allows us to study aggregate wealth differences.

First, we run Model (2) and Model (3) to analyze the relation of the percentage gap with savings. We test the joint significance of both orders of the percentage gap with the following null hypothesis:

H0 : coefficient of Percentage gap = coefficient of Percentage gap^2 = 0.

If the F test is passed, we calculate the extreme value for the coefficients. Columns 1 and 2 in Table 6 give results based on Model (2), which examine the short-term saving change for total wealth and financial wealth respectively. Both pass the joint F test and show a hump-shape profile (about 4.5% and 25.6% of our observations for the percentage gap are smaller than the two extreme values). Results shown in Columns 3 and 4 of Table 6 are based on Model (3), and the non-linear long-term relationship is significant. Again, the two extreme values are around zero with 6.1% and 26.6% of our observations have smaller values than the extreme value. Given that the group Old (together with group Same) constitutes about 10.1% (24.6%) of our observations (see Table 1), it shows that group Young and group Old behave differently as a function of the

Table 6
Subjective age identity and saving behavior.

	ln(Wealth) (1)	ln(Financial wealth) (2)	ln(Wealth) (3)	ln(Financial wealth) (4)
Percentage gap	−0.079	0.039	−0.122	0.143
	(0.155)	(0.270)	(0.202)	(0.275)
Percentage gap^2	−0.472*	−0.942*	−1.063***	−2.555***
	(0.280)	(0.539)	(0.380)	(0.532)
Age	0.059**	0.031	0.141***	0.116**
	(0.026)	(0.040)	(0.036)	(0.047)
Age^2	−0.000**	−0.000	−0.001***	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Female	−0.045	0.008	−0.202**	0.013
	(0.058)	(0.085)	(0.098)	(0.115)
White	0.248***	0.736***	1.492***	2.408***
	(0.053)	(0.086)	(0.085)	(0.103)
Partner	0.204***	0.086	0.747***	0.499***
	(0.053)	(0.086)	(0.089)	(0.115)
Child	−0.104*	−0.135	−0.258***	−0.546***
	(0.057)	(0.090)	(0.099)	(0.126)
College	0.162***	0.517***	0.833***	1.638***
	(0.025)	(0.053)	(0.048)	(0.075)
Retire	0.057	0.278***	0.559***	0.713***
	(0.066)	(0.092)	(0.104)	(0.122)
Employed	0.082	0.111	0.493***	0.241*
	(0.069)	(0.102)	(0.108)	(0.131)
Self-employ	0.006	−0.071	0.399***	0.142
	(0.043)	(0.096)	(0.078)	(0.125)
ln(Income)	0.136***	0.349***	0.536***	0.875***
	(0.022)	(0.030)	(0.036)	(0.043)
Lag ln(Wealth)	0.788***			
	(0.013)			
Lag ln(Financial Wealth)		0.664***		
		(0.010)		
Health	0.108***	0.192***	0.404***	0.591***
	(0.019)	(0.030)	(0.029)	(0.040)
Life expect	−0.083	−0.069	−0.103	−0.224*
	(0.058)	(0.093)	(0.091)	(0.121)
Optimism	0.028	0.102***	0.157***	0.275***
	(0.017)	(0.033)	(0.030)	(0.042)
Satisfaction	0.035	0.029	0.048	0.080*
	(0.022)	(0.035)	(0.035)	(0.046)
Wave FE	Yes	Yes	Yes	Yes
F test	4.01**	3.25**	6.99***	16.58***
Extreme point	−0.084	0.021	−0.058	0.028
Adj. R^2	0.733	0.630	0.333	0.361
Observations	11,198	11,198	12,662	12,662

This table presents the results from OLS regressions of short-term (column 1–2) and long-term (column 3–4) wealth on the percentage gap between subjective age and chronological age and its squared term. H0 of F test is that "coefficient of percentage gap = coefficient of percentage gap^2 = 0". The extreme point is calculated with the equation: − (coefficient of percentage gap^2) / (2 × coefficient of percentage gap). Ln(X) is the natural logarithm of X plus 1. Variables are defined in Table 1. Household-level clustered standard errors are given in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

subjective age gap. Within group Young, the younger an individual feels, the lower the savings; while within group Old, the younger an individual feels, the higher the savings.

To study the effects within a certain group in more detail, we drop the squared term of the percentage gap in the models and run regressions in subsamples of the groups Young and Old separately. In Columns 1 and 3 of Panels A and B of Table 7, the negative relation of feeling younger with the short-term and long-term wealth accumulation is evident inside the group Young. An OSD increase in group Young decreases short-term and long-term financial wealth accumulation (total wealth accumulation) by 10.4% and 29.2% (6.6% and 18.7%) respectively. Within group Old, the effect is positive for financial wealth where an OSD increase in feeling younger leads to 20.8% increase in short-term financial wealth accumulation and 40.3% increase in long-term financial wealth accumulation.

The results in Tables 6 and 7 both convey that both channels interact with each other. It is apparent that the *Preference* channel exerts more influence than the *Ability* channel within group Young. Groups Young and Old show systematic differences in saving behaviors. Following Rubin and Berntsen (2006), the discontinuity of the distribution at the gap of zero indicates that feeling younger or older than one's actual age, and estimating that gap, appear to be different kinds of judg-

Table 7
Subjective age identity and saving behavior: Young and Old.

Panel A: Short-term Sub-samples	ln(Wealth) Young=1 (1)	ln(Wealth) Old=1 (2)	ln(Financial wealth) Young=1 (3)	ln(Financial wealth) Old=1 (4)
Percentage gap	−0.501***	0.383	−0.791***	1.400*
	(0.141)	(0.488)	(0.239)	(0.838)
Lag wealth controls	Yes	Yes	Yes	Yes
Basic controls	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes
Adj. R^2	0.739	0.681	0.619	0.643
Observations	8479	1063	8479	1063
Panel B: Long-term Sub-samples	ln(Wealth) Young=1 (1)	ln(Wealth) Old=1 (2)	ln(Financial wealth) Young=1 (3)	ln(Financial wealth) Old=1 (4)
Percentage gap	−1.399***	0.250	−2.188***	2.510***
	(0.235)	(0.591)	(0.303)	(0.795)
Lag wealth controls	No	No	No	No
Basic controls	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes
Adj. R^2	0.330	0.301	0.357	0.341
Observations	9545	1281	9545	1281

This table presents the results from OLS regressions of short-term (panel A) and long-term (panel B) wealth on the percentage gap between subjective age and chronological age for two sub-samples of group Young and Old. Basic controls include Age, Age^2, Female, White, Partner, Child, College, Retire, Employed, Self-employ, ln(Income), Health, Life expect, Optimism, Satisfaction. Ln(X) is the natural logarithm of X plus 1. Lag wealth control for Wealth is ln(Wealth), and for Financial wealth ln(Financial Wealth). Variables are defined in Table 1. Household-level clustered standard errors are given in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

ments. Results from our self-designed survey on age categorization of behaviors also show a discontinuity between groups Young and Old (see Section 5.1). Again note, as our specifications include control variables that are potentially related to ability the importance of the *Ability* channel might tend to be underestimated.[16]

4.2.2. Disentangling the channels
4.2.2.1. Economic characteristics. If the *Ability* channel is operational, we expect that feeling younger will be related to economic characteristics like higher risk tolerance, longer planning horizon, more financial self-efficacy and improvements in self-efficacy. The latter three variables should be positively related to savings. The direction of the effect of risk tolerance on savings depends on assumptions about a particular utility function. We analyze risk tolerance here because it is related to portfolio choice which we analyze below. Results in Table 8 show that the four variables are positively related with feeling younger (although not significantly in some cases). The monotonous relationship found between the four variables and the percentage gap suggests to resulting from the *Ability* channel, but these characteristics cannot explain the relationships found within group Young.

4.2.2.2. Group differences. Next, we substitute the squared term of the percentage gap with two dummies for group Young and group Old to capture group differences in saving behaviors and the incremental effect of the percentage gap as well. There are two reasons for the superiority of this type of identification (in comparison to using squared terms). First, finding that respondents in group Young, on average, have higher savings than in the groups Same or Old, is consistent with the *Ability* channel because group Young, on average, has higher "abilities" (i.e., the aforementioned four economic characteristics to save more). Second, finding that the incremental effect of the percentage gap is negative, is consistent with *Preference* channel. The regression results in Table 9 are consistent with those conjectures. Individuals from group Young have 34.3% and 29.1% (63.1%) higher long-term total wealth and financial wealth accumulation compared with the groups Same and Old. The results for short-term wealth have the same direction, but are insignificant. The estimated coefficients of the percentage gap are all negative. Feeling much younger, however, decreases wealth accumulation. There is as well economic significance: Specifically, an OSD increase in the subjective age gap reduces the short-term total wealth and financial wealth accumulation by 7.1% and 8.8% and reduces the long-term ones by 19.1% and 24.3%. This result highlights the role of the *Preference* channel in that it can reverse the impact induced by the *Ability* channel.

4.2.2.3. Evidence on portfolio choice. The *Preference* channel predicts that individuals with a younger subjective age identity allocate more financial assets to a safer rather than a risky position as sophisticated financial management might be an old

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[16] When we exclude controls variables in the models, the extreme points move to the right, which may imply a stronger influence of the *Ability* channel (results available on request).

Table 8
Subjective age identity and economic characteristics.

Panel A: (Sub-) Sample	Risk tolerance All (1)	Risk tolerance Young (2)	Risk tolerance Old (3)	Planning horizon All (4)	Planning horizon Young (5)	Planning horizon Old (6)
Percentage gap	0.882***	0.071	1.512**	0.308**	0.419**	0.604
	(0.277)	(0.438)	(0.768)	(0.131)	(0.189)	(0.441)
Basic controls+	Yes	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.099	0.098	0.112	0.044	0.050	0.015
Observations	3330	2483	361	3667	2702	437
Panel B: (Sub-) Sample	Financial control All (1)	Financial control Young (2)	Financial control Old (3)	Control change All (4)	Control change Young (5)	Control change Old (6)
Percentage gap	0.998***	0.143	2.658***	0.170***	0.111**	0.333**
	(0.153)	(0.194)	(0.655)	(0.038)	(0.054)	(0.135)
Basic controls+	Yes	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.145	0.113	0.158	0.035	0.027	0.063
Observations	12,530	9445	1270	9418	7082	974

This table presents the results from OLS regressions of economic characteristics on the percentage gap between subjective age and chronological age for the whole sample and two sub-samples of group Young and Old. Basic controls+ include Age, Age^2, Female, White, Partner, Child, College, Retire, Employed, Self-employ, ln(Income), ln(Wealth), Health, Life expect, Optimism, Satisfaction. Ln(X) is the natural logarithm of X plus 1. Variables are defined in Table 1. Household-level clustered standard errors are given in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 9
Subjective age identity and saving behavior: group differences.

	ln(Wealth) (1)	ln(Financial wealth) (2)	ln(Wealth) (3)	ln(Financial wealth) (4)
Percentage gap	−0.420***	−0.517**	−1.086***	−1.380***
	(0.137)	(0.213)	(0.213)	(0.279)
Young	0.057	0.073	0.343***	0.291***
	(0.049)	(0.082)	(0.080)	(0.108)
Old	−0.112	−0.151	−0.129	−0.340**
	(0.072)	(0.107)	(0.112)	(0.145)
Lag wealth controls	Yes	Yes	No	No
Basic controls	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes
Adj. R^2	0.733	0.630	0.334	0.361
Observations	11,198	11,198	12,662	12,662

This table presents the results from OLS regressions of short-term (column 1–2) and long-term (column 3–4) wealth on the percentage gap between subjective age and chronological age and group dummies for Young and Old. Basic controls include Age, Age^2, Female, White, Partner, Child, College, Retire, Employed, Self-employ, ln(Income), Health, Life expect, Optimism, Satisfaction. Ln(X) is the natural logarithm of X plus 1. Lag wealth control for Wealth is ln(Wealth), and for Financial wealth ln(Financial Wealth). Variables are defined in Table 1. Household-level clustered standard errors are given in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

age trigger. Meanwhile, the *Ability* channel predicts the opposite. Namely, individuals with a younger subjective age identity will allocate more savings to risky assets, given the results in Section 4.2.2.1. Thus, we expect a hump-shape profile of risky asset allocation. We utilize the risky share to investigate this point. Looking at Column 1 in Table 10, we can see that risky share does have a hump-shape profile. In the last two columns, we also separate the groups Young and Old and the effect of the percentage gap on the risky share differs between the two groups. An OSD increase in feeling younger within group Young lowers the risky share by 0.8%, while within group Old feeling younger increases the risky share by 1.4%, which constitute about 4.0% and 10.0% of the conditional means, respectively. This result is consistent with the influence of the *Preference* channel.

5. Robustness checks

5.1. Evidence on age-categorizations of economic behaviors

A main argument underlying the *Preference* channel is that individuals sort behaviors into age categories and choose (avoid) behaviors that belong to a desired (not desired) subjective age identity. The evidence in Giles et al. (2010) shows that,

Table 10
Subjective age identity and portfolio choice.

Sub-samples	Risky share All (1)	Risky share Young=1 (2)	Risky share Old=1 (3)
Percentage gap	0.006 (0.020)	−0.061** (0.027)	0.098* (0.055)
Percentage gap^2	−0.077** (0.036)		
Basic controls+	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes
F test	2.65*		
Extreme point	0.039		
Adj. R^2	0.154	0.158	0.127
Observations	10,893	8339	1009

This table presents the results from OLS regressions of the risky share on the percentage gap between subjective age and chronological age. Basic controls+ include Age, Age^2, Female, White, Partner, Child, College, Retire, Employed, Self-employ, ln(Income), ln(Wealth) Health, Life expect, Optimism, Satisfaction. Ln(X) is the natural logarithm of X plus 1. Variables are defined in Table 1. Household-level clustered standard errors are given in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

for example, "recreational pursuits" are categorized as young while "retirement" is categorized as "old." We lack, however, evidence on some of the behaviors we are analyzing, specifically, saving (vs. consumption) and financial management. As the HRS does not contain such information, we collect additional evidence using an online survey.

We begin the survey by asking respondents to rate 13 behaviors based on the typical age of the person engaging in the behavior. Then, we assess how performing a specific behavior would make a respondent feel personally (i. e., younger or older). In the list, we include behaviors we are interested in for our analyses (saving, consumption, financial management, investing in the stock market, working, being retired). As a cross-validation of our measurements, we also include behaviors that, based on the evidence in Giles et al. (2010) and common sense, are related to a certain age (e.g., making a will or having physical decrements).

Giles et al. (2010) assess the age categorization of behaviors based on qualitative techniques that include interviews and coding of text. As we want to generate measurements that we can evaluate statistically, we develop our own scales. For robustness, we use two versions of our survey to assess the general age ratings. After randomly dividing survey participants into two halves, one of the two versions is distributed to each participant. The first version uses a Likert scale asking: "Below, you see a list of behaviors and events. Please indicate for which group of people the behavior or event is most typical." Responses are measured on a Likert scale ranging from 1 = "very young people" to 7 = "very old people." In the second version, we use a numerical age rating asking "Below, you see a list of behaviors and events. Please indicate an age of a person for which that behavior or event is most typical." Ratings are measured by using a slider for each behavior where the answer range given is 0–110 years (the default position of the slider is 0).

For the personal assessment, we use the same Likert scale measurement for all respondents. Indicating a specific numerical age proved to be too difficult and confusing based on a pre-test of the survey among test respondents. In particular, we asked "Below, you see a list of behaviors and events. Please indicate how performing that behavior yourself or experiencing the event yourself makes or would make *you personally feel*", followed by the same list of behaviors given for the general assessment. Behaviors on the list given were not randomized to avoid confusing respondents when moving from the general to the personal assessment. Instead, behaviors on the list were arranged in an order that mixed presumably old and young behaviors. The order and exact wording of behaviors in the survey is given in Table A5, Column 1 in the Appendix.

After respondents completed the assessments, they indicated their subjective age (using the HRS question) and to provided demographic information. Finally, based on the scales used in Chopik and Giasson (2017), we elicit whether a respondent thinks that there are old age prejudices. Specifically, using a Likert agreement scale, we pose two statements: "No spontaneous prejudiced thoughts come to mind when I encounter an unfamiliar old person", and "Others sometimes have prejudiced thoughts toward old people" (1 = "Strongly agree", 7 = "Strongly disagree"). We aggregate the prejudice assessments by reverse coding the second question and then averaging the assessments for both questions, so a higher value implies stronger old age prejudices. We elicit prejudices because for the *Preference* channel to become effective perceived old age prejudices might play an important role in the triggering of avoiding or choosing certain behaviors.

The survey was programmed in Qualtrics and distributed as an online survey by Qualtrics in June 2018 to an audience based on the selection criteria: age ≥ 50 years, and being a U.S. resident. On average (median), respondents needed 6.7 (5.6) minutes to complete the survey. From the 266 responses originally received from the survey provider, we remove 9 responses that showed flatlining when answering the behavior categorization questions, and 2 responses that indicated a subjective age of 0 or 100 years (where the chronological age of the latter was 50 years). In the end, we have 255 responses
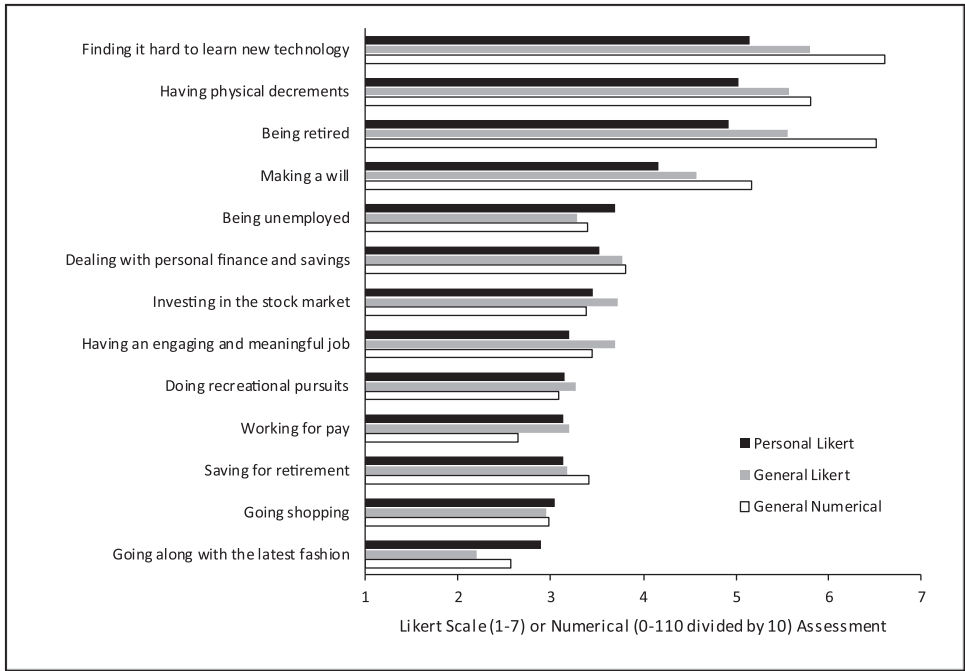
Fig. 4. Average age categorization of behaviors and events.
This figure shows the average age categorization of 13 behaviors and events sorted by the personal assessment Likert scale measure mean rating. The original order in which the behaviors we asked to respondents is given in Table A4. "General Likert" refers to the Likert scale general assessment of behaviors and "General Numerical" refers to the age in years assessment. For this figure, the values for the general numerical assessment are scaled (divided by 10).

for analysis (125 receiving the Likert scale question and 130 the numerical age question). The average age in the sample is 60.8 years, the average percentage subjective age gap is 13.1%, which is roughly in line with the HRS sample (respondents are slightly younger, potentially because the survey was distributed online).

The age categorization proved to be valid as behaviors and events that we expected to be rated as rather old (finding it hard to learn new technology, having physical decrements) or young (going with the latest fashion) indeed were scored to be very old or young (Table A5). In Fig. 4, we show the mean age ratings sorted by the personal assessment from old to young.

Based on Fig. 4, we observe that the age categorization order is strongly correlated across the two different versions for the general assessment, as well for the personal assessment. So for further analyses, we only use the personal assessment as it was asked to all respondents in the same way.

We investigate the behaviors we are particularly interested in to match with our main analyses and framework. We create composite measures for consumption (average of "Going shopping" and "Doing recreational pursuits"), saving and financial management (average of "Dealing with personal finance and savings" and "Saving for retirement"), and working (average of "Having an engaging and meaningful job" and "Working for pay").

We find that working makes respondents feel younger than being retired (mean difference $= -1.755$, p-value $= 0.000$). Saving and financial management makes respondents feel older than consuming (mean difference $= 0.230$, p-value $= 0.006$). Investing in the stock market makes respondents feel older than consuming (mean difference $= 0.359$, p-value $= 0.000$). These results confirm our assumptions regarding the age categorization of behaviors underlying the *Preference* channel.

Next, we investigate subsamples related to analyses performed in Section 4.2.1. We split the sample into two groups: respondents feeling younger than their chronological age and those feeling older or the same age. For the subsample feeling younger (58.3% of respondents) we find saving and financial management makes respondents feel older than consuming (mean difference $= 0.239$, p-value $= 0.012$). For the subsample feeling older the difference is smaller (0.201), and not significant (p-value $= 0.214$). These results confirm the results of our subsample analyses in Section 4.2.1 (Table 7), where we found that the *Preference* channel has a stronger influence in the group feeling young.

Finally, we split the sample based on how survey participants responded to the statements about old age prejudices (low (below median) versus high (above median)). Again comparing means, we find that in the subsample reporting higher older age prejudices the age gap between behaviors is larger than in the low prejudice subsample. In particular, in the high prejudice sample the mean gap between working and being retired is -1.939 (p-value $= 0.000$), the gap between saving and financial management and consuming is 0.277 (p-value $= 0.082$), and the gap between investing in the stock market and consuming is 0.527 (p-value $= 0.005$). In the low prejudice sample the mean gap between working and being retired is -1.680 (p-value $= 0.000$), the gap between saving and financial management and consuming is 0.210 (p-value $= 0.031$), and

the gap between investing in the stock market and consuming is 0.290 (*p*-value = 0.004). These results provide additional support for the notion that the *Preference* channel exerts a stronger influence than the *Ability* channel. As the literature discussed in Section 2 showed, one reason to choose or avoid behaviors is to associate or disassociate from groups with certain behaviors that society might view as favorable or unfavorable. Our results from analyzing subsamples by old age prejudices support those findings. Respondents who report the existence of stronger old age prejudices in society also show a stronger tendency to feel a subjective age impact when performing one versus another behavior.

5.2. Results from subsamples: Single and Partnered

Single and partnered household heads may differ in their saving behaviors (Mazzocco, 2004). We re-run the two saving behavior models based on partnership status. We find in both single and partnered subsamples similar hump-shape profiles of saving behaviors especially for financial wealth (Table A6 in the Appendix). The extreme points of the two groups are both near a zero gap which indicates the differences between the groups Young and Old. For single households, an OSD increase in feeling younger within the group Young is related with a 11.3% and 36.0% decrease in short-term and long-term financial wealth accumulation. The two figures for partnered heads are 9.5% and 21.8%.[17]

5.3. Potential interactions between work intentions and savings decisions

There are two ways in which the two primary variables of interest (i.e. work engagement and saving behavior) might interact with each other. First, it is possible that less saving leads to more work engagement. Potentially, even though we already control for household income and wealth, a younger age identity might interact with work decisions because of monetary concerns that arise from either living longer (Rippon and Steptoe, 2015) or increased consumption required to sustain a young lifestyle. Such monetary motivations might encourage older individuals to remain in the labor force to cope with individual longevity risk. To address this possibility, we utilize two questions that indicate whether respondents continue working because they need money and/or to maintain their health insurance benefits. We find that the percentage gap is significantly related to the money intention, but not with the insurance intention (see Table A7 in the Appendix). As the indirect effect of money intention accounts for only about 4.1% (Table 5, bottom line), the results suggest that working longer is not driven by monetary reasons, which alleviates the interaction concern.

Second, another possible interaction might run from work behaviors to saving behaviors. That is, feeling younger could reduce savings as there are more years of perceived earnings ability ahead. To check for such interaction, we focus on respondents who are currently not employed and utilize the variable Work for pay to proxy for years of perceived earnings ability ahead. The rationale for this test is based on our previous findings: Feeling younger is positively related with Work for pay, and working for pay is the main mechanism through which feeling younger influences the decision to rejoin the labor force. Thus, we next run wealth accumulation regressions only on subsamples of respondents who are currently not employed to analyze if the coefficient of the subjective age gap changes when Work for pay is included in the model. The results show that respondents feeling younger save less not because of higher expectations to rejoin the labor force and therefore expecting more income in the future (Table A8 in the Appendix). Thus, it is unlikely that our results are influenced by interactions between working and saving behaviors.

6. Summary and implications

We investigate the relationship between subjective age identity and a variety of economic behaviors. We show, that responses to a single-item survey question eliciting subjective age explain heterogeneity in economic behaviors (controlling for a range of indicators of socioeconomic status, health and subjective life expectancy etc.), in both a statistically and economically significant way. We find that the relation of subjective age identity with economic decisions is consistent with two channels, an *Ability* channel and a *Preference* channel. The former channel emphasizes the aspect of self-perceived abilities, while the latter emphasizes the aspect of choosing behaviors that relate with subjective age identity.

Our results demonstrate that feeling younger is related to more work engagement, specifically, higher expectations of rejoining the labor force and planning to retire later and also predicts actual work and retirement decisions (irrespective of expectations). Because of the interaction between the two channels, we find hump-shaped profiles of savings as a function of the subjective age gap. On average, individuals who feel younger than their chronological ages save more than those who feel older than their chronological ages consistent with the *Ability* channel. However, the *Preference* channel reverses this relationship within the group where individuals feel younger than their chronological ages. We also find a similar pattern for portfolio choice, that is, feeling much younger relates to a less risky asset allocation.

The implications of our findings are twofold: First, our results suggest to incorporate subjective age in addition to chronological age in economic policies and financial advice. For financial advice and firm policy doing so might be rather straightforward. Eliciting subjective age is simple and the respective advice on, for example, savings and investments can be ad-

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[17] Another identification strategy regarding partnered subsamples is including both partners' subjective age gap and corresponding controls within a household in regression models. Robustness check show that both partners within a household display a hump-shaped profile regarding their wealth accumulation (available on request).

justed accordingly (e.g., the target date of a target date fund). Likewise, similar as in the consumer goods industry (see Barak, 2009 and the references therein) subjective age identity can be used as a dimension to segment individuals and adapt products, services, and communication accordingly. For public policy the implementation of subjective age identity might be more challenging. When assessing subjective age, individuals might respond strategically to a subjective age question in order to, for example, receive higher or earlier retirement benefits. In the public domain therefore our results call for giving individuals flexibility to decide themselves on important issues, like when to retire and when to start the payout-phase of a retirement plan, in order to align with their subjective age identity.

Second, earlier works show that individual subjective age identities can be experimentally manipulated resulting in, for example, improvements in memory and physical functioning (Levy, 2003; Stephan et al., 2013). Thus, if a certain behavioral response to a particular subjective age is perceived as beneficial (e.g., working longer, or saving more), interventions targeting subjective age identity might be used to trigger that behavior.

Our study suggests avenues for future research. Exploring domain-specific measures of subjective age identities (Cleveland et al., 2016) has the potential of refining our understanding of economic behaviors. Studying samples that include younger people who, on average, feel older than their chronological ages (Montepare and Lachmann,1989) might give us deeper insights into age-specific behavioral choices.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jebo.2019.08.004.

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