Happiness and age cycles – return to start...

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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 well-developed OECD countries with long life expectancies, we reveal that age follows a hyperbolic form. We find that life satisfaction reaches another local maximum around the age of 83, with a level identical to that of a 26-years old. This hyperbolic well-being-age relation is robust to the inclusion of cohort effects. We corroborate the functional form using a sample of non-OECD countries.

Keywords: Subjective Well-Being, cohorts, Happiness, Aging, Life-course, OECD, cross-national, life satisfaction

JEL Codes: I31, I3, A14, J14, D61

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With age comes wisdom, and with wisdom contentment.

1. Introduction

Folk wisdom says that with age comes wisdom, and with wisdom comes contentment. Indeed, until recently happiness research has postulated that subjective well-being 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 that overage, with an increasing population share of the oldest. For this reason, happiness research in richer countries should take account of potentially heterogeneous age effects, particularly among the older.

In brief: recent empirical research

Some recent household panel analyses have, however, cast doubt on this *U-form relation* between well-being and lifeyears, arguing that it was driven by unobserved birth cohort effects, while others corroborate it. On the other hand, analyses based on international micro data often find the U-relation robust to accounting for unobserved cohort effects, but rarely test for alternative functional forms. To the confusion is adding that gerontoligical studies, which, by nature, focus on the middle-aged to older population, 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 maximum. Taken altogether, the debate on the relation between happiness and age is open again.

Aim of paper

The aim of this paper is to contribute to this discussion by testing heterogeneity of age effects exploiting survey data from developed countries only that include a relatively large share of aged persons. It is for this strong representation of persons aged 65 and older that allows for testing several functional relations between well-being and age, a neglected aspect in previous studies. We also analyze the sensitivity of the results to the inclusion of age cohort dummies. 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. The hyperbolic functional form persists in a non-OECD sample.

Contents of paper

The reminder of this paper is organized as follows: section 2 provides an overview 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. The next section introduces the literature, before we turn to the data and the empirical analysis for OECD countries.

2. Literature review

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, footnote 1; Blanchflower and Oswald, 2008; Frijters and Beatton, 2008).[1] SWB first declines with age, and, after reaching a minimum, rises again. 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 reflected in a negative estimate for age and a smaller, but positive one for age squared (e.g. Blanchflower and Oswald, 2004). This U-shaped relation becomes also often evident when age categories are employed in place of the continuous age measure (Frey and Stutzer, 2000; Dorn et al., 2008).

Theory I: Sociologists and Psychologists

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

[1] 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).

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 35 to 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. Consequently, SWB rises again in age. Altogether, this explanation relates to life events that occur 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. employment status, civil status, income) is rather not in support of this hypothesis.[2]

Theory I: Economists

However, economic models 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. If the survey question on SWB approximated instantaneous utility, the result would be an empirically observable *inverse* U-relation of the SWB measure with age.[3] 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. Taken altogether, neither field of social science, and the economic the least, has developed a completely convincing theory for the observed relation between SWB and age.

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

[3] Survey questions that aim at measuring SWB either employ the so-called 'happiness' question or the so-called 'life satisfaction' question. Deaton (2007) uses the latter variant, as does also this contribution. This point is also discussed in the data description.

Empirics

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

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.[4] 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

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 for a test of equality of the minima across them. Second, he includes

[4] 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, this study suggests that the hyperbolic form also persists in a sample of developing and transition countries.

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.

Non-Confirmative studies: national, happiness researchers

However, the U-shaped relation is challenged by economists such as Frijters and Beatton (2008), who conclude 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, gerontologists

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 even 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 above from Taiwan, identifies a decline in life satisfaction from the age of 65 on. Notably, controlling for abroad 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. The decline of happiness in age is mirrored by Schilling (2005) for the German population aged between 48 and 75, 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 inverted a 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 rather suggest an *inverted U-relation*.

Summary of literature review

Taken all together, happiness research has no clear message with respect to whether there are U-form life-cycle effects of age that are independent from cohort effects. In contrast, gerontologists' research rather suggests the opposite relation, viewed from the midlife crisis on. Combining these findings, one may suspect that SWB is hyperbolic in age or flattens out from a certain age on. This paper tests this conjecture for sample of OECD countries in which the share of older persons in the population (and in the survey) is sufficiently large to analyze heterogeneous age effects also for this group.

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

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.[5] These cross-sectional data include a measure of subjective well-being that is commonly employed in empirical happiness literature (see below). 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 1000 and 2000 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

[5] www.worldvaluessurvey.org

OECD sample.[6] 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.[7]

SWB and age

The WVS measure of subjective well-being 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.[8] 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.

Control variables

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 (networks and religious engagement), and political ideology. Table 1 provides a list of all control variables and descriptive statistics.

Samples

OECD countries are the economically most advanced and politically most stable countries in the world. This is also reflected in high life expectancies and the overaging of their populations. A

[6] 87% of the aggregate socio-demographic country observations are obtained from the 4th wave (26 out of 30 countries), while the remaining ones are obtained from the 3rd wave (namely Australia, Switzerland, Norway, New Zealand).

[7] 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.

[8] 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.

small comparison reveals the supremacy of OECD countries for analyzing heterogonous age effects also among the older population: In the sample of 44'000 persons, there are 6000 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% in the remaining sample is at least 80 years old. For robustness test, we also use this sample of non-OECD countries in the WVS data.

Method

The impact of age on 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. Inclusion of further socio-demographic control variables should then 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.

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

Table 1

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4. Results

It is now viewed as common knowledge that, at the micro level, individual life satisfaction first decreases in age and then increases again. In Western countries, the turning point lies roughly between 35 and 50 years. In popular Psychology, this period is also referred to as 'midlife crisis'. As described in the literature review section, happiness researchers explain this U-relation between age and life satisfaction by a retarded adjustment of aspiration levels, letting the gap between achieved and aspired utilities become maximal during the midlife crisis years and narrowing it with increasing age again.

Age categories

(background)

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.

(Estimation results and discussion)

The estimates in Table 2 support, in general, a U-form shape, but also reveal the sensitivity of the statistical significance to model specification, and corroborates earlier observations that age effects become more pronounced the more complete the SWB model is specified. 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 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. 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, once individual heterogeneity is taken into account. In model 4, the size of the age effects ranges from -0.23 to -0.57, with SWB of those in the midlife crisis (45-54 years) lowered by more than half of a category compared to the reference group. Notably, the coefficient on the highest age group (> 65 years) is never significant in any model specification. 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).

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'.

Table 2

Different functional forms of continuous age

Table 3 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 no-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 (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 specification

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). According to the estimates, midlife crisis occurs at the age of 43 or 48 years, depending on the model specification. Viewing the effect of age on SWB as partial effect rather than total effect (column 3 versus column 4) 'retards' the midlife crisis by about 5 years in OECD countries. 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

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 a 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 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, the hyperbolic form of the well-being-age-function becomes more pronounced when individual-level controls and country fixed effects are included. 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, column 6 suggests a maximum effect on SWB at the age of 83. [9]

Table 3

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[9] 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 representations

Graph 1 illustrates the non-linear development of the age effects on individual life satisfaction of 44'000 individuals in 30 OECD countries. 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 column 5 excludes other determinants of subjective well-being that may be correlated with individual age, these estimates represent a 'total age effect'. Partial age impacts are larger, 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.[10]

General description of curves

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, subjective well-being reaches, *ceteris paribus*, a level of 7.22 points in model 5, 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 (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 effects are more pronounced once life events are controlled for. This finding is in support of the previous literature.

Comparison of age effects across life years: return to start

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, the SWB level of a 15 year-old is the highest that can be achieved, with a happiness level of 6.96. 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. According to model

[10] 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.

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 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.

Graph 1

Comparison of U-shaped with hyperbolic SWB function

Graph 2 illustrates the bias that arises when a U-shaped relation in place of a more flexible association between SWB and age is estimated. For this purpose, we plot the quadratic functional form obtained from the full model (column 4) against the hyperbolic functional form of model 6 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 in place of 45). Nor does it considerably bias the SWB levels for the 15 to the 69 year olds. Departure from the quadratic function starts between the ages of 69 and 75, which explodes 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

Taking account of birth cohorts

(background)

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 undernutrition that decreased the SWB of these persons for the rest of their lives (lowered their SWB set-points).

(test design)

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). Finally, 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).

(outcome and discussion)

Table 4 reports the estimation results for the age and the gender variables. Model 1 replicates the baseline specification, the full model of Table 3 that includes individual-level controls and country fixed effects. Models 2 to 4 add age cohort dummies, in the variants described above. The continuous age variables pass the robustness test very well. For all cohort definitions, all age coefficients stay significant and keep their signs, indicating that the hyperbolic well-being-age relation is still present. For models 2 and 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'. Interestingly, the age of minimum SWB is between 40 and 45 across all model specifications, *de facto* unaffected by the inclusion or exclusion of cohort controls. In three of four models the age of

maximum happiness in the second half of life is either 82/83 or 91. In two thirds of OECD countries, life expectancy reaches almost 80 years already now, 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 Table 4.

Table 4

Robustness test: non-OECD countries

Notably, 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, in the last 5-year-cohort specification, the ages of (local) maximum and minimum are almost identical in the non-OECD sample compared to those in the OECD sample (38 versus 40 years and 82 versus 82 years). This is quite astonishing given the dominance of developing and transition countries in this sample. Finally, the hyperbolic SWB-age relation appears robust to the inclusion of a self-report state of health variable, which is only available for 11 OECD countries and 32 non-OECD countries, both in the entire world sample and the two 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. Thus, the decline of SWB after the local maximum is not likely to be caused by the omission of health measures from the model.

Taken all together, testing several functional relations between happiness and age we find strong support that well-being robustly follows a hyperbolic functional form, with well-being first

decreasing in age up to 40, increasing again, and after a local maximum around 80, decreasing again.

The last section of this paper summarizes these findings , also in the light of potential policy application.

Graph 3

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5. Conclusion and consequences for policies

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 due to the omission of birth cohort effects. What astonishes most is that both groups use identical data, mostly the British or the German household panels, and still reach opposing conclusions.

Contribution of paper

This paper takes a new look at an old question and proposes a hyperbolic functional form of 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 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, assuming either a quadratic as well as a linear relation would constitute model misspecifications. Assuming a quadratic form may well approximate the first part of the 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.

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. The results clearly reject the linear specification, and strongly support a U-form relation up to the age of 75. Beyond that age, however, another turning point is detected. Most preceding empirical studies have assumed this local maximum away (through model specification). The hyperbolic functional form appears robust to the inclusion of cohort dummies.

Potential policy implications

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 correctly becomes increasingly important. A hyperbolic functional form also bears important policy implications as it changes the trade-offs between specific age groups and the, e.g., allocation of life span-increasing health care expenditures across them. In principle, Utilitarian calculus suggests that increasing the number of actually lived years of those 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 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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Tables

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 squared/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	ref.cat.	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	ref.cat.	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	ref.cat.	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	ref.cat.	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	ref.cat.	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	Ref.cat.	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*
Serv. part. 1: more than weekly	43975	0.07	0.25	0	1	-0.0089
Serv. part. 2	43975	0.17	0.37	0	1	0.009
Serv. part. 3	43975	0.10	0.30	0	1	0.0325*
Serv. part. 4	43975	0.15	0.35	0	1	0.0005
Serv. part. 5	43975	0.03	0.18	0	1	0.0166*
Serv. part. 6	43975	0.08	0.27	0	1	0.0073
Serv. part. 7	43975	0.09	0.29	0	1	0.0023
Serv. part. 8: never	ref. cat.	0.32	0.46	0	1	-0.0358*
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.

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	0.121	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.

Table 3: 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 squared/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	0.18	0.0007	0.181
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.

Table 4: Testing for age cohort effects

	1	2	3	4
Age	-0.158**	-0.156**	-0.130**	-0.156*
	[5.71]	[4.53]	[3.99]	[2.57]
Age squared/100	0.270**	0.277**	0.210**	0.273*
	[4.77]	[3.84]	[3.18]	[2.17]
Age^3 / 1000	-0.014**	-0.014**	-0.009*	-0.015+
	[3.71]	[3.11]	[2.18]	[1.80]
Male	-0.080**	-0.081**	-0.081**	-0.081**
	[2.85]	[2.89]	[2.88]	[2.90]
10-year cohorts I	-	yes	-	-
10-year cohorts II	-	-	yes	-
5-year cohorts	-	-	-	yes
Country fixed effects	yes	yes	yes	yes
Other micro-controls	yes	yes	yes	yes
Constant	8.778**	8.665**	8.378**	8.552**
	[21.87]	[18.76]	[17.67]	[10.83]
Observations	34651	34651	34651	34651
Adj. R2	0.181	0.1821	0.1822	0.1829
Number of countries	30	30	30	30
'Midlife crisis'	45	41	43	40
'Second youth'	83	91	113	82

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.

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]
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+
			[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 squared/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
		[1.40]		[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
Adjusted R-squared	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 squared/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
					[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
Adjusted R-squared	0.1219	0.1821	0.1219	0.1822	0.1225	0.1829
Number of countries	30	30	30	30	30	30

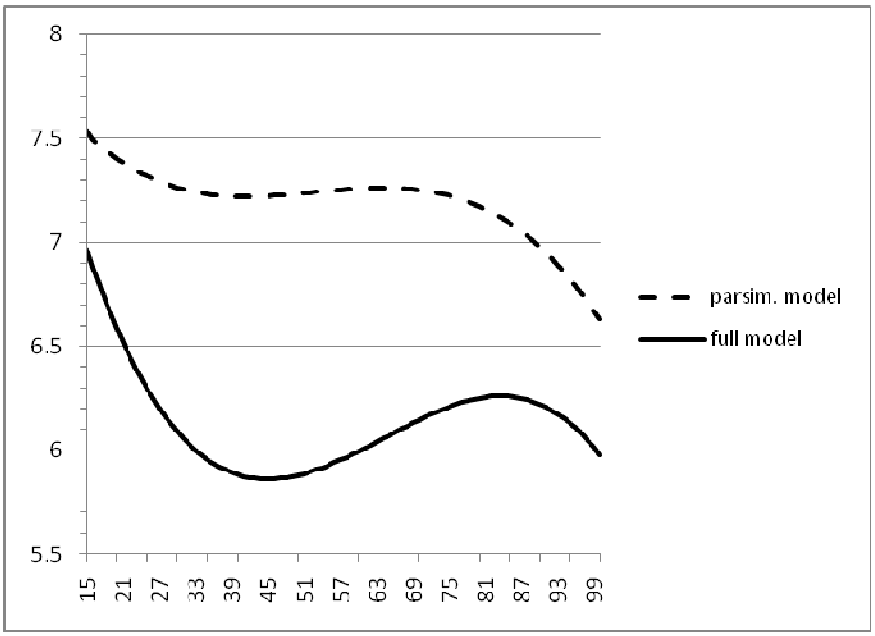
Notes: '**', '*', '+' denote significance levels at the 1, 5 and 10 percent levels, respectively. Weighted OLS regressions with standard errors clustered by countries. Dependent variable: life satisfaction measured on a 10-point scale. Other micro-level controls include income, education, occupational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

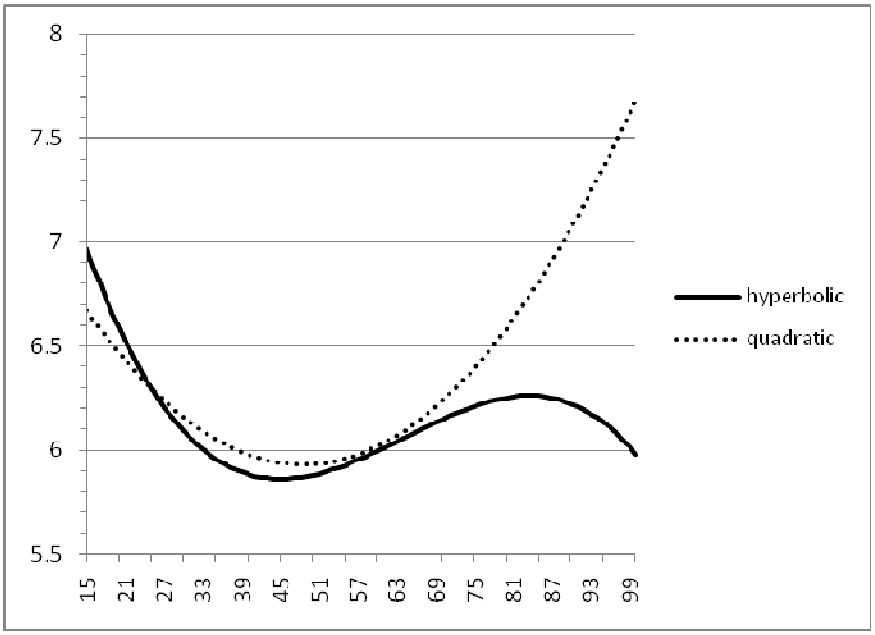
	1	2	3	4	5
Age	-0.139**	-0.185**	-0.197**	-0.257**	-0.150**
	[6.02]	[4.92]	[4.41]	[2.81]	[3.78]
Age squared/100	0.215**	0.345**	0.377**	0.500*	0.288**
	[4.53]	[4.40]	[3.81]	[2.41]	[3.31]
Age^3 / 1000	-0.009**	-0.019**	-0.022**	-0.028+	-0.015*
	[3.05]	[3.84]	[3.20]	[1.94]	[2.52]
Male	-0.104*	-0.103*	-0.103*	-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
Adjusted R-squared	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	45
'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.

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



Graph 2: The effect of functional misspecification



Graph 3: The age effect with and without cohort controls