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Happiness and Age Cycles - Return to Start...? On the Functional Relationship between Subjective Well-Being and Age

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ABSTRACT

Previous happiness research has explicitly assumed that subjective well-being is U-shaped in age. This paper sheds new light on this issue testing several functional forms. Using micro data from the World Values Survey on 44 000 persons in 30 economically advanced OECD countries with long life expectancies, we reveal a hyperbolic functional form. We find that life satisfaction reaches another local maximum around the age of 83, with a level identical to that of a 26-year old. This hyperbolic well-being-age relation is robust to the inclusion of cohort effects. We test this relationship for each OECD country separately, and corroborate the functional form using a sample of non-OECD countries.

RESUMÉ

Jusqu'à présent, la recherche sur le bonheur est partie du principe que le bien-être subjectif suit une distribution de l'âge en forme de U. Ce document apporte de nouvelles informations sur cette question en testant plusieurs formes de fonctions. En utilisant les données individuelles du World Values Survey sur 44 000 personnes dans 30 pays de l'OCDE avec des espérances de vie longues, nous proposons une fonction hyperbolique. Nous trouvons que la satisfaction de vie atteint un autre niveau maximum à 83 ans, un niveau identique à celui de l'âge de 26 ans. Cette relation hyperbolique avec l'âge est robuste en incluant les effets de cohortes. Nous testons cette relation pour chaque pays de l'OCDE séparément, et l'utilisons en utilisant une sélection de pays non-OCDE.

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This paper was written while the author was working as an economist in ELS/SPD, OECD, 2008-2009. Current affiliation: University of Hamburg, Department of Economics, Institute of Public Finance, Von-Melle-Park 5, 20146 Hamburg, Germany, e-mail: javfischer@gmx.de. Justina Fischer thanks participants of the Econometric Society European Meeting ESEM (Barcelona, August 2009) and Simon Chapple, Andrew Clark, Enrico Giovannini, Marco Mira d'Ercole, Adolfo Morrone, Mark Pearson, Monika Queisser and Dominic Richardson for helpful comments and suggestions. An earlier draft of this paper was circulated under the title "Happiness and age cycles – return to start…", MPRA Paper 15249, University Library of Munich, Germany. First version: December 2008; final version: 15 September 2009.

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The views expressed in this paper are those of the author alone, not necessarily of the OECD or any of its member countries.

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With age comes wisdom, and with wisdom contentment.

1. Introduction

1. Folk wisdom says that with age comes wisdom, and with wisdom comes contentment. Indeed, since the contribution of Clark and Oswald (1994) happiness research has postulated that subjective well-being, the overall satisfaction with the life one leads, follows a U-form function in age: happiness first declines in age, but then rises in age again - after the years of midlife crisis have been successfully mastered. Thus, in most studies older persons beyond retirement appear more satisfied with their lives compared to those aged 40 or 50. In developed countries, life expectancy is on the rise, fertility is falling, resulting in societies with an overaging population, namely with an increasing population share of the oldest. In the long run, such development may turn the age pyramid - as it had existed for centuries - upside down, with the youngest persons forming the smallest population group. For this reason, happiness research in richer countries should take account of potentially heterogeneous age effects, focusing on the effects in the older age groups, particularly when attempting to draw policy conclusions.

In brief: previous empirical research

2. Some recent household panel analyses have, however, cast doubt on this *U-form relation* between subjective well-being and lifeyears, while analyses based on international micro data often support the U-relation, but rarely test for alternative functional forms. To the confusion add gerontological studies, which, by nature, focus on the middle-aged to older population. These studies report an *inverted U-relation* between subjective well-being and age, suggesting that another well-being peak is reached at an older age, with well-being declining after this old-age maximum. Taken altogether, the debate on the relation between happiness and age is open again (see also Blanchflower and Oswald, 2009).[1]

Aim of paper

3. The aim of this paper is to contribute to this discussion by testing the heterogeneity of age effects exploiting survey data from developed countries that include a relatively large share of aged persons. It is for this strong representation of persons aged 65 and older in the sample that allows for testing several functional relations between subjective well-being and age, and contrasting them against each other, a neglected aspect in previous happiness research. We also analyze the sensitivity of our results to the inclusion of age cohort dummies and additional controls for personal characteristics and life events. Using the 3rd and 4th waves of the World Values Survey, socio-demographic information on 44 000 persons in 30 OECD countries is extracted. Empirical evidence suggests a hyperbolic relation between subjective well-being and age, with a minimum around 40-45 and an old-age maximum around 80-90 years. This hyperbolic functional form is tested for each OECD country separately and persists in a non-OECD sample.

Contents of paper

4. The reminder of this paper is organized as follows: Section 2 provides a review of the empirical research on the relation between happiness and age, while Section 3 introduces the data, provides descriptive statistics and describes the method of analysis. The subsequent section discusses the empirical results for various functional forms of a multivariate regression analysis and provides graphical illustrations of the estimated well-being–age functions. Section 5 concludes and discusses the policy relevance of these findings.

1. See also van Landeghem (2009), and Gwozdz and Sousa-Poza (2009) for other recent discussions.

5. The next section introduces the literature, before we turn to the data and the empirical analysis for OECD countries.

2. Literature review

6. Since the contribution of Clark and Oswald (1994) it appears common sense that subjective well-being (SWB), also referred to as 'happiness', is U-shaped in age (for a literature review, see Clark, 2007; Blanchflower and Oswald, 2008; Frijters and Beatton, 2008).[2] SWB first declines with age, and, after reaching a minimum, rises again. In Western countries, the turning point lies roughly between 35 and 50 years, termed in popular psychology as 'midlife crisis'. Older empirical happiness studies often did not set their focus on age effects, rather treating age as control variable. In previous empirical research this non-linear relation is modelled as a second-order polynomial, and, as such, reflected in a negative estimate for 'age' and a smaller, but positive one for its squared term (e.g. Blanchflower and Oswald, 2004). This U-shaped relation becomes also often evident when 10-year age categories are employed in place of the continuous age measure, with those being older than 65 forming the last, assumingly homogenous age group (e.g. Frey and Stutzer, 2000; Dorn et al., 2008).

2.1. Theory

Theory I: Sociologists and Psychologists

7. From a theoretical perspective, the U-shaped relation is usually explained through aspiration theory that was developed by psychologists and sociologists. Subjective well-being is defined as the difference between aspired and achieved utility, with SWB rising as the actual level approaches the expected level (e.g. Andrews and Withey, 1976). In explanation of the non-linear age effect, it is argued that aspired consumption (including marriage etc.) grows faster in age than do one's financial resources for its realization, finally resulting in what is often called the 'midlife crisis'. From the age of between 35 and 50 on (depending on the study), a re-evaluation of aspirations occurs that leads to their downward adjustment. For example, Carstensen et al. (1999) propose that a re-orientation towards living a meaningful life takes place, giving less weight to aspired consumption. Consequently, according to aspiration theory, SWB rises again in age. Altogether, this explanation rests on aspired consumption that relates to life events occurring during the years 30 to 50 (e.g. Hayo and Seifert, 2002). Arguably, the fact that the life cycle effects persist and become more pronounced when such events are controlled for (e.g. change in employment status, civil status, or income) is rather not in support of the aspiration hypothesis.[3]

Theory II: Economists

8. However, theoretical models developed by economists are even worse at predicting the U-relation. For example, Deaton (2007) develops a model in which an agent maximizes her life-time utility from birth to death, with overall utility defined as an accumulation of (discounted) instantaneous utils. Under certain simplifying assumptions instantaneous utility rises with the capacity to enjoy consumption, thus with age (due to human capital accumulation), and then declines again in age, as this capacity starts to shrink. If the survey question on SWB approximated instantaneous utility, the result would be an

2. For earlier research suggesting no relation between well-being measures and age see Diener et al. (1999). For the relation between age and job satisfaction, see Clark et al. (2003).

3. An upward development after the midlife crisis might also be triggered by a selection of unhappier people out of the sample.

empirically observable *inverse* U-relation of the SWB measure with age.[4] In contrast, Blanchflower and Oswald (2007) present a multi-period consumption-based lifetime utility model in which subjective well-being is independent of age as period-specific utility is flat over the lifespan. The authors argue that it required assumptions too strong to derive a U-shaped relation between utility and age.

9. Taken altogether, neither field of social science, nor the economic the least, has developed a completely convincing theory for the observed U-relation between SWB and age.

2.2. Previous empirical findings

10. Recently the scientific debate on the robustness of the empirically often supported U-shaped relation between subjective well-being and age has rekindled. Some happiness researchers who employ household panels claim that this effect is driven by omitted birth cohort impacts, while others, employing identical household panels, but also repeated cross-sections, corroborate the U-relation.

Confirmative studies: international

11. Confirmative of the U-form for both Europe and the USA is the study by Blanchflower and Oswald (2008) who also control for birth cohorts. They combine repeated micro-level cross-sections for up to 30 years which facilitates controlling for cohort effects. The U-shaped function in the Western and Eastern European countries is identified using the four repeated waves of the World Values Survey (1982, 1992, 1996, 2000) with a 10-point scaled life satisfaction question as dependent variable (minima/maxima: 45(m), 47(w), 46(m), 48(w)). For the USA a 3-scale happiness question of the General Social Survey, 1972-2006, is employed, yielding a turning point of 52.9 for men and 38.6 for women.[5] International evidence for the U-shaped relation is also provided by Blanchflower (2008), who, however, omits cohort dummies from his model specification.

Confirmative studies: national panel studies

12. Country-specific household panel frameworks allow to overcome the potential bias through the omission of age cohort effects by including individual fixed effects which implicitly control for the time-invariant trait 'year of birth'. Choosing such panel fixed effects approach, Clark and Oswald (2006) equally report a U-shaped relation between age and several measures of mental well-being of British residents from 1991 to 2004, and, similarly, Ferrer-i-Carbonell (2005) for German residents' life satisfaction in the GSOEP panel. Clark (2007) provides the most complete set of tests of the robustness to cohort effects. Using the BHPS data, cross-sectional analyses wave by wave allow to test the equality of the minima across them. Second, he includes individual fixed effects in a panel framework. Employing an overall life satisfaction measure, he finds that the U-form persists and that the minima do not change considerably across waves.

4. Survey questions that aim at measuring SWB either employ the so-called 'happiness' question or the so-called 'life satisfaction' question (see Fischer, 2009, for a discussion of their differences). Deaton (2007) uses the latter variant, as does this contribution. This point is also discussed in the data description.

5. The results by Blanchflower and Oswald (2008) suggest that the life cycle effect of age does not hold for developing countries. This may be either due to the lack of sufficient waves for many of these countries or be triggered by rapid economic growth (expectations) which prevents the downward adjustment of expectations/aspirations after the mid-life crisis. Nevertheless, their study suggests that the hyperbolic form also persists in a sample of developing and transition countries.

Non-Confirmative studies: national panel studies by happiness researchers

13. However, the U-shaped relation is challenged by economists such as Frijters and Beatton (2008, July), who conclude for their analysis with the GSOEP data that there are "no age, time, or cohort effects" (p.18). First, they argue that the U-turn may be caused by an endogeneity bias in the age variable, as (unobserved) genetics (in principle uncorrelated with age) may not only determine happiness, but also observed time-varying determinants such as e.g. income, marital status, health state, etc, which are, in turn, correlated with age (which makes genes indirectly correlated with age). In their analysis, inclusion of individual fixed effects yields a negative, but linear relation between life satisfaction and age. In a second step, they conjecture that this decline may be caused by a selection of individuals out of the panel who experience persistent negative shocks. However, estimating the model for the new entrants only yields still no U-shaped relation. A cross-check with official UN data for divorce rate (as example for such negative shock) does not support their conjecture equally, and the alternative explanation of a change in response culture from overstatement to true statement is never empirically supported.

Non-Confirmative studies: national studies by gerontologists

14. The U-shaped relation between age and SWB is also challenged by gerontological studies. While most happiness researchers (implicitly) put emphasis on the population during their economically active life, with a small number of observations above the age of 65, gerontologists focus, by nature of their research object, on persons in old age. Based on the postulated U-shaped relation, one may expect a rise of SWB in age among the older. However, the findings are far from conclusive: Controlling for cohort effects, Chen (2001), using two longitudinal waves of persons aged 60 and older from Taiwan, identifies a decline in life satisfaction from the age of 65 on. Notably, controlling for a broad range of life events Chen (2001) also finds a positive effect of those in the 75 to 79 age group, which he views as a cohort effect of having overcome war time experience. For the German population aged between 48 and 75, this decline of happiness in age is mirrored by Schilling (2005), who, using the GSOEP from 1984 to 1999, also controls for cohort effects. Similarly, psychological studies with a focus on elder persons identify an inverted U-shape function for the older population. For example, Mroczek and Spiro (2005) report in a sample of American veterans older than 40 years an inverted U-shaped function of SWB in age with a peak around 65. After the peak, subjective well-being declines again; controlling for health and excluding those dying the following year rules out deterioration of health as possible explanation. In sum, gerontological studies focusing on the older population rather suggest an *inverted U-relation*.

Summary of literature review

15. Taken all together, happiness research suggests in tendency that there are U-form life-cycle effects on subjective well-being that are independent from age cohort effects. In contrast, gerontologists' research rather suggests the opposite relation of an inverted U-relationship, viewed from the point of the midlife crisis on. Combining these findings, one may suspect that SWB is hyperbolic in age (like an inverted sinus-wave: first declining in age, then increasing and then declining again), or that it flattens out from a certain old age on. This paper tests this conjecture for sample of OECD countries in which the share of persons older than 65 in the population (and in the surveys) is sufficiently large to analyze heterogeneous age effects also for this specific group.

16. As next step, the data and statistical method will be described, before we turn to the empirical analysis.

3. Data and methodology

The WVS data

17. The only freely available dataset with individual-specific information on socio-demographic characteristics for all 30 OECD countries are the World Values Survey (WVS), a survey focusing on people's values and beliefs.[6] These cross-sectional data include a measure of subjective well-being that is commonly employed in empirical happiness literature (see Fischer, 2009). The non-profit WVS organization, located in Stockholm, Sweden, conducts world-wide surveys, starting in 1980 with about 10 countries and the 5th wave of 2005 containing 54 nations. For each country, between 1 000 and 2 000 persons are interviewed, who constitute, for most developed countries, a representative sample. Combining waves 3 (1997-1999) and 4 (1999-2001) allows for a full OECD sample.[7] The empirical analyses are carried out for an OECD sample of ca. 44 000 persons, which includes the most recent accession country of 2000, the Slovak Republic.[8]

SWB and age

18. The WVS measure of subjective well-being (SWB) is approximated by an individual's life satisfaction, captured by the question "All things considered, how satisfied are you with your life as a whole these days?" Responses are measured on an ordinal 10-point scale, ranging from 1 (completely dissatisfied) to 10 (completely satisfied). The life satisfaction question aims at measuring an individual's cognitive assessment of the perceived overall quality of her life as a whole, from her past until the very moment the question is posed (for a discussion of the advantages and disadvantages of this SWB measure, see Fischer, 2009).[9] Our focal variable is age, which the WVS data provides in two forms: first, as 6 separate age categories, and, second, as continuous measure. The age categories are in 10-year steps, starting with the age of 15, and the last age group starting at the age of 65. Continuously measured 'age' ranges from 15 to 101 life years. To allow for second- and third-order polynomials, the squared term of continuously measured 'age' (divided by 100) and age to the power of three (divided by 1000) have been calculated. The variation in SWB by age (measured by its standard deviation) is not substantially different across age groups, so that any empirical analysis should focus on SWB levels and changes therein, as this study does.

Control variables

19. Derived from the same data source are socio-demographic control variables that are commonly employed in empirical happiness research (e.g. Bjørnskov, Dreher and Fischer, 2008). These include gender, income, occupational status, marital status, number of children, religion and spirituality, vertical and horizontal trust, social capital, and political ideology. Table 1 provides a list of all control variables and descriptive statistics.

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6. www.worldvaluessurvey.org

7. 87% of the observations in the sample are obtained from the 4th wave (residents in 26 out of 30 OECD countries), while the remaining ones are obtained from the 3rd wave (namely persons living in Australia, Switzerland, Norway, New Zealand).

8. The full combined third and fourth waves of the World Values Survey (1997-2001) contain socio-demographic information of appr. 120 000 individuals in more than 80 countries.

9. The alternative variant, the so-called 'happiness' question ("How happy are you/with your life/ now/ these days?") is, depending on the exact wording, more susceptible to the influence of affective states, moods and momentaneous experienced utility.

Samples

20. OECD countries are among the most economically advanced and politically stable countries in the world. This is also reflected in high life expectancies and the overaging of their populations. A small comparison reveals the supremacy of OECD countries for analyzing heterogonous age effects among the older population: In the sample of 44 000 persons, there are 6 000 persons older than 65 (13%), of which, in turn, 760 are aged 80 or older (2% in OECD sample). In contrast, in the remaining world sample (80 000 observations) only 7.5% are older than 65 and only 1% is at least 80 years old. For robustness test, we also use this sample of non-OECD countries in the WVS data.

Method

21. The impact of age on subjective well-being is analyzed at the micro-level, exploiting the variation between up to 44 000 persons in 30 well-developed and democratic countries. Associations between age and subjective well-being are analyzed using OLS. Applying OLS to the ordinal life satisfaction variable can be justified based on Ferrer and Frijters (2004). To test whether unobservable country-specific culture drives the correlations between life satisfaction and age, we analyze this relation with two model specifications, one excluding and one including country fixed effects. A comparison of the estimates should then reveal to what extent the previous findings are sensitive to taking account of differences in national culture and institutions. In principle, country fixed effects capture all national characteristics – be it institutions, language, history, traumata - but also culture-specific ways of replying to the life satisfaction question. Further inclusion of socio-demographic control variables - such as e.g. marital status, number of children, or occupational status - should then (partly) reveal to what extent the correlations between age and life satisfaction are caused by unobserved life events. Notably, due to the cross-sectional nature of our data causality cannot be inferred directly from the estimates, and 'natural' selection of unhappy persons out of the sample may particularly occur at higher ages. Table 1 presents descriptive statistics of the life satisfaction measure, the variables of interest and the control variables.

22. The following section presents our own empirical findings, on which preliminary conclusion and policy implications are based.

Table 1: Descriptive statistics for up to 44 000 individuals in 30 OECD countries

Variable	Obs.	Mean	Std. dev.	Min.	Max.	Correlation with SWB
Life satisfaction	44317	7.17	2.24	1	10	1
Male	44317	0.47	0.50	0	1	-0.0246*
Age	44151	43.73	16.97	15	101	0.0324*
Age^2/100	44151	22.01	16.30	2.25	102.01	0.0370*
Age^3/1000	44151	123.45	131.53	3.37	1030.30	0.0392*
Education low	43652	0.39	0.49	0	1	-0.0702*
Education middle	43652	0.39	0.49	0	1	0.0121(*)
Education high	43652	0.21	0.41	0	1	0.0693*
Income low	44317	0.28	0.45	0	1	-0.1475*
Income middle	44317	0.29	0.46	0	1	-0.0050
Income high	44317	0.24	0.43	0	1	0.1093*
Divorced	44317	0.06	0.23	0	1	-0.0395*
Single	44317	0.24	0.43	0	1	-0.0381*
Married/cohabiting	44317	0.61	0.49	0	1	0.0844*
Separated	44317	0.02	0.13	0	1	-0.0370*
Widowed	44317	0.07	0.26	0	1	-0.0427*
No children	44317	0.28	0.45	0	1	-0.0118*
Has had 1 child	44317	0.15	0.35	0	1	0.0024
Has had 2 children	44317	0.29	0.45	0	1	0.0140*
Has had 3 or more children	44317	0.26	0.44	0	1	0.0068
Fulltime employment	44317	0.37	0.48	0	1	0.0645*
Part-time employment	44317	0.08	0.28	0	1	0.0132*
Self-employed	44317	0.07	0.26	0	1	-0.0206*
Housewife	44317	0.13	0.33	0	1	-0.0132*
Retired	44317	0.18	0.38	0	1	0.0059
Other occupational status	44317	0.02	0.14	0	1	-0.0197*
Student	44317	0.06	0.24	0	1	0.0160*
Unemployed	44317	0.05	0.23	0	1	-0.1461*
Conservative ideology	44317	0.23	0.42	0	1	0.0583*
Centrist ideology	44317	0.39	0.49	0	1	-0.0035
Leftist ideology	44317	0.23	0.42	0	1	-0.0503*
Believes in superior being	44317	0.72	0.45	0	1	0.0255*
Religion missing	44317	0.01	0.10	0	1	0.000
No religion	44317	0.22	0.42	0	1	-0.0235*
Buddhist	44317	0.02	0.13	0	1	-0.0384*
Catholic	44317	0.37	0.48	0	1	0.0581*
Jewish	44317	0.00	0.05	0	1	-0.0032
Muslim	44317	0.10	0.31	0	1	-0.2273*
Protestant	44317	0.21	0.41	0	1	0.1349*
Christian-orthodox	44317	0.03	0.17	0	1	-0.0294*
Other Christian denomination	44317	0.01	0.09	0	1	0.0271*
Other religion	44317	0.02	0.13	0	1	0.0226*
Friends are important	44317	0.92	0.27	0	1	0.0688*
Trusts most people	42877	0.33	0.47	0	1	0.1452*
Conf. in churches	43150	0.52	0.50	0	1	0.0392*
Conf. in army	42872	0.60	0.49	0	1	0.0045
Conf. in press	43403	0.38	0.49	0	1	0.0112*
Conf. in labor unions	41041	0.38	0.49	0	1	0.0149*
Conf. in police	43627	0.65	0.48	0	1	0.1300*
Conf. in parliament	42408	0.38	0.49	0	1	0.0894*
Conf. in civil services	42325	0.44	0.50	0	1	0.0567*
Conf. in United Nations	39939	0.55	0.50	0	1	0.0892*

Notes: *, (*) denote significance at the 1, 5 percent levels, respectively.

4. Results

4.1. Using age categories

23. Our micro-level analysis starts with an estimation of age category effects on life satisfaction, at the micro-level for 44 000 persons in 30 OECD countries using OLS, taking the group of the youngest (15-24 years old) as reference category. The WVS data follow common practice in happiness research by aggregating all persons of age 65 or above into one group. Similar age categories have been employed in the early beginnings of this research, e.g., in Frey and Stutzer (2000) for a cross-section of 6 000 Swiss residents. Table 2 presents the estimation results in various model specifications: either including or excluding country fixed effects, either including or excluding additional individual-specific controls. Based on the previous happiness literature, we expect age effects to be more pronounced when additional personal characteristics are included in the model.

24. The estimates in Table 2 support, in general, a U-form shape, but also reveal the sensitivity of the statistical significance to model specification: Table 2 corroborates earlier observations that age effects become more pronounced the more complete the SWB model is specified.

25. Starting with model 1, the most parsimonious specification which includes only age and gender, only the coefficient on the group of the 45- to 54-years old appears significant (at 5 percent level). Its negative sign indicates that persons in this group have a lower subjective well-being by about 0.2 life satisfaction categories compared to the reference group, the 15- to 24-years old. Already in model 1, the size and signs of the estimates suggests a U-form relationship between age and happiness, with its minimum in the 45- to 54-years group.

26. Inclusion of country fixed effects in model 2 enlarges the magnitudes of the coefficients and levels of significance for almost all age categories (up to 1 percent level). Estimates increase again in size when individual-specific variables are added (model 3) and country fixed effects are included (model 4). The similarity of the coefficients across models 3 and 4 suggests that unobserved country heterogeneity does not considerably bias the results for age, once individual heterogeneity is taken into account. In model 4, the size of the age effects ranges from -0.23 to -0.57, again indicating a U-form relation with respect to the reference category, with SWB of those in the midlife crisis (45-54 years) lowered by more than half of a category. Notably, the coefficient on the highest age group (> 65 years) is never significant in any model specification, possibly a result of unobserved heterogeneity. According to the adjusted R2, the measure of goodness of fit, the full specification in model 4 is to be preferred over all other models (adjusted R2 = 0.1811, which is an acceptable fit in the light of data employed, model design and estimation method).[10]

27. Taken all together, employing age group dummies suggests a U-form relation between age and SWB, while aggregating all persons aged 65 and above into one single age category, as common in early empirical happiness research, does not allow for detecting heterogeneous effects among the population in their 'third age'.

10. Usual levels of goodness of fit in terms of adjusted R2 are between 0.1 and 0.06. There are three reasons: first, cross-sectional data fail to take into account personality traits and other unobservable time-invariant facets that account for 30% of the variance in SWB. In addition, moods are omitted from the model, equally making up to 30% of the variation in responses to the SWB question (see also Fischer, 2009). Finally, estimation of a categorical dependent variable with OLS usually produces low values of adjusted R2.

Table 2: Individual age categories and individual SWB in 30 OECD countries

	1	2	3	4
Age 25 - 34	-0.026	-0.038	-0.208**	-0.232**
	[0.55]	[0.83]	[3.73]	[3.95]
Age 35 - 44	-0.073	-0.135+	-0.420**	-0.473**
	[1.03]	[1.94]	[6.52]	[6.25]
Age 45 - 54	-0.179*	-0.219**	-0.556**	-0.576**
	[2.16]	[3.23]	[8.23]	[6.77]
Age 55 - 64	0.031	-0.045	-0.224**	-0.287**
	[0.30]	[0.55]	[3.09]	[3.72]
Age > 64	0.056	-0.046	0.089	-0.018
	[0.40]	[0.48]	[0.76]	[0.16]
Male	-0.029	-0.042	-0.027	-0.081**
	[0.71]	[1.22]	[0.73]	[2.93]
Other micro-controls	no	no	yes	yes
Country fixed effects	no	yes	no	yes
Constant	7.360**	7.650**	6.406**	6.466**
	[54.95]	[143.14]	[24.94]	[44.24]
Observations	44151	44151	34651	34651
Adj. R2	0.0012	0.1217	0.1210	0.1811
Countries	30	30	30	30

Notes: '**', '*', '+' denote significance levels at the 1, 5 and 10 percent levels, respectively. Weighted OLS regressions with standard errors clustered by countries. Dependent variable: life satisfaction measured on a 10-point scale. Other micro-level controls include income, education, occupational status, marital status, family size, religion, social capital, vertical and horizontal trust, political ideology. The full estimation results are in Table A1 of the Appendix.

4.2. Different functional forms of continuous age

28. Table 3a employs 'age' as a continuous variable and tests various functional forms. These include a linear relation (columns 1 and 2), but also, to account for the expected non-linearity of happiness in age, one model variant that adds the squared age term (columns 3 and 4), and finally one that tests a third-order polynomial term (columns 5 and 6). Again, each model is estimated as most parsimonious specification, controlling only for gender in addition to age, and as full model, including all available micro-level controls and country fixed effects. We also report the adjusted R2 to assess the goodness of fit.

Linear and quadratic specifications

29. Columns 1 and 2 do not provide empirical support for a linear relation between age and happiness, neither in the parsimonious nor in the full models. However, including a squared term suggests for both specifications that the happiness-age relation follows the postulated U-shaped functional form (columns 3 and 4). Comparing models 1 with 3 and models 2 with 4 suggests that adding the squared term substantially improves the predictive power of the empirical model, as indicated by the changes in adjusted R2. According to the estimates, midlife crisis occurs at the age of 43 or 48 years, depending on the model specification. Obviously, viewing the effect of age on SWB as partial effect rather than total effect (column 3 versus column 4) increases the model fit considerably and 'retards' the midlife crisis by about 5 years in

OECD countries.[11] Notably, the age at which the SWB minimum occurs overlaps with the age category that yields the most sizeable well-being decreasing effect in Table 2.

The hyperbolic function

30. Models 5 and 6 contain the main contribution of this paper to the happiness literature by testing the hyperbolic functional form. In both models, the coefficients on all three age variables are independently significant suggesting that each term exerts an impact on SWB of its own. A hyperbolic form implies that the age effect follows an inverted sinus-wave: happiness first decreases in age until a local minimum is reached, then rises in age again until a local maximum is reached, and falls again (usually, average human life span ends around that time). (Notably, the notions of 'local minimum' and 'local maximum' imply that at the beginning and ending of this SWB-age function higher or lower values may be observed.) Column 5 presents the results for the most parsimonious specification, while column 6 estimates the full model. Again, estimated coefficients and levels of statistical significance of the age variables become larger when individual-level controls and country fixed effects are included: the hyperbolic form of the well-being age-function becomes more pronounced in column 6 as compared to column 5. In other words, age effects explain the variation in happiness better after controlling for its additional determinants. The parsimonious model in column 5 suggests that the local minimum occurs at the age of 42, but the maximum at the age of 64. In contrast, while yielding a similar minimum age of 45 life years, the full model in column 6 suggests a maximum effect on SWB at the age of 83. [12]

Table 3a: Age effects: different functional forms

	1	2	3	4	5	6
Age	0.001	-0.002	-0.013*	-0.064**	-0.056*	-0.158**
	[0.30]	[1.07]	[2.19]	[8.83]	[2.41]	[5.71]
Age^2/100			0.015*	0.066**	0.111*	0.270**
			[2.20]	[7.92]	[2.21]	[4.77]
Age^3 / 1000					-0.007+	-0.014**
					[1.96]	[3.71]
Male	-0.029	-0.070*	-0.028	-0.078**	-0.030	-0.080**
	[0.73]	[2.54]	[0.71]	[2.78]	[0.74]	[2.85]
Country fixed effects	no	yes	no	yes	no	yes
Other micro-controls	no	yes	no	yes	no	yes
Constant	7.284**	6.203**	7.576**	7.483**	8.150**	8.778**
	[41.98]	[34.93]	[43.46]	[42.67]	[25.36]	[21.87]
Observations	44151	34651	44151	34651	44151	34651
Adj. R2	0.0001	0.1751	0.0005	0.1800	0.0007	0.1810
Number of countries	30	30	30	30	30	30
'Midlife crisis'	-	-	43	48	42	45
'Second youth'	-	-	-	-	64	83

Notes: '**', '*', '+' denote significance levels at the 1, 5 and 10 percent levels, respectively. Weighted OLS regressions with standard errors clustered by countries. Dependent variable: life satisfaction measured on a 10-point scale. Other micro-level controls include income, education, occupational status, marital status, family size, religion, social capital, vertical and horizontal trust, political ideology. The full estimation results are in Table A2 of the Appendix.

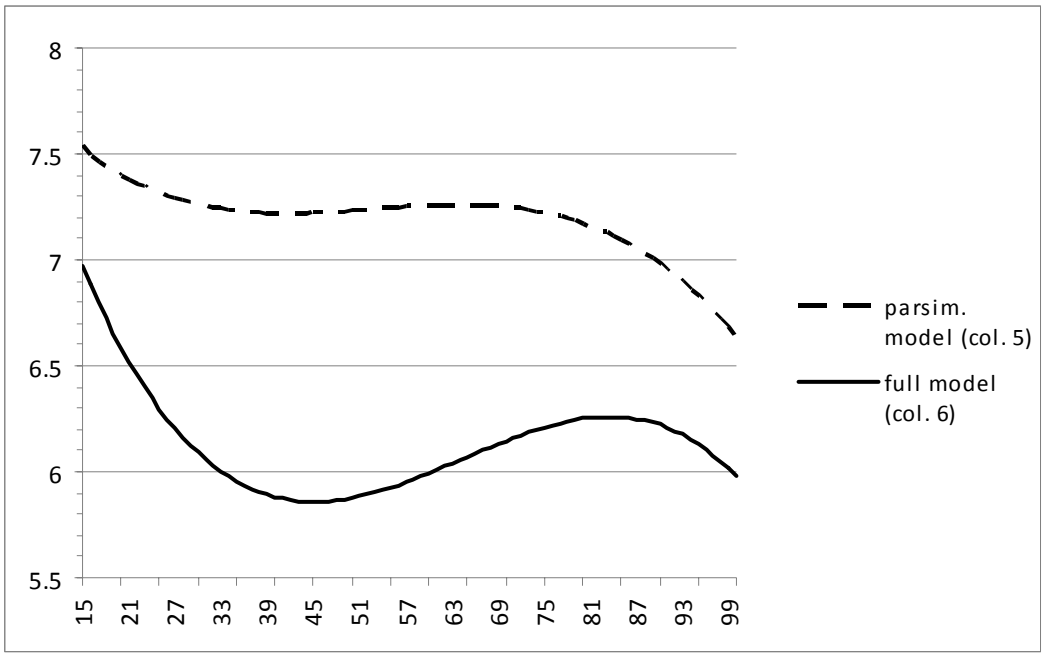
11. The estimates give rise to the happiness-age function in the form of: SWB (age) = a*age + b*age^2 + c*age^3 (with a < 0, b > 0 and c < 0), where a, b. and c are derived from the estimated coefficients. Points of local minima and maxima can be identified by taking the first derivative d*SWB*/d*age* and setting it to zero.

12. Given that there is no information on the year of death of the interviewee, this decline may well be driven by those aged persons anticipating their ends of life. The presence of such anticipation effects has been shown by Mroczek and Spiro (2005). However, given that there are about 700 persons in the sample with an age of 80 or older, this mechanism is unlikely to drive our results. The impact of health is discussed in the robustness section.

Graphical representation

31. Graph 1 illustrates the non-linear development of the age effects on individual life satisfaction of 44 000 individuals in 30 OECD countries based on columns 5 and 6 of Table 3a. In comparison with the parsimonious model (dashed line), the (local) minimum and maximum are more pronounced when unobserved cultural effects (that may affect reporting behaviour) and further individual characteristics are accounted for (solid line). Notably, given that model 5 excludes other determinants of subjective well-being that may be correlated with individual age, these estimates represent a 'total age effect'.[13] Partial age impacts are larger in size, as the steeper slopes (both upward and downward) of the solid line compared to that of the dashed line indicate, which represent a graphical illustration of the functions' first derivatives.[14]

Graph 1: The relation between age and subjective well-being in OECD countries



Notes: based on Table 3a

General description of curves

32. The well-being-age curve starts at the age of 15, the minimum age for being included in the survey, and ends at the age of 100 – the WVS data include two persons with 98 and one individual with 101 life years. At local minimum, in model 5 subjective well-being reaches, *ceteris paribus*, a level of 7.22 points on the 10-point subjective well-being scale, and a level of 5.86 according to model 6. The maxima at the ages of 64 and 83, respectively, are, accordingly 7.25 and 6.26. While the parsimonious model yields no substantial happiness gain as one grows older after the midlife crisis year, with an almost flat curve

13. After a first version of this paper was written, Blanchflower and Oswald (2009) present an analysis of total age effects on happiness - that excludes personal characteristics - for eight major European countries between 1973 and 2006. They interpret their results as corroborating a U-shape, although in Figure 1 for the oldest-old (age 70 or older) a decline in subjective well-being is observable.

14. Notably, this analysis, as all others that follow, pools all persons living in 30 countries, disguising that in one of these countries the actual age effects may follow a different pattern. We discuss this point later in the paper.

(7.22 versus 7.25), the full model predicts an increase of about half of a life satisfaction category from the age of 45 to 83. This difference in the curvature of the two functions reflects, again, that marginal age effects are more pronounced once life events are controlled for. This finding is in support of the previous literature.

Marginal effects

33. Table 3b displays the marginal effects of age based on the estimates for the three age variables from Table3a, model 6. Table 3b reports the marginal effects for selected ages, from the life year 20 on, in 5-year steps. In addition, it also sets focus on those persons in their early twenties (20 – 24 years), those around their midlife crisis (40 – 49 years), and those around their second (local) peak in happiness (80 – 85 years). Larger marginal effects (in absolute terms) indicate a stronger steepness of the curve (displayed in Graph 1). As common in functions of a hyperbolic form, marginal effects are rather small *around* the function's turning points (minimum, maximum), with the curve developing almost as a flat line, while steeper slopes are observable *between* two turning points of the function. This observation is also confirmed for the happiness-age function in Graph 1, dashed line. Steep declines (up to 0.05) in happiness are observable for persons in their twenties on their descent into the midlife crisis (45 life years), while those in their forties experience only small changes in happiness as they grow older (around +/- 0.01). Similarly small changes in SWB are observable for those in their eighties, around the second turning point of the function (marginal effects of less than 0.01 in absolute terms). Notably, the increase in SWB after the midlife crisis (50 – 75 years) does not appear as steep as the decline prior to the midlife crisis (45 years), or after the local maximum (83 years), in absolute terms. Thus, over the life course, recovering in terms of happiness takes much longer than losing it.

Table 3b: Marginal effects of age for certain ages

Age	mfx	mfx in %	Age	mfx	mfx in %
20	-0.0650	-6.50			
21	-0.0613	-6.13	50	0.0076	0.76
22	-0.0578	-5.78	55	0.0123	1.23
23	-0.0543	-5.43	60	0.0150	1.50
24	-0.0509	-5.09	65	0.0155	1.55
			70	0.0139	1.39
25	-0.0476	-4.76	75	0.0103	1.03
30	-0.0324	-3.24			
35	-0.0192	-1.92	80	0.0045	0.45
			81	0.0031	0.31
40	-0.0082	-0.82	82	0.0016	0.16
41	-0.0062	-0.62	83	0.0001	0.01
42	-0.0044	-0.44	84	-0.0016	-0.16
43	-0.0026	-0.26	85	-0.0033	-0.33
44	-0.0009	-0.09			
45	0.0007	0.07	90	-0.0133	-1.33
46	0.0023	0.23	95	-0.0254	-2.54
47	0.0037	0.37	99	-0.0365	-3.65
48	0.0051	0.51			
49	0.0064	0.64			

Notes: 'mfx' denotes marginal effect, the increase or decrease in life satisfaction an individual will experience at a certain age when growing one year older. For example, at the age of 25, getting older by another year is associated with a decrease in SWB by about 0.05 categories (or 5% of a SWB category). Marginal effects are based on Table 3a, model 6.

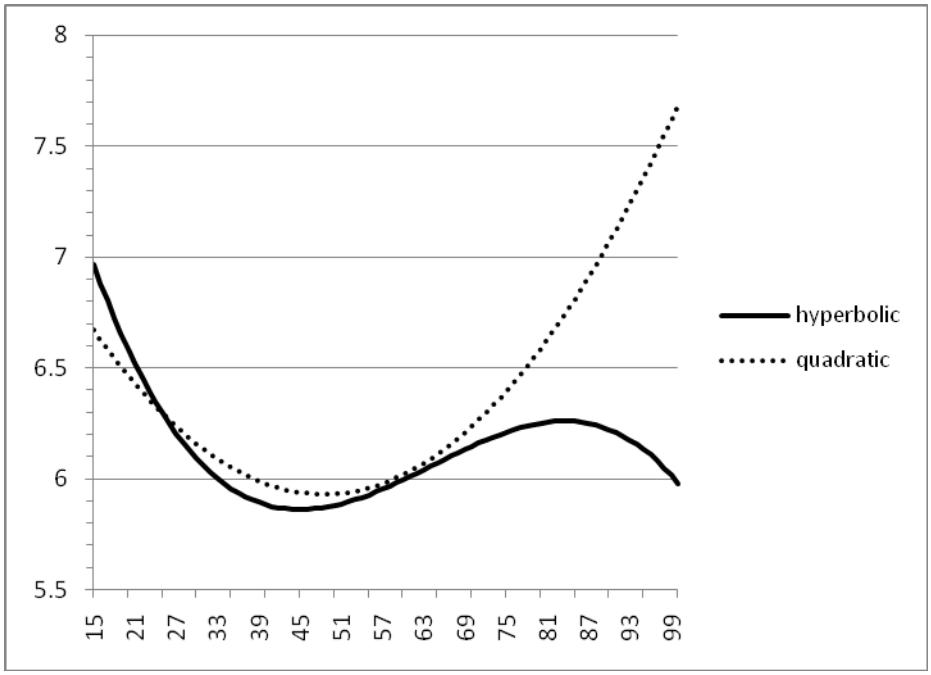
4.3. Comparison of age effects across life years: return to start

34. Turning to the starting age (15) and the ending age (100) of the function, the local maxima and minima appear dominated by the end-points of the well-being-age function. For model 6 in Table 3a, the SWB level of a 15 year-old is the highest that can be achieved, with a happiness level of 6.96 points. This level is clearly above the one reached at the age of 83, which amounts to only 6.26 SWB points, about half of a category lower compared to that of the youngest in the sample. The age which comes closest in happiness to the local maximum point is 26 life years. Thus, according to model 6, an 83-year old is as happy as a 26-year old, *ceteris paribus*, namely holding constant all life events that might have occurred between these two points in life. On the other hand, a 100-year old person is as satisfied with her life as is a 60-year old or, owed by the hyperbolic functional form, a 34-year-old.

Comparison of U-shaped with hyperbolic SWB function

35. Graph 2 illustrates the bias that arises when a U-shaped relation in place of a more flexible, higher polynomial association between SWB and age is estimated. For this purpose, we plot the quadratic functional form obtained from the full model (column 4 of Table 3a) against the hyperbolic functional form from model 6 of Table 3a that employs identical additional controls. Graph 2 clearly shows that the functional misspecification does not affect very much the estimated age of minimum happiness (48 years in place of 45 years). Nor does it considerably bias the SWB levels for the 15 to the 69 year olds. Departure of the hyperbolic function from the U-function starts between the ages of 69 and 75, with the U-function exploding into the positive space as the quadratic term starts to drive the predicted value of the dependent variable. Thus, the bias of misspecification becomes virulent for the oldest-old only, who are often underrepresented in household surveys, or for which heterogeneous age effects are simply assumed away.

Graph 2: The effect of functional misspecification



Notes: based on model 4 and model 6 of Table 3a

4.4. Robustness test: taking account of birth cohorts

Background and test design

36. Critics claim that the estimated relation between age and subjective well-being reflected unobserved cohort effects, namely that a group of persons born during a specific period shared certain common, i.e. group-specific characteristics that influenced their life satisfactions. Based on this argument, e.g. the midlife crisis effect in Table 2 (age category 45 – 54 years) could be interpreted not as a phase in life everybody had to transgress in one way or the other, but as effect pertaining to persons born between the years 1955 – 1946 (year of survey: around 2000). In this view, the large well-being-lowering impact would be interpreted as an early childhood post-war trauma or, perhaps, undernutrition that decreased the SWB of these persons for the rest of their lives (lowered their SWB set-points).

37. To test to what extent the hyperbolic well-being-age relation is robust to the inclusion of age cohort effects, several variants of age cohort variables have been included to the model. First, 10-year cohort dummies have been defined analogously to the age categories employed in Table 2, with the last, 6 000 persons encompassing group of those aged 65 and older (born 1935 or earlier) split into two separate subgroups (65-74 years (birth years: 1935-1926), > 74 years (birth year: < 1926)), to be consistent in the construction. In a second variant, to take account of the numerous observations of the oldest old in the WVS data, the last sub-group has been further split into those aged 75-84 (born: 1925-1916) and those aged 85 or older (born before 1916). To mitigate the criticism that 10-year age cohorts may be quite heterogeneous in themselves and mis-defined, also 5-year cohorts have been constructed, with the last and smallest cohort formed by those aged 90 years or older (53 individuals born 1910 or earlier). Finally, due to shrinking samples caused by the inclusion of personal characteristics, we have estimated all models with a more parsimonious specification that yields regression samples with an additional 7 000 observations. This specification excludes the income variables and reduces the number of controls for institutional trust by employing only 'confidence in the police'.

Results and discussion

38. Table 4 reports the estimation results for the age and the gender variables. Model 1 replicates the baseline specification - the full model of Table 3a (column 6) that includes individual-level controls and country fixed effects. Models 2 to 4 add age cohort dummies, in the variants described above. Models 4 to 8 employ the more parsimonious set of personal characteristics. The estimates for continuous age variables pass this robustness test very well: For all cohort definitions in all eight models, all age coefficients stay significant and keep their signs, indicating that the hyperbolic well-being-age relation is still present.

Table 4: Testing for age cohort effects

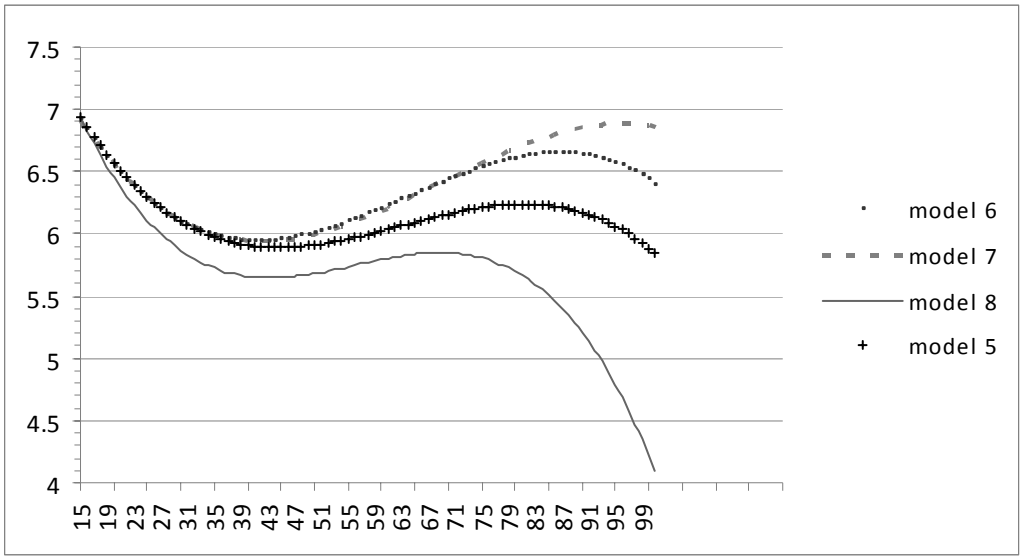
	1	2	3	4	5	6	7	8
Age	-0.158**	-0.156**	-0.130**	-0.156*	-0.153**	-0.161**	-0.146**	-0.215**
	[5.71]	[4.53]	[3.99]	[2.57]	[7.00]	[5.42]	[5.51]	[4.25]
Age^2/100	0.270**	0.277**	0.210**	0.273*	0.265**	0.288**	0.249**	0.404**
	[4.77]	[3.84]	[3.18]	[2.17]	[5.95]	[5.05]	[4.92]	[3.79]
Age^3 / 1000	-0.014**	-0.014**	-0.009*	-0.015+	-0.014**	-0.015**	-0.012**	-0.024**
	[3.71]	[3.11]	[2.18]	[1.80]	[4.87]	[4.36]	[3.82]	[3.49]
Male	-0.080**	-0.081**	-0.081**	-0.081**	-0.122**	-0.123**	-0.123**	-0.124**
	[2.85]	[2.89]	[2.88]	[2.90]	[2.77]	[2.79]	[2.79]	[2.82]
10-year cohorts I	-	yes	-	-	-	yes	-	-
10-year cohorts II	-	-	yes	-	-	-	yes	-
5-year cohorts	-	-	-	yes	-	-	-	yes
Country fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Other micro-controls	yes	yes	yes	yes	yes	yes	yes	yes
Constant	8.778**	8.665**	8.378**	8.552**	8.685**	8.736**	8.572**	9.332**
	[21.87]	[18.76]	[17.67]	[10.83]	[27.38]	[20.73]	[22.12]	[15.31]
Observations	34651	34651	34651	34651	41515	41515	41515	41515
Adj. R2	0.181	0.1821	0.1822	0.1829	0.1847	0.185	0.185	0.1853
Number of countries	30	30	30	30	30	30	30	30
'Midlife crisis'	45	41	43	46	45	41	42	43
'Second youth'	84	91	113	75	82	87	96	69

Notes: '**', '*', '+' denote significance levels at the 1, 5 and 10 percent levels, respectively. Weighted OLS regressions with standard errors clustered by countries. Dependent variable: life satisfaction measured on a 10-point scale. In columns 1 to 4, other micro-level controls include income, education, occupational status, marital status, family size, religion, social capital, vertical and horizontal trust, political ideology (for full estimation results, see Table A3 of the Appendix). Columns 5 to 8 exclude income and most of the vertical trust measures. "10-year cohorts I" denotes inclusion of age cohorts in 10-year steps (15-24, 25-34, etc, 65-74), with the last cohort formed by those 75 years an older. "10-year cohorts II" splits the oldest group of the previous specification into two further sub-categories: the '75-84 years old', and the '84 and older' categories. "5-year cohorts" defines age cohorts in 5-year steps, starting with '15-19 years old', followed by the '20- 24 years old', etc. The last age cohort includes those aged 90 years or older.

39. For models 2 to 7 of Table 4, we observe coefficient sizes very similar to those in the baseline specification (model 1). Also in model 3, which controls for a wider set of 10-year cohort variables, the functional form appears hyperbolic, albeit slightly 'stretched', while in model 8, which employs the 5-year cohort controls, the happiness-age function appears more 'contracted'. The sensitivity of the age-value of maximum happiness across models indicates that the relatively low number of old-aged persons prevents a very precise and 'waterproof' estimation of the second turning point. According to the adjusted R2 as goodness of fit measure, the slightly higher adjusted R2 of model 4 over models 2 and 3 suggests a weak preference for the 5-year-cohort-effects specification, while across models 6 to 8 no clear preference becomes evident. In general, the more parsimonious specifications in models 5 to 8 should be preferred over the models 1 to 4.

40. Interestingly, the age of minimum SWB is between 41 and 46 life years across all eight model specifications, *de facto* unaffected by the inclusion or exclusion of cohort controls. In contrast, the local maxima are more heterogeneous across models, sensitive to the included set of personal characteristics and resulting changes in sample sizes. In four of eight models, the age of maximum happiness in the second half of life is between 82 and 91 life years. In two thirds of OECD countries, life expectancy reaches almost 80 years, with average life span in tendency increasing. Thus, more and more persons are likely to experience the second local maximum in their lives. Graph 3 depicts the development of subjective well-being as a function of age for the four estimated specifications in models 5 to 8 of Table 4.

Graph 3: The age effect with and without cohort controls



Notes: based on model 6 to model 8 of Table 4

4.5. Robustness test: non-OECD countries and health effects

41. Following the robustness test in Frijters and Beatton (2008), the hyperbolic form persists when persons with an extremely high age (> 90 years) are excluded from the sample. Finally, Table A4 of the Appendix provides the estimates for the non-OECD sample of 45 mostly developing, newly industrializing and Eastern European transition countries, also controlling for birth cohorts. The minimum of SWB is equally observed around 40, and the maximum between 74 and 82, depending on the definition of birth cohorts. Remarkably, comparing results for OECD and non-OECD countries (Tables 4 and A4), (local) maximum appears to come at older ages in OECD countries, while the ages of minimum happiness are almost identical. This is quite astonishing given the dominance of developing and transition countries in this sample.

42. Finally, the inclusion of a self-report state of health variable is tested as some gerontologists and economists claim that the decline in happiness among the oldest-old is driven by the deterioration of health only. The health variable has not been collected in all WVS waves and, thus, is only available for 11 OECD countries and 32 non-OECD countries. However, adding 'health status' to the full model does not affect the hyperbolic SWB-age relation both in the entire world sample, the OECD and the non-OECD sub-samples equally. The last column of Table A4 displays the results for the full world sample of 43 countries when the health measure is added to the model (yielding a minimum at the age of 45 and a maximum at the age of 91.5). Thus, the decline of SWB after the local maximum is not likely to be caused by the omission of health measures from the model.

43. Taken all together, testing several functional relations between happiness and age we find strong support that subjective well-being robustly follows a hyperbolic functional form, with well-being first decreasing in age up to 45, increasing again, and after a local maximum around 80-90, decreasing again.

4.6. Robustness test: analysis for single OECD countries

44. The analysis of the age-happiness relation is based on data that pools individuals from 30 OECD countries into one sample. Even though country fixed effects (as in model 6 of Table 3a) take account of

some of the systematic differences across countries, it may still well be that the hyperbolic age-happiness relation is not prevalent in all countries in the sample. Table 5 displays the estimates of the age effects for the three full model variants (linear, quadratic, hyperbolic) by OECD member state, with between 900 and 2 000 persons observed per country.[15] Arguably, the small number of observations in some country samples, particularly among the oldest-old, may affect the statistical significance of the age variables.

45. The results are heterogeneous across OECD member states. A clear hyperbolic age-happiness relationship (with statistical significance of all three age terms and the appropriate signs) is observable in about 1/3 of the OECD countries (BEL, CAN, CZR, DNK, HUN, IRL, ISL, JPN, and USA). Weaker support for a hyperbolic relation (with only two of three terms significant, or alternatively, coefficient estimates only close to statistical significance, but with the overall impression that the hyperbolic specification performs better than the quadrative one, judged by the adjusted R2)[16] is identifiable for the following countries: Austria, Great Britain, Luxembourg, New Zealand, Portugal, and Poland. Overall, we find support for the hyperbolic relation in about half of all OECD countries.

46. Instead, the typical U-shaped functional form is strongly or weakly supported in about the other half of 30 OECD countries (14 countries): Australia, Switzerland, Spain, Finland, France, Greece, Italy, Korea, Mexico, the Netherlands, Norway, Slovakia, Sweden and Turkey. Noteworthy is the agglomeration of Romance-language speaking and Mediterranean countries (6 countries). This finding leaves us with the question whether the happiness-age-relationship is possibly owed to the local culture, e.g. how the society values elder persons.

47. For one country in the OECD sample we observe no relation between age and happiness: for residents of (unified) Germany (columns 19 – 21 of Table 5), although the coefficient estimates are in support of the hyperbolic functional form.[17] Estimating a parsimonious model with gender as sole additional personal control only (columns 91 – 99 of Table 5) strongly supports this view: the estimation results indicate that Germany needs to be counted among the countries in which happiness follows a hyperbolic curve in age.

15. The relatively small country samples do not allow the inclusion of cohort effects in the empirical model. Individual-level controls include gender, civil status, number of children, occupational status, education, confidence in police, importance of friendship, horizontal trust, belief in superior being, and measures of political ideology.

16. The adjusted R2 is corrected for the artificial increase in R2 caused by a growing number of predictors.

17. The results are qualitatively identical for East and West Germany. See also bottom of Table 5.

Table 5: Australia, Austria, Belgium, Canada, Switzerland, Czech Republic, Germany, Denmark, Spain

	1	2	3	4	5	6	7	8	9
		AUS			*AUT*			*BEL*	
Age	0.007+	-0.064**	-0.106*	-0.010+	-0.027	-0.143	0	-0.072**	-0.285**
	[1.76]	[4.10]	[2.15]	[1.76]	[1.12]	[1.63]	[0.04]	[3.78]	[4.15]
Age┐ /100		0.076**	0.172		0.018	0.268		0.071**	0.508**
		[4.69]	[1.61]		[0.73]	[1.46]		[3.89]	[3.73]
Age^3 / 1000			-0.007			-0.017			-0.027**
			[0.91]			[1.37]			[3.24]
Constant	5.287**	6.789**	7.358**	6.447**	6.835**	8.476**	6.047**	7.685**	10.826**
	[16.05]	[14.82]	[9.49]	[16.00]	[10.28]	[6.20]	[17.32]	[14.08]	[9.73]
Observations	1974	1974	1974	1392	1392	1392	1765	1765	1765
Adj. R2	0.0950	0.1047	0.1046	0.0687	0.0684	0.0690	0.0937	0.1010	0.1059
	10	11	12	13	14	15	16	17	18
		CAN			*CHE*			*CZE*	
Age	-0.010*	-0.045**	-0.361**	0.010+	-0.054*	-0.133	-0.002	-0.075**	-0.210**
	[2.33]	[2.88]	[6.53]	[1.85]	[2.25]	[1.61]	[0.42]	[3.51]	[2.63]
Age^2/100		0.038*	0.705**		0.068**	0.233		0.077**	0.365*
		[2.34]	[6.23]		[2.74]	[1.40]		[3.50]	[2.20]
Age^3 / 1000			-0.043**			-0.011			-0.019+
			[5.96]			[1.00]			[1.75]
Constant	6.979**	7.701**	12.286**	6.564**	7.880**	9.013**	5.710**	7.302**	9.221**
	[18.88]	[16.01]	[13.57]	[15.83]	[12.44]	[6.93]	[17.90]	[13.17]	[7.51]
Observations	1884	1884	1884	1091	1091	1091	1831	1831	1831
Adj. R2	0.0961	0.0982	0.1147	0.0789	0.0845	0.0845	0.0996	0.1052	0.1062
	19	20	21	22	23	24	25	26	27
		DEU			*DNK*			*ESP*	
Age	0.006	-0.011	-0.054	-0.002	-0.034	-0.172*	-0.005	-0.048**	-0.042
	[1.31]	[0.64]	[0.87]	[0.35]	[1.45]	[2.05]	[1.19]	[2.92]	[0.73]
Age┐ /100		0.018	0.107		0.033	0.319+		0.044**	0.03
		[1.02]	[0.85]		[1.41]	[1.89]		[2.72]	[0.26]
Age^3 / 1000			-0.006			-0.018+			0.001
			[0.72]			[1.71]			[0.12]
Constant	5.380**	5.778**	6.408**	7.470**	8.182**	10.186**	6.957**	7.925**	7.828**
	[16.98]	[11.53]	[6.33]	[15.89]	[11.88]	[7.50]	[17.01]	[14.63]	[8.26]
Observations	1886	1886	1886	910	910	910	2226	2226	2226
Adj. R2	0.2007	0.2007	0.2005	0.0852	0.0863	0.0883	0.0437	0.0465	0.0461

Table 5: Finland, France, Great Britain, Greece, Hungary, Ireland, Island, Italy, Japan

	28	29	30	31	32	33	34	35	36
		FIN			*FRA*			*GBR*	
Age	0.003	-0.050*	-0.116	-0.017**	-0.083**	-0.033	-0.012+	-0.027	-0.144
	[0.48]	[2.24]	[1.38]	[3.32]	[3.74]	[0.40]	[1.90]	[1.04]	[1.63]
Age^2/100		0.062*	0.218		0.069**	-0.035		0.016	0.267
		[2.44]	[1.13]		[3.06]	[0.21]		[0.58]	[1.45]
Age^3 / 1000			-0.011			0.007			-0.016
			[0.82]			[0.62]			[1.38]
Constant	6.027**	7.060**	7.894**	7.146**	8.575**	7.863**	5.792**	6.091**	7.717**
	[14.29]	[11.83]	[6.67]	[20.76]	[14.80]	[6.09]	[10.75]	[8.17]	[5.54]
Observations	963	963	963	1537	1537	1537	862	862	862
Adj. R2	0.1169	0.1216	0.1213	0.0825	0.0876	0.0872	0.0615	0.0608	0.0618
	37	38	39	40	41	42	43	44	45
		GRC			*HUN*			*IRL*	
Age	0.001	-0.055	-0.009	-0.016*	-0.111**	-0.359**	-0.011*	-0.057*	-0.249**
	[0.14]	[1.36]	[0.07]	[2.11]	[3.59]	[3.31]	[2.11]	[2.34]	[2.71]
Age^2/100		0.064	-0.045		0.095**	0.610**		0.046+	0.445*
		[1.42]	[0.15]		[3.17]	[2.79]		[1.91]	[2.40]
Age^3 / 1000			0.008			-0.033*			-0.026*
			[0.36]			[2.38]			[2.17]
Constant	6.261**	7.369**	6.756**	4.893**	7.014**	10.577**	6.187**	7.225**	10.050**
	[9.03]	[7.07]	[3.40]	[9.24]	[8.24]	[6.15]	[8.70]	[8.09]	[6.37]
Observations	943	943	943	960	960	960	945	945	945
Adj. R2	0.0404	0.0415	0.0406	0.0895	0.0982	0.1027	0.0677	0.0704	0.0741
	46	47	48	49	50	51	52	53	54
		ISL			*ITA*			*JPN*	
Age	-0.014**	-0.032	0.192*	0	-0.061**	-0.101	0.006	-0.080**	-0.293**
	[2.76]	[1.24]	[2.14]	[0.07]	[2.66]	[1.27]	[1.00]	[2.71]	[2.73]
Age^2/100		0.019	-0.501*		0.063**	0.151		0.089**	0.553*
		[0.71]	[2.48]		[2.71]	[0.90]		[2.96]	[2.44]
Age^3 / 1000			0.038**			-0.006			-0.032*
			[2.60]			[0.53]			[2.06]
Constant	7.874**	8.218**	5.386**	6.000**	7.306**	7.877**	5.563**	7.413**	10.464**
	[19.57]	[13.04]	[4.28]	[13.33]	[11.08]	[6.22]	[10.85]	[9.18]	[6.21]
Observations	909	909	909	1904	1904	1904	1133	1133	1133
Adj. R2	0.0671	0.0665	0.0726	0.0746	0.0777	0.0774	0.0730	0.0794	0.0821

Table 5: Korea, Luxembourg, Mexico, Netherlands, Norway, New Zealand, Poland, Portugal, Slovakia

	55	56	57	58	59	60	61	62	63
		KOR			*LUX*			*MEX*	
Age	0.007	-0.121**	-0.049	-0.001	0	-0.089	0.008	-0.076**	-0.083
	[0.72]	[2.73]	[0.31]	[0.14]	[0.02]	[1.01]	[1.29]	[2.92]	[0.93]
Age^2/100		0.146**	-0.022		-0.001	0.201		0.093**	0.109
		[2.95]	[0.06]		[0.05]	[1.04]		[3.29]	[0.54]
Age^3 / 1000			0.012			-0.014			-0.001
			[0.47]			[1.06]			[0.08]
Constant	2.167*	4.637**	3.682	6.991**	6.965**	8.160**	7.289**	8.992**	9.076**
	[2.36]	[3.74]	[1.55]	[18.79]	[11.35]	[6.37]	[10.74]	[10.56]	[6.58]
Observations	1150	1150	1150	1063	1063	1063	1438	1438	1438
Adj. R2	0.0545	0.0609	0.0603	0.0373	0.0363	0.0365	0.006	0.0128	0.0121
	64	65	66	67	68	69	70	71	72
		NLD			*NOR*			*NZL*	
Age	-0.006	-0.071**	-0.131+	-0.005	-0.103**	-0.131	0.022**	-0.017	-0.131
	[1.38]	[3.91]	[1.88]	[0.87]	[3.98]	[1.43]	[4.63]	[0.70]	[1.63]
Age^2/100		0.068**	0.189		0.109**	0.173		0.038+	0.280+
		[3.68]	[1.37]		[3.89]	[0.86]		[1.68]	[1.70]
Age^3 / 1000			-0.008			-0.004			-0.016
			[0.89]			[0.32]			[1.49]
Constant	7.650**	9.116**	10.027**	6.857**	8.732**	9.100**	5.359**	6.192**	7.829**
	[22.28]	[17.39]	[8.70]	[13.52]	[12.52]	[6.72]	[12.37]	[9.40]	[6.10]
Observations	992	992	992	1109	1109	1109	1060	1060	1060
Adj. R2	0.0562	0.0683	0.0681	0.0732	0.0851	0.0844	0.0730	0.0746	0.0757
	73	74	75	76	77	78	79	80	81
		POL			*PRT*			*SVK*	
Age	-0.001	-0.110**	-0.280*	-0.003	-0.023	-0.146+	-0.01	-0.045	-0.069
	[0.12]	[3.54]	[2.34]	[0.49]	[0.93]	[1.66]	[1.37]	[1.63]	[0.65]
Age^2/100		0.110**	0.464+		0.02	0.277		0.04	0.093
		[3.64]	[1.91]		[0.84]	[1.56]		[1.33]	[0.41]
Age^3 / 1000			-0.023			-0.016			-0.004
			[1.47]			[1.46]			[0.23]
Constant	5.198**	7.712**	10.155**	6.443**	6.900**	8.680**	4.768**	5.498**	5.826**
	[7.05]	[7.66]	[5.23]	[11.81]	[8.94]	[6.01]	[8.90]	[7.17]	[3.63]
Observations	1020	1020	1020	954	954	954	1227	1227	1227
Adj. R2	0.0915	0.1025	0.1035	0.1121	0.1118	0.1129	0.0915	0.0921	0.0914

Table 5: Sweden, Turkey, Unites States of America

	82	83	84	85	86	87	88	89	90
	SWE			*TUR*			*USA*		
Age	-0.001	-0.062*	-0.048	0.003	-0.064**	-0.057	0.005	-0.077**	-0.224**
	[0.12]	[2.00]	[0.44]	[0.70]	[3.23]	[0.83]	[0.96]	[3.68]	[2.96]
Age^2/100		0.069*	0.037		0.078**	0.061		0.091**	0.424*
		[2.02]	[0.15]		[3.48]	[0.38]		[4.02]	[2.55]
Age^3 / 1000			0.002			0.001			-0.023*
			[0.13]			[0.11]			[2.02]
Constant	6.242**	7.484**	7.305**	2.937**	4.264**	4.174**	5.916**	7.574**	9.522**
	[11.18]	[9.02]	[4.60]	[5.52]	[6.52]	[3.94]	[13.53]	[12.65]	[8.40]
Observations	967	967	967	4248	4248	4248	1172	1172	1172
Adj. R2	0.0563	0.0594	0.0584	0.0744	0.0768	0.0766	0.0943	0.1061	0.1085
	91	92	93	94	95	96	97	98	99
	DEU all			*DEU West*			*DEU East*		
Age	0.003	-0.046**	-0.175**	0.003	-0.016	-0.145*	0.002	-0.090**	-0.234**
	[1.15]	[3.16]	[3.27]	[1.15]	[0.91]	[2.15]	[0.41]	[3.77]	[2.63]
Age^2/100		0.049**	0.328**		0.02	0.299*		0.092**	0.401*
		[3.40]	[2.92]		[1.12]	[2.11]		[3.90]	[2.16]
Age^3 / 1000			-0.018*			-0.019*			-0.020+
			[2.51]			[1.98]			[1.68]
Constant	7.332**	8.379**	10.180**	7.269**	7.701**	9.495**	7.440**	9.411**	11.399**
	[55.40]	[25.00]	[12.86]	[45.15]	[18.34]	[9.52]	[32.01]	[16.94]	[8.72]
Observations	2020	2020	2020	1288	1288	1288	732	732	732
Adj. R2	0.0006	0.0058	0.0085	0.0008	0.0009	0.0032	-0.0020	0.0171	0.0196

Notes: '**', '*', '+' denote significance levels at the 1, 5 and 10 percent levels, respectively. Unweighted OLS regressions. Dependent variable: life satisfaction measured on a 10-point scale. Other micro-level controls include gender, education, occupational status, marital status, family size, spirituality, social capital, vertical and horizontal trust, political ideology.

Columns 91 – 99 include only gender as additional controlling variable.

48. Overall, partial age effects appear to follow an inverted sinus-wave in about half of the OECD countries. For a final conclusion, however, larger country samples need to be analyzed. The last section of this paper summarizes these findings, also in the light of potential policy application.

5. Conclusion and consequences for policies

49. There is still an ongoing debate what the functional relation between subjective well-being and age is. While one group of researchers supports the view and finds evidence for a U-shaped relationship, other researchers claim that this relation was spurious, for example due to the omission of birth cohort effects. What astonishes most is that both groups of researchers often use identical data, mostly the British or the German household panels, and still reach opposing conclusions, seemingly owed to their differing empirical strategies.

Contribution of paper

50. This paper takes a new look at an old question and proposes a hyperbolic functional form for the SWB-age relation. In this sense, it combines the evidence of gerontological studies with that of traditional happiness research, the latter not taking a differentiated view on those aged 65 or older. Many gerontological studies report a decline in well-being among oldest old, while traditional happiness research identifies a U-shaped function, with well-being rising in age after a certain phase of 'midlife' crisis has been passed. In resolution, this paper proposes a hyperbolic relation, with subjective well-being first following the U-relation but then, after a second turning point (maximum), declining again. In this light of an actual inverted sinus-wave, assuming either a quadratic or a linear relation would constitute model misspecifications. Assuming a quadratic form may approximate the first part of the subjective well-being age relation well, but probably neglect the local maximum and the further decline afterwards for the old aged. Assuming a linear relation, however, may render the age coefficient insignificant.

51. This hypothesis of a hyperbolic function is tested using the World Values Survey data on life satisfaction of 44 000 individuals in 30 OECD countries. Using observations from these economically well-developed and democratic countries only has the advantage that the share of persons older than 80 is relatively large. The latter is a technical prerequisite to identifying heterogeneous age effects among the oldest old. This study tests the effects of age measured in categories and in continuous form. Controlling for personal characteristics and country fixed effects, the results for 'age' clearly reject the linear specification, and strongly support a U-form relation up to the age of approx. 80. Beyond that age, however, another turning point is detected. Most preceding empirical studies have assumed this local maximum away (through model specification).[18] Notably, this study also suggests that the variation in SWB does not significantly change across people of same age. The hyperbolic functional form appears robust to the inclusion of cohort dummies, and is corroborated in country-specific analyses for more than half of OECD countries, and for a sample of non-OECD countries.

Potential policy implications

52. Societies in developed countries are over-aging, and the population share of those in retirement age is rising. Thus, this population group will grow in political, economic and societal importance. For this reason, correct modelling of heterogeneous age effects among the older becomes increasingly important. A hyperbolic functional form also bears important policy implications as it changes the trade-offs between specific age groups for e.g. the question of allocating life span-increasing health care expenditures across them. In principle, Utilitarian calculus suggests that increasing the number of actually lived years of those

18. Or by not carefully looking at the outcomes of the empirical analysis for the oldest-old group, see e.g. the graph in Blanchflower and Oswald (2009) and the authors' interpretation.

between the midlife crisis and the local maximum of 80 years is more beneficial than an alternative policy which focuses on the oldest old, whose marginal utility from living an additional year is negative, at an increasing rate. The largest increases in well-being among the older are observable for those between the ages of 61 and 67. In contrast, assuming a traditional U-form which explodes into the positive space health policy focus should be rather on the oldest-old, who would experience the steepest increase in SWB. However, it is a long step from econometric outcome to actual political decision-making, to which also moral and ethical concerns should apply.

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APPENDIX

Table A1: Individual age categories, all estimates

	1	2	3	4
Age 25 - 34	-0.026	-0.038	-0.208**	-0.232**
	[0.55]	[0.83]	[3.73]	[3.95]
Age 35 - 44	-0.073	-0.135+	-0.420**	-0.473**
	[1.03]	[1.94]	[6.52]	[6.25]
Age 45 - 54	-0.179*	-0.219**	-0.556**	-0.576**
	[2.16]	[3.23]	[8.23]	[6.77]
Age 55 - 64	0.031	-0.045	-0.224**	-0.287**
	[0.30]	[0.55]	[3.09]	[3.72]
Age > 64	0.056	-0.046	0.089	-0.018
	[0.40]	[0.48]	[0.76]	[0.16]
Male	-0.029	-0.042	-0.027	-0.081**
	[0.71]	[1.22]	[0.73]	[2.93]
Part-time employment			0.001	-0.101+
			[0.02]	[1.92]
Self-employed			-0.089	-0.078
			[0.81]	[1.16]
Housewife			0.081	-0.03
			[0.69]	[0.37]
Retired			-0.309**	-0.220**
			[3.11]	[3.20]
Other occupational status			-0.601**	-0.400**
			[5.39]	[4.20]
Student			0.023	0.039
			[0.34]	[0.65]
Unemployed			-1.007**	-0.907**
			[8.19]	[8.95]
Single			0.033	0.055
			[0.49]	[0.84]
Married or cohabiting			0.385**	0.461**
			[6.16]	[7.91]
Separated			-0.435**	-0.451**
			[3.40]	[4.18]
Widowed			-0.225*	-0.170+
			[2.72]	[2.04]
Has had 1 child			-0.033	0
			[0.57]	[0.01]
Has had 2 children			-0.016	0.051
			[0.28]	[0.96]

	1	2	3	4
Has had 3 or more children			0.086	0.079
			[0.95]	[1.05]
Trusts most people			0.388**	0.276**
			[6.87]	[7.26]
Friends are important			0.374**	0.330**
			[3.75]	[5.39]
Conf. in churches			0.02	0.121**
			[0.30]	[2.99]
Conf. in armed forces			-0.014	0.100**
			[0.33]	[3.18]
Conf. in the press			-0.102*	-0.017
			[2.13]	[0.50]
Conf. in labor unions			0.041	-0.007
			[0.90]	[0.28]
Conf. in the police			0.392**	0.228**
			[4.49]	[6.26]
Conf. in parliament			0.167*	0.078*
			[2.11]	[2.13]
Conf. in the civil services			0.048	0.091*
			[0.62]	[2.59]
Conf. in the United Nations			0.052	0.097**
			[1.51]	[3.95]
Believes in superior being			0.236*	0.039
			[2.18]	[1.25]
Buddhist			-0.874**	0.089
			[4.64]	[0.75]
Catholic			-0.147	-0.024
			[0.79]	[0.23]
Jewish			-0.326	-0.201
			[0.95]	[0.72]
Muslim			-1.904**	-0.327
			[8.12]	[1.48]
Protestant			0.099	0.109
			[0.63]	[1.08]
Christian-orthodox			-0.576**	-0.016
			[3.10]	[0.07]
Other Christian denomination			0.108	0.136
			[0.65]	[0.97]
Other religion			-0.002	0.063
			[0.01]	[0.48]
No denomination			-0.179	0.021
			[1.01]	[0.17]
Income middle			0.165*	0.217**
			[2.35]	[4.87]
Income high			0.409**	0.466**
			[6.06]	[6.04]
Leftist ideology			-0.105*	-0.070+

	1	2	3	4
			[2.25]	[1.90]
Conservative ideology			0.259**	0.235**
			[4.31]	[5.71]
Middle education			0.08	0.087*
			[0.87]	[2.71]
Upper education			0.109	0.120*
			[1.03]	[2.75]
country fixed effects		yes		yes
Constant	7.360**	7.650**	6.406**	6.466**
	[54.95]	[143.14]	[24.94]	[44.24]
Observations	44151	44151	34651	34651
Adj. R2	0.0012	0.1217	0.121	0.1811
Number of countries	30	30	30	30

Notes: '**', '*', '+' denote significance levels at the 1, 5 and 10 percent levels, respectively. Weighted OLS regressions with standard errors clustered by countries. Dependent variable: life satisfaction measured on a 10-point scale.

Table A2: Different functional forms of age, all estimates

	1	2	3	4	5	6
Age	0.001	-0.002	-0.013*	-0.064**	-0.056*	-0.158**
	[0.30]	[1.07]	[2.19]	[8.83]	[2.41]	[5.71]
Age^2/100			0.015*	0.066**	0.111*	0.270**
			[2.20]	[7.92]	[2.21]	[4.77]
Age^3 / 1000					-0.007+	-0.014**
					[1.96]	[3.71]
Male	-0.029	-0.070*	-0.028	-0.078**	-0.03	-0.080**
	[0.73]	[2.54]	[0.71]	[2.78]	[0.74]	[2.85]
Part-time employment		-0.066		-0.096+		-0.114*
		[1.22]		[1.84]		[2.21]
Self-employed		-0.078		-0.07		-0.075
		[1.12]		[1.02]		[1.09]
Housewife		0.043		-0.008		-0.02
		[0.54]		[0.10]		[0.26]
Retired		0.062		-0.132+		-0.177*
		[0.89]		[1.75]		[2.50]
Other occupational status		-0.333**		-0.381**		-0.404**
		[3.32]		[4.14]		[4.35]
Student		0.195**		0.014		-0.074
		[3.17]		[0.24]		[1.31]
Unemployed		-0.879**		-0.901**		-0.912**
		[8.60]		[8.83]		[9.01]
Single		0.177*		0.057		0.034
		[2.62]		[0.88]		[0.52]
Married or cohabiting		0.505**		0.469**		0.473**
		[8.63]		[8.15]		[8.32]
Separated		-0.445**		-0.455**		-0.444**
		[4.10]		[4.13]		[4.04]
Widowed		-0.012		-0.197*		-0.169+
		[0.15]		[2.32]		[1.97]
Has had 1 child		-0.06		0		0.015
		[1.32]		[0.00]		[0.33]
Has had 2 children		-0.053		0.052		0.065
		[0.97]		[0.96]		[1.18]
Has had 3 or more children		-0.015		0.086		0.094
		[0.19]		[1.13]		[1.24]
Trusts most people		0.265**		0.276**		0.276**
		[6.97]		[7.25]		[7.24]
Friends are important		0.336**		0.336**		0.333**
		[5.46]		[5.47]		[5.45]
Conf. in churches		0.126**		0.121**		0.120**
		[3.09]		[2.95]		[2.94]
Conf. in armed forces		0.104**		0.101**		0.098**
		[3.27]		[3.19]		[3.10]
Conf. in the press		-0.017		-0.015		-0.013
		[0.49]		[0.44]		[0.38]
Conf. in labor unions		-0.003		-0.007		-0.009
		[0.13]		[0.27]		[0.36]
Conf. in the police		0.231**		0.228**		0.231**
		[6.22]		[6.19]		[6.23]
Conf. in parliament		0.077*		0.082*		0.080*
		[2.13]		[2.23]		[2.18]
Conf. in the civil services		0.096*		0.087*		0.086*
		[2.73]		[2.42]		[2.43]
Conf. in the United Nations		0.100**		0.096**		0.096**
		[3.99]		[3.88]		[3.89]
Believes in superior being		0.043		0.041		0.04

	1	2	3	4	5	6
		[1.40]		[1.32]		[1.31]
Buddhist		0.113		0.096		0.082
		[1.07]		[0.88]		[0.73]
Catholic		-0.018		-0.022		-0.028
		[0.18]		[0.21]		[0.26]
Jewish		-0.209		-0.225		-0.237
		[0.74]		[0.81]		[0.83]
Muslim		-0.335		-0.341		-0.339
		[1.60]		[1.55]		[1.52]
Protestant		0.129		0.11		0.108
		[1.32]		[1.11]		[1.08]
Christian-orthodox		-0.008		-0.019		-0.024
		[0.04]		[0.09]		[0.11]
Other Christian denomination		0.144		0.132		0.13
		[1.04]		[0.98]		[0.96]
Other religion		0.078		0.067		0.066
		[0.60]		[0.51]		[0.50]
No denomination		0.027		0.018		0.016
		[0.22]		[0.15]		[0.13]
Income middle		0.197**		0.213**		0.214**
		[4.31]		[4.70]		[4.77]
Income high		0.437**		0.456**		0.454**
		[5.69]		[5.88]		[5.91]
Leftist ideology		-0.079*		-0.071+		-0.070+
		[2.05]		[1.93]		[1.88]
Conservative ideology		0.237**		0.236**		0.235**
		[5.60]		[5.72]		[5.73]
Middle education		0.081*		0.085*		0.092**
		[2.52]		[2.56]		[2.77]
Upper education		0.101*		0.124**		0.145**
		[2.29]		[2.76]		[3.20]
country fixed effects		yes		yes		yes
Constant	7.284**	6.203**	7.576**	7.483**	8.150**	8.778**
	[41.98]	[34.93]	[43.46]	[42.67]	[25.36]	[21.87]
Observations	44151	34651	44151	34651	44151	34651
Adj. R2	0.0001	0.1751	0.0005	0.1800	0.0007	0.1810
Number of countries	30	30	30	30	30	30

Notes: '**', '*', '+' denote significance levels at the 1, 5 and 10 percent levels, respectively. Weighted OLS regressions with standard errors clustered by countries. Dependent variable: life satisfaction measured on a 10-point scale. .

Table A3: Age cohort effects

	1	2	3	4	5	6
Age	-0.065*	-0.156**	-0.054+	-0.130**	-0.091	-0.156*
	[2.06]	[4.53]	[1.98]	[3.99]	[1.67]	[2.57]
Age^2/100	0.138+	0.277**	0.108+	0.210**	0.203+	0.273*
	[2.03]	[3.84]	[1.93]	[3.18]	[1.87]	[2.17]
Age^3 / 1000	-0.009+	-0.014**	-0.006+	-0.009*	-0.014*	-0.015+
	[1.99]	[3.11]	[1.80]	[2.18]	[2.16]	[1.80]
Male	-0.042	-0.081**	-0.042	-0.081**	-0.042	-0.081**
	[1.24]	[2.89]	[1.24]	[2.88]	[1.23]	[2.90]
Age 15-24						
Age 25 - 34	0.069	0.095	0.062	0.08		
	[0.87]	[1.04]	[0.80]	[0.87]		
Age 35 - 44	-0.009	0.004	-0.007	0.005		
	[0.07]	[0.03]	[0.06]	[0.04]		
Age 45 - 54	-0.14	-0.147	-0.127	-0.121		
	[0.94]	[0.77]	[0.86]	[0.65]		
Age 55 - 64	-0.031	-0.031	-0.016	-0.001		
	[0.20]	[0.14]	[0.10]	[0.01]		
Age 65 - 74	-0.008	0.047	-0.014	0.03		
	[0.05]	[0.19]	[0.08]	[0.12]		
Age > 74	-0.104	-0.182				
	[0.49]	[0.70]				
Age 75 - 84			-0.149	-0.287		
			[0.68]	[1.06]		
Age > 84			-0.352	-0.787		
			[0.83]	[1.42]		
cat_1_1 (15-19 years)						
cat_1_2 (20-24 years)					0.131	0.196+
					[1.45]	[2.02]
cat_2_2 (25-29 years)					0.189	0.275
					[1.15]	[1.65]
cat_2_3 (30-34 years)					0.205	0.266
					[0.97]	[1.23]
cat_3_3 (35-39 years)					0.2	0.279
					[0.85]	[1.08]
cat_3_4 (40-44 years)					0.059	0.151
					[0.23]	[0.54]
cat_4_4 (45-49 years)					-0.028	0.064
					[0.10]	[0.20]
cat_4_5 (50-54 years)					0.056	0.177
					[0.18]	[0.52]
cat_5_5 (55-59 years)					0.058	0.178
					[0.20]	[0.50]
cat_5_6 (60-64 years)					0.276	0.447

	1	2	3	4	5	6
					[0.87]	[1.15]
cat_6_6 (65-69 years)					0.279	0.487
					[0.83]	[1.18]
cat_6_7 (70-74 years)					0.31	0.457
					[0.79]	[0.94]
cat_7_7 (75-79 years)					0.363	0.324
					[0.90]	[0.65]
cat_7_8 (80-84 years)					0.451	0.453
					[0.99]	[0.81]
cat_8_8 (85-89 years)					0.393	0.084
					[0.63]	[0.11]
age > = 90					1.384+	0.648
					[1.80]	[0.62]
Country fixed effects	yes	yes	yes	yes	yes	yes
Other micro-controls	no	yes	no	yes	no	yes
Constant	8.487**	8.665**	8.360**	8.378**	8.704**	8.552**
	[20.65]	[18.76]	[23.04]	[17.67]	[12.49]	[10.83]
Observations	44151	34651	44151	34651	44151	34651
Adj. R2	0.1219	0.1821	0.1219	0.1822	0.1225	0.1829
Number of countries	30	30	30	30	30	30

Notes: '**', '*', '+' denote significance levels at the 1, 5 and 10 percent levels, respectively. Weighted OLS regressions with standard errors clustered by countries. Dependent variable: life satisfaction measured on a 10-point scale. Other micro-level controls include income, education, occupational status, marital status, family size, religion, social capital, vertical and horizontal trust, political ideology.

Table A4: Age cohort effects and health, non-OECD sample and full world sample

	1	2	3	4	5
Age	-0.139**	-0.185**	-0.197**	-0.257**	-0.150**
	[6.02]	[4.92]	[4.41]	[2.81]	[3.78]
Age^2/100	0.215**	0.345**	0.377**	0.500*	0.288**
	[4.53]	[4.40]	[3.81]	[2.41]	[3.31]
Age^3 / 1000	-0.009**	-0.019**	-0.022**	-0.028+	-0.015*
	[3.05]	[3.84]	[3.20]	[1.94]	[2.52]
Male	-0.104*	-0.103*	-0.103*	-0.102*	-0.188**
	[2.14]	[2.11]	[2.11]	[2.09]	[4.30]
10-year cohorts I	-	yes	-	-	-
10-year cohorts II	-	-	yes	-	yes
5-year cohorts	-	-	-	yes	-
Country fixed effects	yes	yes	yes	yes	yes
Other micro-controls	yes	yes	yes	yes	yes
Health	-	-	-	-	yes
Constant	6.384**	6.870**	7.001**	7.764**	7.002**
	[15.58]	[13.90]	[12.45]	[7.16]	[14.23]
Observations	40838	40838	40838	40838	44432
Adj. R2	0.227	0.2271	0.2271	0.2271	0.2702
Non-OECD countries	yes	yes	yes	yes	-
Full world	-	-	-	-	yes
Number of countries	45	45	45	45	42
'Midlife crisis'	45	40	40.5	38	36
'Second youth'	114	81	74	82	91.5

Notes: '**', '*', '+' denote significance levels at the 1, 5 and 10 percent levels, respectively. Weighted OLS regressions with standard errors clustered by countries. Dependent variable: life satisfaction measured on a 10-point scale. Other micro-level controls include income, education, occupational status, marital status, family size, religion, social capital, vertical and horizontal trust, political ideology. The full estimation results are in Table A3 of the Appendix. "10-year cohorts I" denotes inclusion of age cohorts in 10-year steps (15-24, 25-34, etc, 65-74), with the last cohort formed by those 75 years an older. "10-year cohorts II" splits the oldest group of the previous specification into two further sub-categories: the '75-84 years old', and the '84 and older' categories. "5-year cohorts" defines age cohorts in 5-year steps, starting with '15-19 years old', followed by the '20- 24 years old', etc. The last age cohort includes those aged 90 years or older.

Table A5: Variation in subjective well-being by age categories and age

Age category	Range of standard deviations in SWB		Minimum number of persons in each age group
	Min	Max	
Age cat. 15 - 17	1.8	2.6	x < 100
Age cat. 18 - 19	2.1	2.3	x > 490
Age cat. 20 - 29	2.1	2.3	x > 630
Age cat. 30 - 39	2.1	2.3	x > 720
Age cat. 40 - 45	2.1	2.3	x > 660
Age cat. 46 - 49	2.2	2.3	x > 620
Age cat. 50 - 59	2.1	2.3	x > 420
Age cat. 60 - 69	2.1	2.3	x > 320
Age cat. 70 - 79	1.9	2.5	x > 140
Age cat. 80 - 89	1.6	2.6	x < 110
Age cat. 90 - 99	1.5	3	x < 10

Notes: Based on life satisfaction data on 34'651 persons in regression sample of Table 3a, model 6. Each age category is comprised of 5 to 10 age groups (people with the same age at the time of interview).

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