Journal of Economic Behavior & Organization 82 (2012) 525–542

Contents lists available at SciVerse ScienceDirect

Journal of Economic Behavior & Organization

journal homepage: www.elsevier.com/locate/jebo

The mystery of the U-shaped relationship between happiness and age[☆]

Paul Frijters[a], Tony Beatton[b,*]

[a] School of Economics, University of Queensland, Brisbane, Australia
[b] School of Economics and Finance, Queensland University of Technology, Brisbane, Australia

ARTICLE INFO

Article history:
Received 7 October 2008
Received in revised form 23 January 2012
Accepted 15 March 2012
Available online 28 March 2012

JEL classification:
C23
C25
I31

Keywords:
Happiness methodology
Unobservables
Latent variable models
Age effects
Selection effects
Fixed effects

ABSTRACT

In this paper, we address the puzzle of the relationship between age and happiness. Whilst the majority of psychologists have concluded there is not much of a relationship at all, the economic literature has unearthed a possible U-shape relationship with the minimum level of satisfaction occurring in middle age (35–50). In this paper, we look for a U-shape in three panel data sets, the German Socioeconomic Panel (GSOEP), the British Household Panel Survey (BHPS) and the Household Income Labour Dynamics Australia (HILDA). We find that the raw data mainly supports a wave-like shape that only weakly looks U-shaped for the 20–60 age range. That weak U-shape in middle age becomes more pronounced when allowing for socio-economic variables. When we then take account of selection effects via fixed-effects, however, the dominant age-effect in all three panels is a strong happiness increase around the age of 60 followed by a major decline after 75, with the U-shape in middle age disappearing such that there is almost no change in happiness between the age of 20 and 50.

© 2012 Elsevier B.V. All rights reserved.

1. Introduction

What is the relationship between happiness and age? Do we become more miserable as we age, or, is our happiness relatively constant throughout our lives with only the occasional special event (marriage, birth, promotion, and illness) temporarily raising or reducing our happiness, or do we actually get happier as we age?

The answer to this question in the recent economic literature is that the age–happiness relationship is U-shaped.[1] This finding holds for the US, Germany, Britain, Australia, Europe, and South Africa. The stylised finding is that individuals gradually become unhappier after their 18th birthday, with a minimum around 50, followed by a gradual upturn in old age. The predicted effect of age can be quite large. For example, the predicted difference in average happiness between an 18 year old and a 50 year old from regressions can be as much as 1.5 points on a 10-point-scale.

This recent economics literature, however, conflicts with an old psychology literature that finds no happiness-age relationship (Cantril, 1965). Palmore and Luikart (1972) comment in their review; 'Several variables thought to be related to life

☆ We would like to thank conference, staff, and seminar participants for useful comments and suggestions. The usual disclaimer applies.

* Corresponding author. Tel.: +61 7 313 84262; fax: +61 7 313 81500.
E-mail address: t.beatton@qut.edu.au (T. Beatton).

[1] Recent papers on this in the economic literature include: (Bell and Blanchflower, 2007; Blanchflower, 2008; Blanchflower and Oswald, 2001, 2004, 2007, 2008, 2009; Clark, 2006; Dear et al., 2002; Di Tella et al., 2001; Ferrer-i-Carbonell and Frijters, 2004; Ferrer-i-Carbonell, 2005; Gerdtham and Johannesson, 2001; Hayo and Seifert, 2003; Headey and Wearing, 1989; Helliwell, 2003; Oswald, 1997; Oswald and Powdthavee, 2008; Powdthavee, 2003; Seifert, 2003; Senik, 2004; Theodossiou, 1998; Van Landeghem, 2008; Winkelmann and Winkelmann, 1998; Wolpert, 2010).

0167-2681/$ – see front matter © 2012 Elsevier B.V. All rights reserved.
doi:10.1016/j.jebo.2012.03.008

satisfaction had little or no relationship: age, sex, total social contacts'. More recently, the psychologists Dear et al. (2002) postulate a slight reduction in life satisfaction as people age, due to the prevalence of high life satisfaction becoming less common at higher ages. From this reading, it is clear that either the psychologists have overlooked something important for a long time or that the methodology of economists begets different answers. This paper intends to find out, which it is.

We re-examine the age–happiness relationship and delve into the methodological aspects to provide an explanation for the difference of opinion between economists and psychologists. We essentially want to know if the U-shape that economic scholars find is an artefact or real, and what the actual relationship between age and life satisfaction is. We re-examine the age–happiness relationship in three often-used panel datasets, the German Socio Economic Panel (the GSOEP), the British Household Panel Survey (BHPS), and the Household Income Labour Dynamics Australia (HILDA), which all have an extensive set of variables on the individual level. This data-richness allows us to not only replicate the findings of other studies based on cross-sectional data, but, furthermore, allows us to explore the dynamic interplay between age, covariates, unobserved heterogeneity, and happiness.

The format of this paper is to let the solution to the puzzle of the age–happiness relationship progressively unfold. We first briefly review the recent literature where we summarise the main findings of others, as well as their methodology. Then we present the data we have and show that we can indeed replicate a U-shape in happiness when we run similar regressions to those in the literature. We then go through a succession of reasons for both the raw relationship between happiness and age in these panels, as well as the changes in coefficients of age-related variables as more factors are included. This includes the possibility: that the age–happiness relationship is dominated by a happiness reduction found in early adulthood (age 18–22); that found age effects are due to estimation biases arising from selectivity, or; that it is a truly robust finding. We find that selection, i.e. fixed effects, and are extremely important for the age–happiness puzzle. Not only does the inclusion of fixed-effects change the coefficients of important age-varying factors (such as employment and income), which in turn changes the found residual effects of age directly, but it also turns out that the raw relation is heavily tainted by selection effects; the panels seem to over-sample particularly happy very old individual and particularly unhappy middle age individuals, leading these datasets to exaggerate the happiness decline in middle-age and to underestimate the decline in very old age.

2. Literature review

Whilst a lot of the economic literature on the age–happiness relationship is recent, there have been earlier discussions of it (see Theodossiou, 1998 for a discussion of the history of this issue). Until the early 2000s, the opinion of economists about the effect of age was still divided. Clark and Oswald (1994) found a U-shaped pattern for the UK, whilst Winkelmann and Winkelmann (1998) found no U-shape in happiness but simply a very strong negative effect of age. Easterlin et al. (1993) using 20 years of the US General Social Survey concluded that life satisfaction is almost flat in age, with neither a U-shape nor a negative slope. Alesina et al. (2004) and van Praag et al. (2000) even found an inverted U-shape.

Despite this early controversy, nearly all recent papers come down on the side of a U-shaped relationship between happiness and age. Blanchflower and Oswald (2001, 2004) simply state that 'Wellbeing is U-shaped in age'. Gerdtham and Johannesson (2001) also report a U-shape in age with a minimum around the age of 55. Hayo and Seifert (2003) and Seifert (2003) also report a U-shape and call the U-shaped age effect a 'typical finding in happiness regressions'. The most comprehensive study to date is Blanchflower and Oswald (2007) who combine cross-sectional data for the US, Europe, and the World Value Survey. In total, they have about 800,000 respondents in over 60 countries for which they all report a U-shape in happiness and age. Clark (2006), (p. 14) claims some robustness with respect to methodology for this finding when he concludes that '*even controlling for individual fixed effects, . . . life* satisfaction . . .. *remains U-shaped in age*'.

In order to get a feeling for the role of methodology in these findings, we reproduce in Tables 1a and 1b the main findings of the recent economic studies on the U-shape between age and happiness. The statistical model used in these studies generally takes the form:

$$LS_{it} = \alpha + X_{it}\beta_1 + \beta_2 age + \beta_3 age^2 + \varepsilon_{it}$$

where,

LS_{it}: life satisfaction (individual happiness)
α: constant
X_{it}: time-variant socio-demographic variables (e.g. income, health, employment status, relationship status, etc.)
$age + age^2$: age effects
ε_{it}: error term.

Importantly, in the economics of happiness literature, the existence of a U-shape is inferred from the combination of a negative coefficient on *age* and a positive coefficient on age^2 in happiness regressions. In the analysis sections of this paper we show the found coefficients on age and age-squared and detail the source of the data and the estimation method. We may mention already that all the studies included in this table also use other personal variables in the same regression. The controls mainly include measures for employment, income, partnerships, the number of children, education and, sometimes, indicators of where someone lives.

Table 1a
Life satisfaction regression results (*t*-values) from recent studies.

Author, date	Sample (size and name)	Coefficients – pooled (*t*-value)		Coefficients – fixed effects (*t*-value)		Dependent variable (DV) and controls
		Age	Age squared	Age	Age squared	
Blanchflower and Oswald (2009)	Data from 8 European nations	OLS −0.00800	OLS 0.0000815			DV: life satisfaction without controls
Blanchflower and Oswald (2008)	Data from 16 countries	Ordered logit −0.0576 (8.85)	Ordered logit 0.0006 (9.95)			DV: life satisfaction with personal controls
Blanchflower and Oswald (2001)	USA: General Social Survey 1972–2006	Ordered logit (men + women averaged) USA −0.0211 (4.39) N = 45,474	Ordered logit (men + women averaged) USA: 0.0003 (5.92) N = 45,474			DV: happiness controls: yes (specification without cohort)
Blanchflower and Oswald (2001)	Europe: Eurobarometer 1976–2002	Ordered logit (men + women averaged) Eur: −0.045 (31.31) N = 589,446	Ordered logit (men + women averaged) Eur: 0.00052 (10.1) N = 589,446			DV: life satisfaction controls: yes (specification without cohort)
Blanchflower and Oswald (2001)	World Value Survey 1981–2004	Ordered logit (men + women averaged) WVS: −0.0505 (10.1) N = 163,852	Ordered logit (men + women averaged) WVS: 0.0003 (5.92) N = 163,852			DV: life satisfaction controls: yes (specification without cohort)

Table 1b
Continuation of life satisfaction regression results (*t*-values) from recent studies.

Author, date	Sample (size and name)	Coefficients – pooled (*t*-value)		Coefficients – fixed effects (*t*-value)		Dependent variable (DV) and controls
		Age	Age squared	Age	Age squared	
Blanchflower and Oswald (2004)	UK: Eurobarometer Survey 1975–1998	Ordered logits – all UK: −0.0424 (2.84) $N = 54{,}549$	Ordered logits – all UK: 0.0005 (15.38) $N = 54{,}549$			DV: life satisfaction controls: yes
Clark (2006)	British Household Panel Survey (BHPS) Waves 1–14	−0.075 (−25) $N = 82{,}096$	0.00091 (30.33) $N = 82{,}096$	Applied age cohorts to derive fixed effect coefficients		DV: life satisfaction controls: yes
Di Tella et al. (2001)	Eurobarometer Survey Series 1975–1991	OLS −0.02 (20.0) $N = 264{,}710$	OLS 0.0002 (33.33) $N = 264{,}710$			DV: life satisfaction controls: yes
Powdthavee (2005)	Statistics South Africa OHS study of 1997	−0.011 (*z*-stat: −2.38) $N = 20{,}634$	0.0001 (*z*-stat: 2.03) $N = 20{,}634$			DV: life satisfaction controls: yes
Senik (2004)	Russian longitudinal monitoring survey (RLMS)	Ordered probit (2) −0.050 (8.33) $N = 17{,}897$	Ordered probit (2) 0.001 ($p < .01$) $N = 17{,}897$			DV: life satisfaction controls: yes
Winkelmann and Winkelmann (1998)	German Socio-Economic Panel 1984–89 waves of the GSOEP	−0.098 (−9.8) $N = 20{,}944$	0.0012 (12) $N = 20{,}944$	Fixed effects logit model 2 −0.118 (−3.19) $N = 20{,}944$	Fixed effects logit model 2 −0.0001 (0.25) $N = 20{,}944$	DV: binary life satisfaction controls: yes

Tables 1a and 1b confirm the very strong effect that age is found to have upon life satisfaction in recent studies, and, that the effect of linear age is always negative, whilst that of age-squared is positive, indicating a U-shape. Bearing in mind that the age at which the minimum occurs is given by the negative of the coefficient of linear age divided by twice the coefficient of age-squared, it appears that the majority of the studies find that age 55 is when the minimum occurs. Tables 1a and 1b also underscore that the effects are mainly found in cross-sections when controls are added for individual socio-economic variables.

Despite the reliance in the literature on using age and age-squared in order to unearth a U-shape or not, other approaches can be taken. Wunder et al. (2009) hence include a fourth-order polynomial of age in their happiness regressions, where they find that the higher order terms are also significant and hence that the U-shape is not a perfect description of the actual relationships (they find a clear negative slope at the very high age ranges). We will in this paper also look at the full age-profile later on, but initially will follow the literature and focus on a second-order polynomial (age and age-squared).

We might here ask what the ideal dataset would be to answer the question what the age–happiness relation is? The ideal is clearly to follow representative individuals throughout their whole life, starting at birth. Such datasets, unfortunately, are rarely available and none of the studies in this literature so far has used that kind of data, which is why this paper too will focus on panels that follow people for a considerable length of time, which is the data we use.

Yet, there are two longitudinal British cohort studies that shed some light on the basic question: (1) the National Child Development Study (NCDS), which followed everyone born in a particular week in 1958 in Britain, and; (2) the British Cohort Study (BC70), which followed everyone born in a week in 1970. Quite importantly, neither of those studies find a U-shape in age (Frijters et al., 2011); mean happiness in the NCDS at ages 33, 42, 46, and 50, is 7.44, 7.30, 7.58, and 7.33; whilst mean happiness in the BC70 at ages 26, 30, and 34, is 7.27, 7.42, and 7.51. If anything, these figures show an increase in happiness as middle age (age 46) approaches, which is the age for which the papers mentioned above find a decrease in happiness.

3. The three panel data sets

3.1. The GSOEP

We use the 1984–2002 waves of the German Socio-Economic Panel (GSOEP, 2008), a representative 18-year panel of the German population. The first wave (1980) included only the Federal Republic of Germany; it has included the former East Germany since 1990. We use only the information on West Germany in order to be able to abstract from the importance of the 1990 German reunification, which had a tremendous impact on the lives and satisfaction levels of East Germans (Frijters et al., 2004). The GSOEP currently tracks about 20,000 individuals and 12,000 households. See Wunder et al. (2009) for a detailed description of the data and summary statistics.

Life satisfaction is derived from the (scaled 0–10) answers to the question *How satisfied are you with your life, all things considered?*

3.2. The HILDA

The second data set we use are waves 2–8 from the 'Household, Income and Labour Dynamics in Australia' (HILDA) Survey.[2] This annual household-based panel survey began in 2001 (HILDA, 2008) and includes about 13,000 individuals and 7000 households. See Watson and Wooden (2010) for further descriptions.

Life satisfaction is derived from the (scaled 0–10) answers to the question *All things considered', how satisfied are you with your life?*'.

3.3. The British (BHPS) data

We use waves 6–10 and waves 12–18 of the British Household Panel Survey[3] (BHPS). It began in 1991 and contains about 10,000 households and 2500 individuals (BHPS, 2010). Life satisfaction is derived from the (scaled 1–7) answers to the question, *Which number best describes how satisfied or dissatisfied you are with your life as a whole?* Appendix A provides summary statistics for all three datasets.

4. Is there a U-shape in the raw data?

For all analyses that follow the full regression tables are shown in Appendix B, but we tell the story using graphs and summary tables in the main text. We experimented using both simple least squares (which is the dominant method in the literature) and latent-variable analyses (for cross-sectional as well as fixed-effects analyses) but we found, as in Ferrer-i-Carbonell and Frijters (2004), that there is no qualitative difference, so we choose to present the least squares results here whilst having the latent-variable results available on request.

[2] The questionnaire for wave 1 of the HILDA panel survey did not include several important variables often used in happiness regressions (life events).

[3] The BHPS Waves 1–5 and 11 did not include the happiness question.

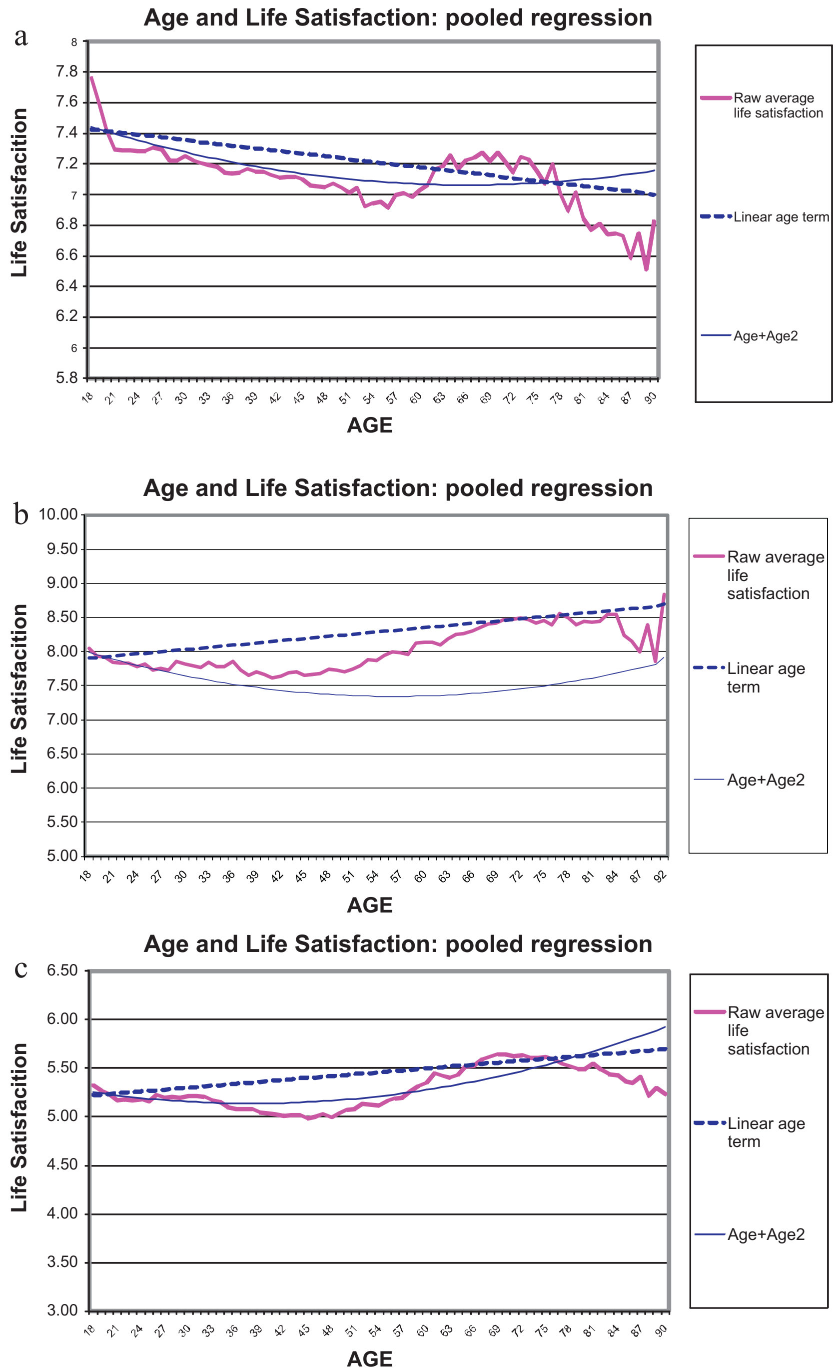

Fig. 1. (a) Average life satisfaction by age in the GSOEP for the pooled sample. (b) Life satisfaction in the HILDA for the pooled sample. (c) Life satisfaction in the BHPS for the pooled sample.

We begin by showing a picture of the raw pooled cross-sectional relationship between age and aggregate happiness for each three datasets, with the predicted lines overlaid for least-squared regressions that include either just age or age and age-squared (Fig. 1a–c). The shown intercepts are normalised such that satisfaction at age 20 is always the same.[4]

[4] Thus, the thin curved lines depict $\{Life\ Satisfaction_{(age\ 20)} + (\beta_{age} \times (age - 20)) + (\beta_{age\ 2} \times (age^2 - 20^2))\}$ where age runs from 18 to 92 in the GSOEP, 18 to 92 in the HILDA and 18 to 90 in the BHPS.

Whether the raw data relation shows a U-shape or not is somewhat a matter of opinion. The main relation in the GSOEP appears less to be a minimum at middle age with maximums at early and late age, but rather an almost continuous decline by age. As a result, the prediction line with just age is strongly negative, and the prediction line with age and age-squared has a minimum quite late (age about 70). The HILDA shows arguably the 'cleanest' U-shape with a predicted minimum at age 36 and no clear happiness decrease in old age. Indeed, the linear happiness profile is quite strongly increasing by age, counter to the general profile in the GSOEP. The BHPS has a minimum at age 38 but the raw profile has, like the GSOEP, a clear reduction at higher ages that visually conflicts with a U-shape.

In summary, the raw data is conflicted about whether there is a U-shape or not. A 'wave' is perhaps a more accurate description for both the GSOEP and the BHPS (and indeed Wunder et al., 2009, using higher order polynomials and splines, finds a wave for the GSOEP). The basic profiles also show where some of the statements in the psychological literature come from. The reduction in happiness at old age for Germany and Britain is for instance in line with the postulate of Dear et al. (2002) that the elderly are less frequently very happy. Explaining this raw data is part of the objective of this paper.

4.1. The importance of additional variables

What if we add additional regressors to these simple specifications, akin to the norm in the literature reviewed in Tables 1a and 1b? Again, the full tables are in Appendix B. Fig. 2a–c shows the predicted age–happiness profiles when we successively add additional variables. What is termed the 'usual suspects' are the variables income, gender, education, number of children, marriage, employment, non-participant, and unemployed. What is termed 'usual suspects + health' adds self-reported health and indicators of wealth (regional income, assets, imputed rent). What is termed the 'kitchen sink' corresponds to the fuller specifications found in the literature by adding available life-events (divorce, death in the family, promotion, being fired, marriage in a year, pregnancy, etc.).[5]

Fig. 2a shows that adding the 'Usual suspects' yields a dramatic deepening of the U-shape, with the predicted happiness decline from 18 to 50 year old being about 0.63 for Germany, whereas it was only a predicted 0.34 in the prediction line in Fig. 1a. Including health and wealth makes virtually no difference. When we include a large set of indicators of life events, 'Kitchen sink', (including the loss of a spouse, being fired, and birth of a child), the age at which the minimum occurs is the youngest yet, i.e. age 50, but the decline in happiness from age 18 to 50 is still 0.47.

If we turn to the HILDA results in Fig. 2b, we also find that adding regressors significantly deepens the predicted U-shape. The predicted decline in happiness from age 18 to the minimum point (which is 42 with the 'Usual suspects') equals 0.37, whereas it was only 0.15 in the predicted line in Fig. 1b. The 'upswing' from the minimum to the highest age point increases to 1.8, up from 0.77. Hence, even though the U-shape is slightly less pronounced as result of including regressors than it is in the GSOEP, there is a marked increase in profile.

For the BHPS results in Fig. 2c, we again find that adding regressors significantly deepens the predicted U-shape. The predicted decline in happiness from age 18 to the minimum point (which is 44 with the 'Usual suspects) equals 0.42, whereas it was only 0.10 in the predicted line in Fig. 1b. The 'upswing' from the minimum to the highest age point increases to 1.34, up from 1.4. Again, the profile is slightly less strong when adding health and the 'Kitchen sink'. Yet, the change in the direction of a clear U-shape is actually strongest in the BHPS, in that it experiences the greatest relative change between the downswing after adding further controls.

We can also address the question statistically by comparing the coefficient on age-square between the raw specification (just age and age-square) and the specifications with the usual suspects. In all three datasets, the coefficient on age-square increases significantly at the 1 percent level.[6] Summarising, a strong U-shape pattern emerges in all three datasets when adding controls usually included in the economic happiness literature, particularly in the GSOEP and in the BHPS, but less so in the HILDA where the raw data is most supportive of a U-shape.

5. Explanations

5.1. The relation is due to the very young and the very old

A naive first-thought is that there is a particular issue with the early ages, i.e. age 18–22, and with high ages, i.e. those above 80. This is because the happiness decline is particularly steep for the early years and one may worry about the selectivity of those who are still alive at very high ages; they could be much happier or much less happy than others. This makes one wonder if the young are being overly optimistic about their actual levels of happiness and that the happiness of the very old is hard to tell from the selective data points in that range. To examine this possibility, Fig. 3a–c look only at the 22–80 age range, including overlaid regression lines with the regression results in Appendix B.

[5] Though there is some degree of collinearity between the different events, there are a sufficiently large number of separate events to identify the separate effects. For the HILDA for instance, there are 2083 cases of individuals becoming unemployed, 3831 cases of pregnancy, 507 cases of divorce, and 2968 cases of separation. The descriptive statistics in Table A1 in Appendix A gives the sample averages of these variables.

[6] In the GSOEP, the coefficient increases from 0.00016 to 0.00049, which is an increase significant at the 0.1 percent confidence levels. In the HILDA, the coefficient increases from 0.00044 to 0.00066, which is an increase significant at the 0.1 percent confidence levels. In the BHPS, the coefficient increases from 0.00029 to 0.00063, which is an increase again significant at the 0.1 percent confidence levels.

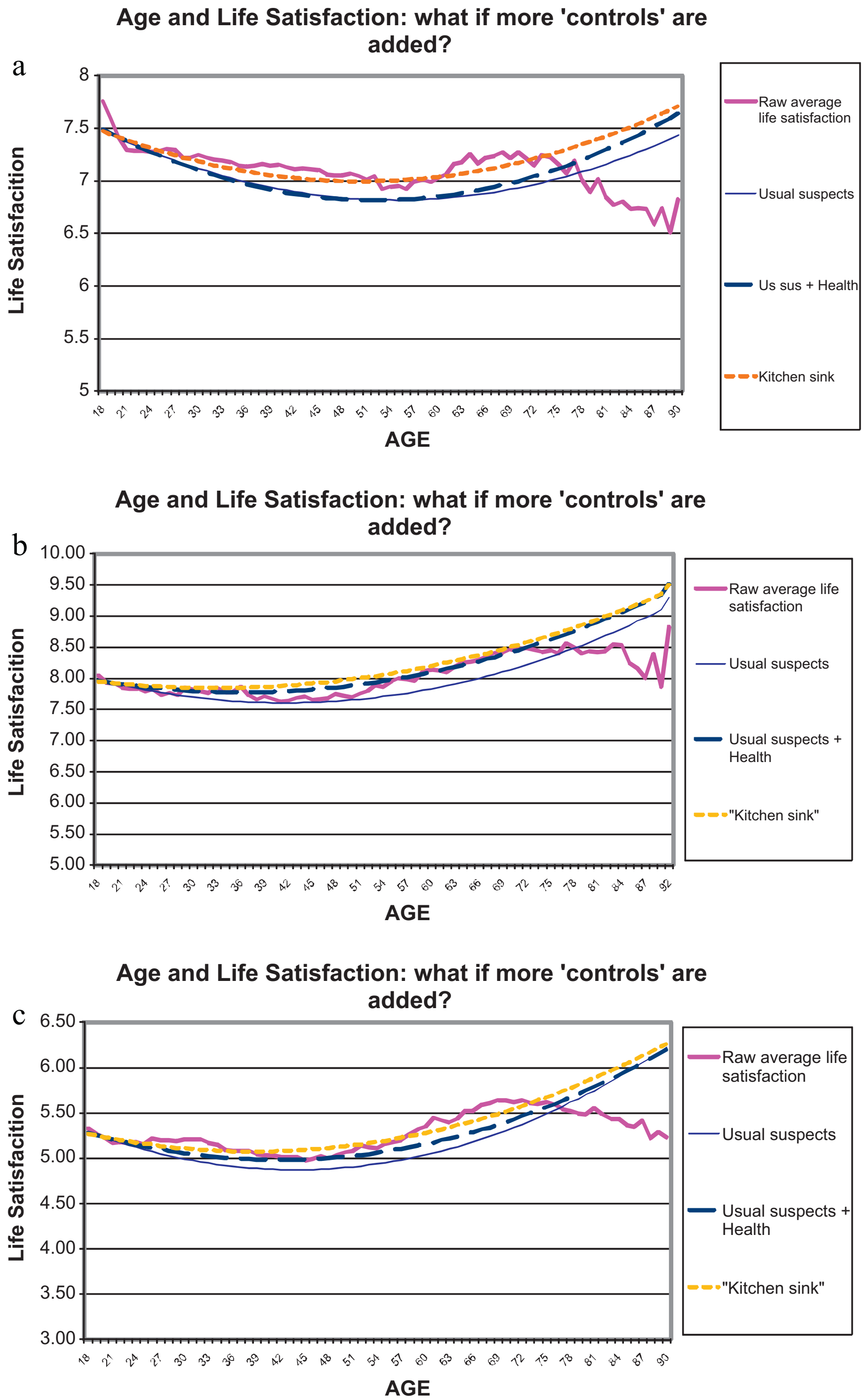

Fig. 2. (a) Life satisfaction in the GSOEP for the pooled sample with added controls. (b) Life satisfaction in the HILDA for the pooled sample with added controls. (c) Life satisfaction in the BHPS for the pooled sample with added controls.

If we compare Fig. 3a to Fig. 2a there is almost no change in the profile of the ‘usual suspect’ prediction line for Germany. The drop from the lowest age to the minimum is now 0.58 in Fig. 3a compared to 0.66 in Fig. 2a, still up from 0.34 in Fig. 1a. The U-shape has hence slightly weakened, but only marginally (the coefficient on age-squared only reduced by 10 percent).

For the HILDA, Fig. 3b shows a slightly stronger U-shape than before. The age-square coefficient underlying the ‘usual suspect’ lines in Figs. 3b and 2b increased by almost 30 percent, as did the down-swing from the happiness level at the lowest age to the minimum level of predicted happiness.

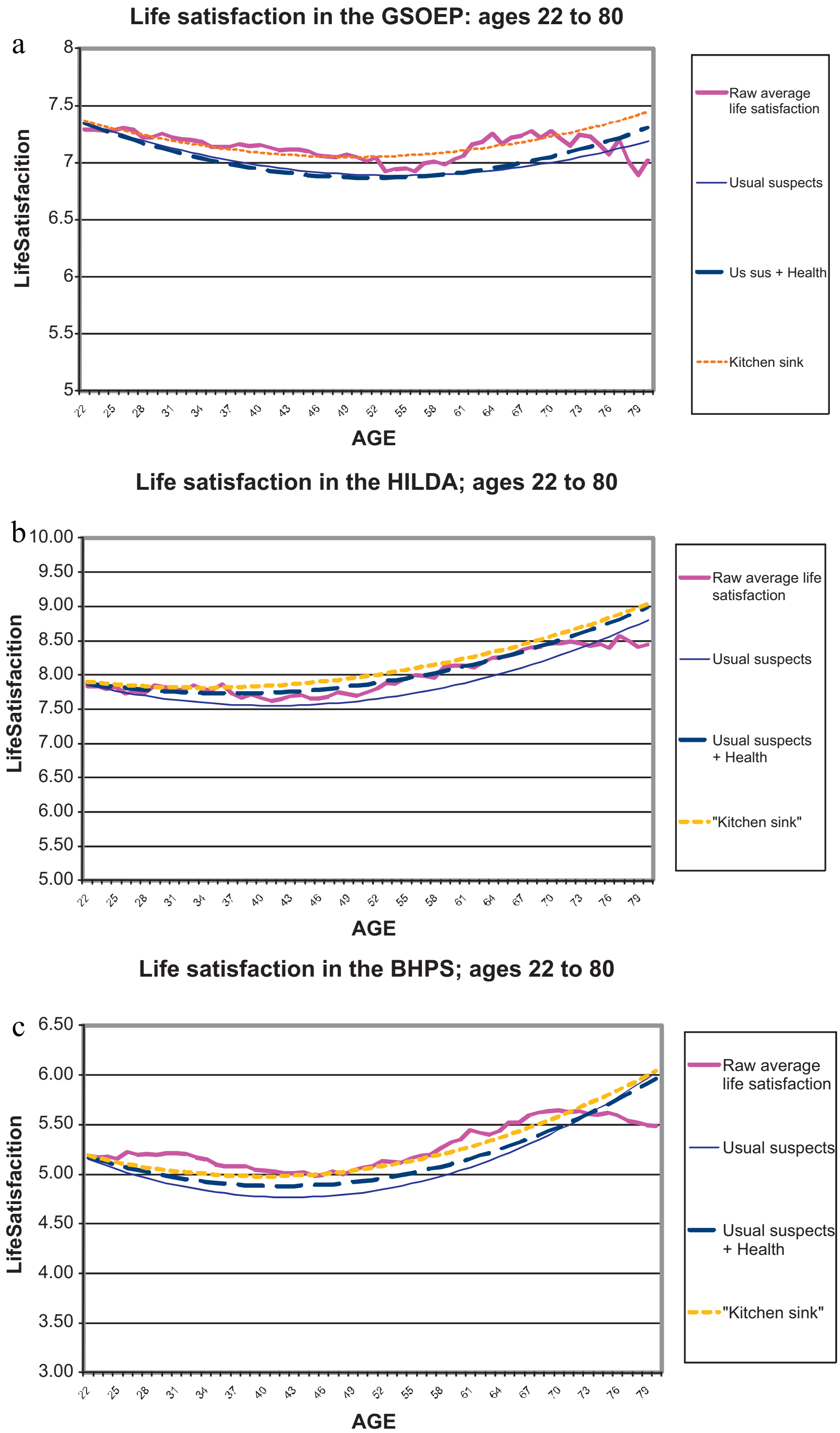

Fig. 3. (a) Life satisfaction in the GSOEP for the pooled sample for the mid-age range. (b) Life satisfaction in the HILDA for the pooled sample for the mid-age range. (c) Life satisfaction in the BHPS for the pooled sample for the mid-age range.

For the BHPS, the increase in the U-shape profile is the most pronounced, with the relevant coefficient underlying the 'usual suspect' lines in Figs. 3c and 2c increasing by 50 percent. The concomitant predicted downswings and upswings are also more pronounced than before.

We can thus conclude that the U-shape is certainly not an artefact of including the very young and the very old. If anything, including the very young and old reduced the U-shape for the results for the HILDA and the BHPS whilst it has little effect on the results for the GSOEP.

5.2. Selectivity matters

An important finding in the literature so far is that happiness is strongly affected by stable personality traits (see Argyle et al., 1999; Costa and McCrae, 1980; Diener et al., 1992; Ferrer-i-Carbonell and Frijters, 2004; Frey and Stutzer, 2002; Goldberg, 1990; Sahoo et al., 2005). These fixed individual traits are usually part of the error term. A stylised finding from both the economic and the psychological literature is that accounting for fixed traits has a very strong impact on the coefficients found for socio-economic variables (Clark et al., 2008; Ferrer-i-Carbonell and Frijters, 2004). A leading explanation for this is the possibility of reverse causality arising from unobserved heterogeneity. As Lyubomirsky et al. (2005) argue, the traits that make you happier also make it more likely that you will have a higher income, a job, a partner, better health, greater wealth, and a higher level of education.

Selectivity not only applies to the found effects of other covariates, but can also apply to being in the data set itself. It may well be that only individuals with particular traits are willing to be interviewed in longer panels, and that the proclivity to be in a panel differs for individuals at different ages, i.e. there might be age–happiness selectivity. We first discuss the first problem arising from selectivity and then the second.

How could reverse causality caused by unobserved fixed traits explain something about the U-shape? At first glance, one would think not because fixed personality traits are by design uncorrelated with age. However, personality traits can be correlated with variables that are in turn correlated with age, such as income, a job, a partner, good health and wealth. How would this work? Consider the problem in its simplest form. Suppose for the purposes of this subsection the truth is that the following relationship holds

$$\begin{aligned} &y_{it} = \alpha_1 \times age^2 + x_{it}\beta + f_i + u_{it} \\ &f_i \perp age_{it}^2, \operatorname{cov}(f_i, x_{it}) > 0, \operatorname{cov}(age_{it}, x_{it}) > 0. E[u_{it}|age_{it}, x_{it}, f_i] = 0 \end{aligned}$$

where we have for simplicity subsumed a linear age term into x_{it} and all variables are normalised to have expectation 0 implying there is no constant term either; there are individual fixed traits f_i unrelated to age-squared but related to a composite time-varying socio-economic variable called x_{it}. There is an error term, u_{it}, orthogonal to everything else. What are now the estimated coefficients if we mistakenly run a regression without accounting for fixed-effects? The asymptotic values are,

$$\begin{aligned} &p\lim\widehat{\beta} = \beta + \frac{\operatorname{cov}(f_i, x_{it})}{\operatorname{var}(x_{it})} + (\alpha_1 - p\lim\widehat{\alpha}_1)\frac{\operatorname{cov}(age_{it}^2, x_{it})}{\operatorname{var}(x_{it})} \\ &p\lim\widehat{\alpha}_1 = \alpha_1 + (\beta - p\lim\widehat{\beta})\frac{\operatorname{cov}(x_{it}, age_{it}^2)}{\operatorname{var}(age_{it})} \end{aligned}$$

which shows that even though age_{it}^2 is not correlated with the omitted fixed effect, the coefficient on age_{it}^2 can nevertheless be biased when it is related to included time-varying variables that are correlated with the omitted fixed-effect. The equations become rather elaborate if we add a linear age term and a constant but the basic principle remains that a bias in the age-term can occur if the added variables are correlated with age and with the omitted fixed-effect.

Intuitively, there are two steps in the possible emergence of the bias. The first is that, as shown just above, the inclusion of fixed effects will change the coefficients of the non-age variables x_{it}. The second is that x_{it} itself changes systematically with age-squared, which leads to a bias in the estimated coefficient of age-squared.

To explore this possibility we run fixed-effect analyses on the three datasets, with the full regression results in Appendix B. Fig. 4a–c shows the predicted age-profiles for all three datasets.

The results for Fig. 4a–c are both confirming and surprising. The graphs show the raw relationship between age and happiness and three overlaid lines. The U-shaped line is the same one seen previously in Fig. 2a–c and is the pooled regression on the entire age range with the preferred specification including health and wealth. Overlaid are two lines from fixed-effect regressions. The thick dark dashed line is the result of running the same regression as for the pooled regression but including fixed effects. The third thin solid line shows the result of just running a fixed effect regression with only age and age-squared as regressors.

As one can see in Fig. 4a, the predicted U-shape apparent previously completely disappears, i.e. the age-squared coefficient becomes tiny and insignificant. Indeed, the age-squared coefficient has become significantly negative (Appendix B). It, however, replaces the U-shape by a similarly puzzling effect, which is a very strongly significant negative linear relationship. The third thin solid line, which shows the result of just running a fixed effect regression with only age and age-squared as regressors, confirms this. The U-shape reverses into an inverted U shape.

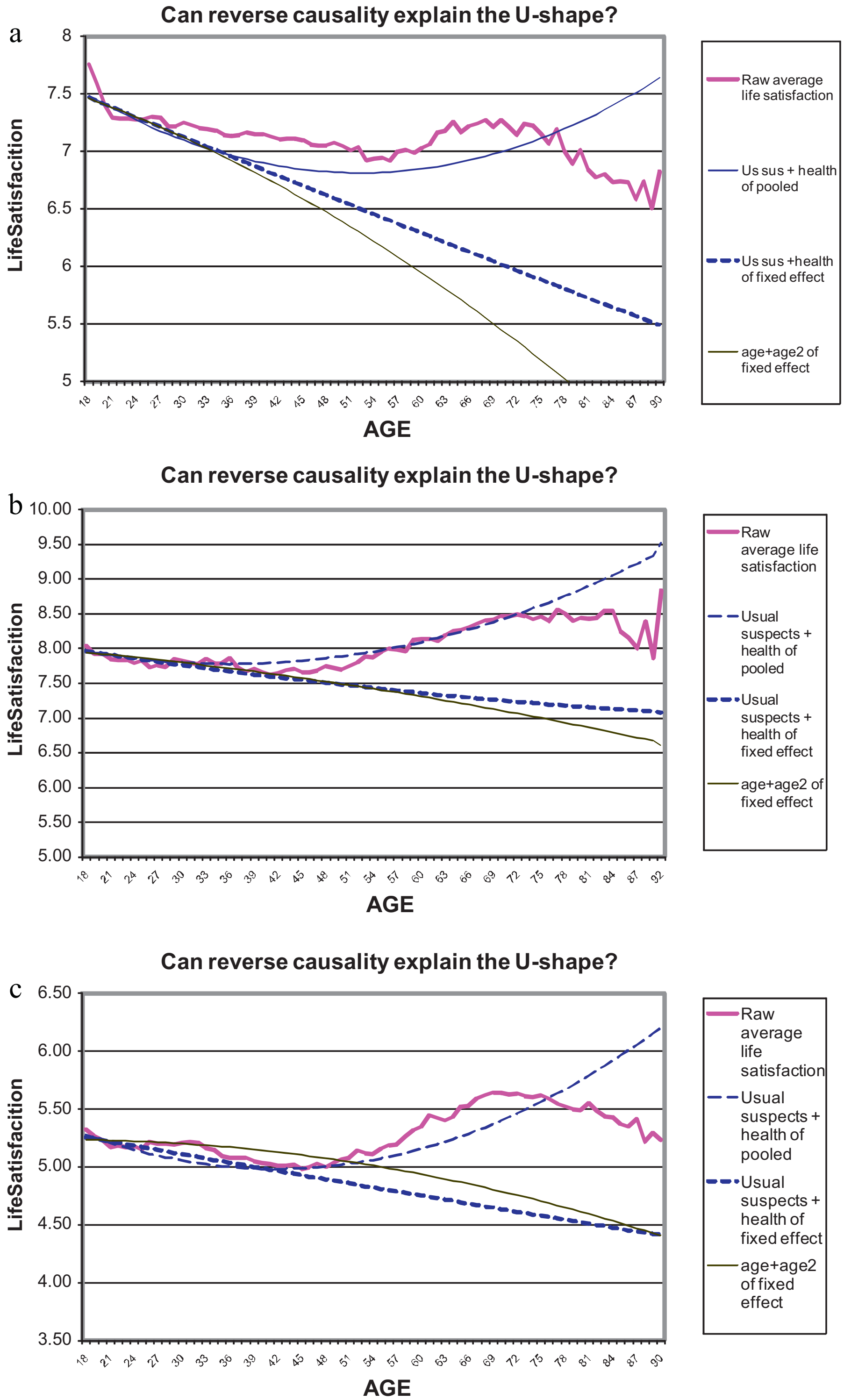

Fig. 4. (a) Life satisfaction in the GSOEP for the balanced panel including fixed-effects. (b) Life satisfaction in the HILDA for the balanced panel including fixed-effects. (c) Life satisfaction in the BHPS for the balanced panel including fixed-effects.

Table 2
Coefficients on the key 5 variables (pooled and fixed effects) for the three data sets.

Specification	OLS						OLS with fixed effects					
	GSOEP		HILDA		BHPS		GSOEP		HILDA		BHPS	
	Coefficient	*t*-Value	Coefficient	*t*-Value	Coefficient	*t*-Value	Coefficient	*t*-Value	Coefficient	*t*-Value	Coefficient	*t*-Value
Age + Age^2												
Age	−0.0217**	15.69	−0.0320**	19.0	−0.0221**	21.96	−0.0166**	6.60	−0.0076	1.02	0.0044**	1.42
Age × age	0.00016**	11.63	0.0004**	25.8	0.0003**	29.00	−0.0003**	9.71	−0.0001+	1.30	−0.0001**	4.61
Usual suspects												
Age	−0.0541**	32.80	−0.0554**	29.6	−0.0554**	49.28	−0.00328**	11.61	−0.0173*	2.12	−0.0064+	1.88
Age × age	0.0005**	29.20	0.0007**	34.0	0.0006**	55.15	−0.0001**	2.22	0.00001	0.17	−0.0001+	1.75
Income	0.4619**	52.2	0.0805**	15.00	0.0943**	19.44	0.2414**	23.13	0.0257**	4.26	0.0164**	2.64
Employed	0.0650**	4.8	0.1355**	9.27	0.2397**	27.19	0.0991**	6.69	0.0536**	2.33	0.0618**	4.63
Married	0.3106**	27.9	0.4429**	36.20	−0.0033*	2.27	0.2385**	14.95	0.2056**	6.76	0.3567**	46.48
Usual suspect + healths												
Age	−0.0600**	36.77	−0.0403**	22.7	−0.0438**	41.01	−0.0298**	9.95	−0.0202**	2.50	−0.0127**	3.86
Age × age	0.0006**	34.13	0.0006**	30.3	0.0005**	48.21	0.00006	0.74	0.00007	0.94	0.00008	0.27
Income	0.4420**	45.91	0.0329**	4.77	0.0399**	5.47	0.2750**	23.67	0.0191**	3.22	0.0166**	2.7
Employed	0.0791**	7.60	−0.1338**	9.20	0.0295*	2.02	0.1001**	6.75	−0.0238	1.06	0.0355**	2.77
Married	0.2915**	26.50	0.3624**	30.32	−0.3063**	41.48	0.2457**	15.42	0.1963**	6.52	0.1390**	8.47
Kitchen sink												
Age	−0.0454**	25.64	−0.0311**	16.0	−0.0350**	31.02	−0.0184**	5.81	−0.0033	0.40	−0.0082**	2.49
Age × age	0.0005**	25.39	0.0005**	24.0	0.0005**	39.43	−0.00002**	2.40	−0.00006	0.72	0.000008	0.31
Income	0.4307**	44.53	0.0309**	5.69	0.0251**	5.25	0.2585**	22.15	0.0151**	2.55	0.0060	0.98
Employed	0.0688**	5.11	−0.1166**	8.00	0.0372**	4.38	0.0925**	6.24	0.0394+	1.75	0.0365**	2.86
Married	0.1180**	7.65	0.2514**	14.85	−0.0195**	14.27	0.0327+	1.37	−0.1095**	2.84	0.2014**	22.43
N=	176,770		75,529		153,886		176,770		75,529		153,886	

Level of significance:
+ $p < 0.1$.
* $p < 0.05$.
** $p < 0.01$.

What goes for the GSOEP goes for the HILDA in Fig. 4b: the fixed-effect 'usual suspect + health' prediction line no longer resembles a U-shape but becomes a linear decline. As with the GSOEP, the significantly positive coefficients on age-squared of Figs. 1–3 revert into a negative coefficient (significant for the specification with other covariates). The age-squared coefficient has a small standard error such that we can reject the hypothesis that it equals the coefficient without fixed effects with high levels of significance (0.1 percent). The pattern is repeated for the BHPS; when including fixed-effects the U-shape disappears and a simple linear decline emerges, though for the BHPS the age-square coefficients are insignificant.[7]

5.3. How does the unobserved heterogeneity bias the pooled results?

The first mechanism hypothesised in the previous sub-section was that fixed traits lead to a reverse causality between variables and life-satisfaction (i.e. people have high incomes and get married partially because they have high levels of happiness). The biases in the coefficients of these reverse causality variables would then lead to a bias in the age profile because those variables change systematically with age. Here we look at whether we can confirm whether those mechanisms are visible in the data.

There are two separate steps in the emergence of a bias in the age-coefficients that we can look at. The first is simply whether the coefficients of other variables changes when fixed-effects are included. Table 2 below summarises the estimates of particular coefficients when one includes fixed-effects and when one does not. The variables we show are the ones often used in economic research: employment, unemployment, marriage, income, and education. These are also the most significant variables in the 'usual suspects' category.

From Table 2 we can indeed see large changes in coefficients for all three datasets when including fixed-effects. For income, the coefficient drops 37 percent in the GSOEP (0.28 in fixed-effects compared to 0.44 in the pooled regressions), 40 percent in the HILDA and 58 percent in the BHPS. For marriage, the coefficient drops 16 percent in the GSOEP (0.25 in fixed-effects compared to 0.29 in the pooled regressions), 32 percent in the HILDA and 55 percent in the BHPS. Interestingly, the absolute coefficients of all these 5 variables reduce in all three datasets when including fixed effects. There is a clear change in the coefficients of variables from pooled to fixed-effects.

The second step is to see if the changes in the coefficients of these non-age variables lead to a difference in the predicted age-profile. The clearest way to see if this happens is to show the predicted effect of all non-age variables in the pooled regressions versus the fixed-effects regressions. Hence, in Fig. 5a–c we show, for all three datasets, two prediction lines. The

[7] The increases in the age-square coefficients between the specifications with and without age-squared are significant at the 0.1 percent level for all three datasets. See Appendix B.

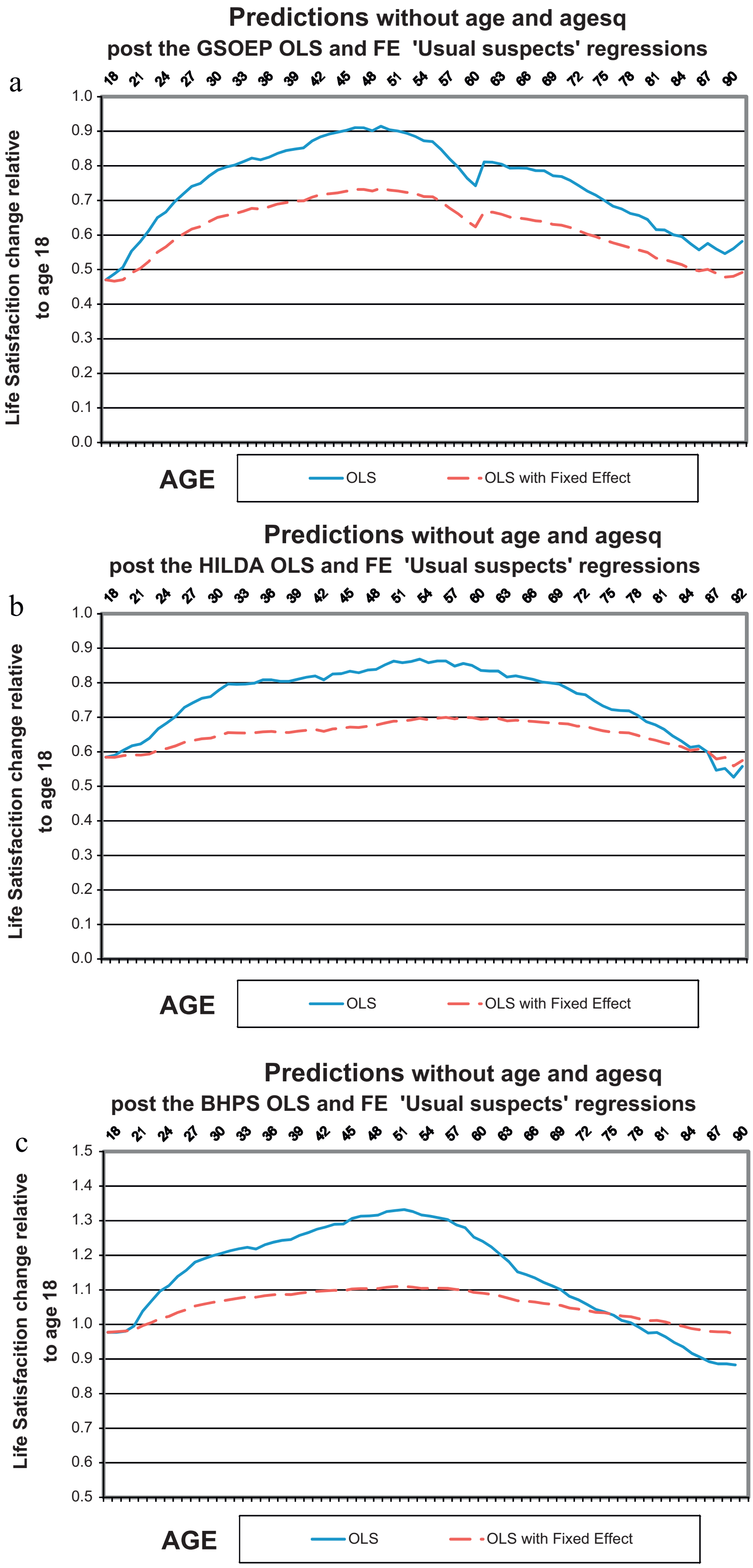

Fig. 5. (a) Predicted happiness effects of the non-age variables in the GSOEP. (b) Predicted happiness effects of the non-age variables in the HILDA. (c) Predicted happiness effects of the non-age variables in the BHPS.

first is from the 'usual suspects' regressions that do not include fixed effects (column 3 of Table B1, Table B4, and Table B7 in the Appendix), and the second from the 'usual suspects' regressions that do include fixed effects (column 3 of Table B3, Table B6, and Table B9 in the Appendix). In all cases, we let the prediction lines start at the same point at age 18 to aid the interpretation.[8]

Looking at the results for the GSOEP in Fig. 5a first, the main thing to note is that the predicted OLS line looks very much like an inverted U-shape: the increase from age 18 to the top at age 48 is about 0.32 and the subsequent decrease to age 80 is about 0.9. Since the regression coefficients of age- and age-square essentially try to fit the actual age-profiles conditional on this predicted effect from the non-age variables, this inverted U-shape forces a finding of a U-shape in the age coefficients. When including fixed-effects one can see that the inverted U-shape is much less pronounced (though not entirely gone): the increase from age 18 to the top is about 0.22 and the subsequent decrease is 0.54. This reduction in the predicted inverted U-shape from the non-age variables in turn will lead to a reduction in the U-shape found for age when including fixed-effects.

Qualitatively, the same results appear for the HILDA in Fig. 5b: the reduction in the predicted happiness contribution of the non-age variables from the top to age 90 is 0.5 with the pooled regression results and only 0.35 with the fixed-effects. The results from the BHPS in Fig. 5c look very close to those of the GSOEP: the inverted U-shape of the happiness contribution of the non-age variables is much stronger without fixed-effects than with fixed-effects. Both the upswing and the downswing are more pronounced.

Summarising, we can indeed see that the inclusion of fixed-effects reduces the coefficients of variables that themselves systematically vary by age (incomes and marriage peak in middle age) and that this in turn reduces the predicted inverted U-profile of their effects.

6. The actual age–happiness relationship

In order to arrive at a consolidated model of the age–happiness relation, we must allow for a more flexible age-profile, age-specific selectivity, and panel-dependent response profile than hitherto. We wish to answer two questions[9]:

1. How does raw happiness vary over the life cycle for a given individual with a given level of initial happiness?
2. What is the potential causal impact of age on happiness ceteris paribus?

Our preferred models to elucidate these two questions in the age-effect on happiness are

$$LS_{it} = \alpha + f_i + \gamma\tau_{it} + g(age_{it}) + \varepsilon_{it}$$
$$LS_{it} = \alpha + X_{it}\beta_1 + f_i + g(age_{it}) + \gamma\tau_{it} + \varepsilon_{it}$$

Here, τ_{it} is the time spent in the panel, whose importance is that it allows for the possibility that individuals who are in a panel many years become more honest about their actual level of happiness (this was already argued in the 2008 working paper of this paper, as well as in Kassenboehmer and Haisken-DeNew, 2011). This is an important panel-answering effect that we want to take out when considering the 'raw' age–happiness relation. This effect is essentially identified by using the fact that not all respondents are in the panel every year but drop in and out, for instance because they cannot be found every year.

Also, $g(age_{it})$ is now a flexible function of age. As the most flexible specification possible, we estimate a step function in narrow 5-year age bands, like Clark (2006), whereby the reference group is those aged above 87 years. By including fixed-effects, f_i, we insure that the resulting profile $g(age_{it})$ holds for an individual over time.

The resulting $g(age_{it})$ of the first equation effectively answers the question how an individual's happiness profile would change over her life from a give point, whereby the fixed-effects correct for the selectivity of individuals in the panel (cf. Inkmann, 2010; Kassenboehmer and Haisken-DeNew, 2011; Wulfgramm, 2011) and we also correct for changes in answering style when people are longer in a panel. The resulting $g(age_{it})$ of the second equation gives us the residual effect of age, Ceteris Paribus all the available time-varying variables in X_{it}.

The results of these preferred specifications are in Table B10, Table B11 and Table B12. Fig. 6a–c shows both the resulting 'corrected raw' age–happiness profile as well as the conditional ('Ceteris Paribus') age–happiness profile, starting from a happiness level of 7 at age 18.

The solid line shows the raw-relationship corrected for selectivity and panel-answering effects. We see a quite large difference between this raw-relationship and the one shown in Fig. 1. The profile we now find in Fig. 6b and c for the HILDA and the BHPS is a 'late wave': no changes in happiness from the age 18 to around 55, then a large increase until around 67, with a very large drop-off after age 75; essentially looking like a slanted wave, with no U-shape but a very pronounced high-age decline. The profile for the GSOEP shows less of an increase after 55 and more of a decrease between 18 and 25, but the dominant age-related phenomenon is again the drop at very old age.

[8] The model is $Life\ \ Satisfaction = \beta_{age} \times age + \beta_{age2} \times age^2 + x'_{it}\beta_x + e_{it}$ where e_{it} is the error term that either includes fixed-effects or not. The prediction lines shows the average over i of $x'_{it}\beta_x$ by age which uses the fact that x_{it} changes by age.

[9] We are grateful to an anonymous referee for clarifying the importance of these two questions.

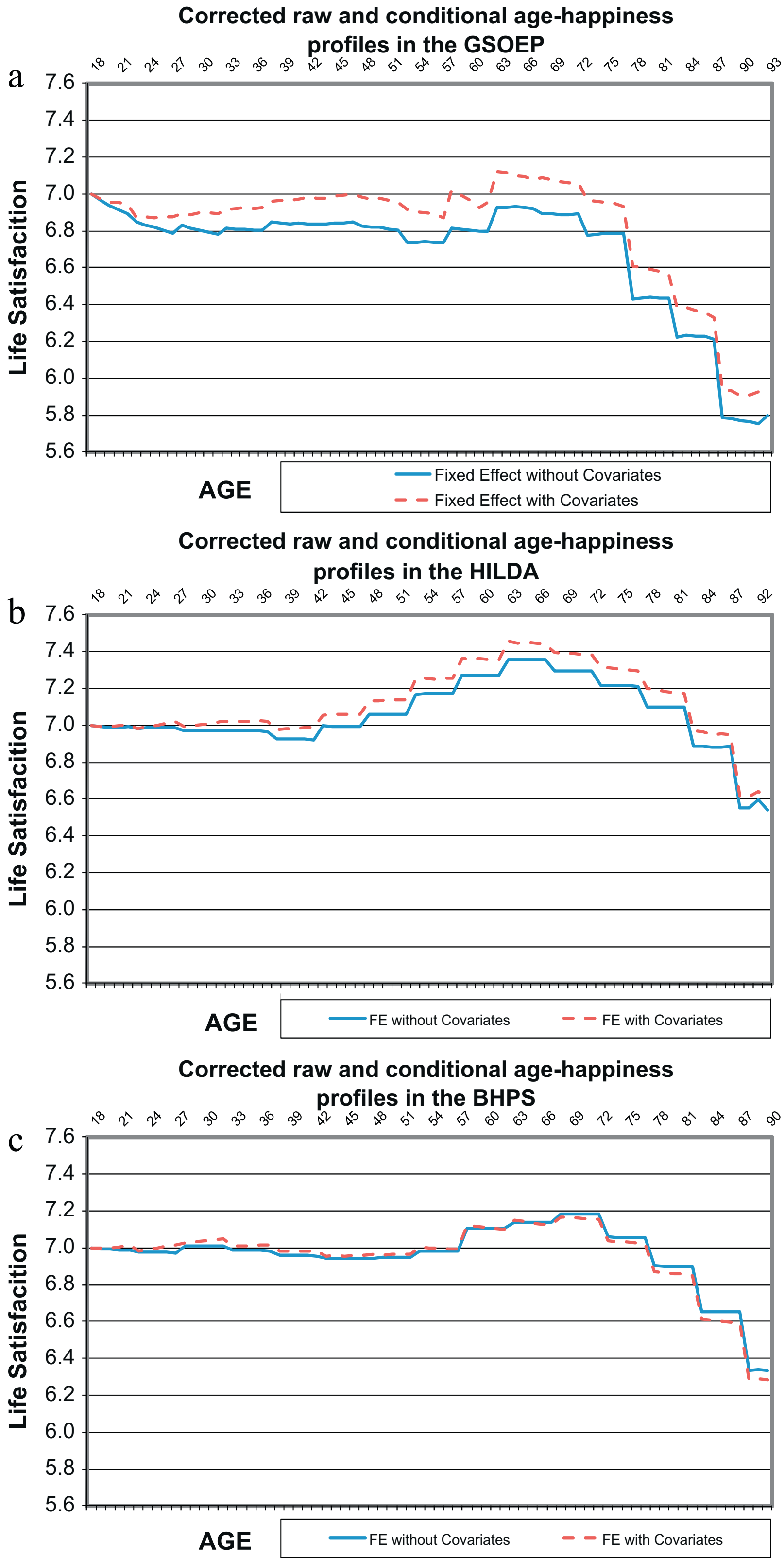

Fig. 6. (a) Corrected age–happiness effect in the GSOEP using age-bands. (b) Corrected age–happiness effect in the HILDA using age-bands. (c) Corrected age–happiness effect in the BHPS using age-bands.

Why does this profile differ from the uncorrected profile in Fig. 1? The difference comes from two major factors. Firstly, the selectivity effect that is accounted for by including fixed-effects dramatically increased the steepening of the happiness decline after age 75, and reduced the age-decline between ages 20 and 40. This means that the older individuals in the panel are happier than others of the same age and individuals of middle age in the panel are less happy than those of the same age. Intuitively, this effect is identified by comparisons between individuals who started out middle-aged or very old in the panel with individuals reaching those ages as they became older in the panel. The second major factor is the large time-in-panel effect, which is quite significant and negative in the GSOEP and tilts the whole age–happiness relationship found when pooling all the observations downwards (as was done in Fig. 1a). Intuitively, this bias is identified by comparing individuals of the same age who have only been in the panel for a short whilst with those who have been in there a long time. Accounting for this bias reduced the raw happiness reduction in middle age. We see that including other covariates makes very little difference to the corrected raw relationship and that the previous findings in the literature are hence driven by not accounting for selectivity and time-in-panel effects.

What can explain the residual age–happiness effects? By design, the effect has to come from variables not included in the regressions. Our preferred interpretation is that happiness shows a large increase around age 60 due to the reduced high-expectations at that age and the lower levels of stress (as in Beatton and Frijters, 2009). The steep decline after age 75 is probably due to declines in health not captured with our variables. The story of age and happiness thus changes from a story about middle-age declines in happiness to a large crest of high happiness around 67.

7. Robustness analyses

We here briefly mention the robustness analyses we ran. We redid everything with latent-variable techniques rather than linear regressions. To this end we used ordered logits as a cross-sectional model and the recent BUC estimator from Baetschmann et al. (2011), which is a fixed-effect conditional logit estimator. The results are in Appendix C, Table C1, Table C2, Table C3. As in the main text above, the highly significant and positive effect on age-squared found in the cross-section disappeared with the inclusion of fixed-effects. Further robustness analysis varied the treatment of the included health variable. Instead of including self-reported health as a continuous variable, we included each of the 5 possible health states (from very bad to very good) as separate dummy variables (as recommended by Terza, 1987). The results are in Appendix C, Table C1, Table C2, Table C3. Again, this made almost no difference to the age-squared effects.

8. Conclusions and discussion

This paper started out with the puzzling findings of other researchers of a U-shaped relationship between age and happiness. We replicated this relationship for Germany, Australia, and Britain using well-known panel datasets, the GSOEP, the HILDA, and the BHPS. In all three cases, the age–happiness profile became a much clearer U-shape when adding commonly used socio-economic variables. This emergence of the U-shape was not dependent on the inclusion of individuals aged 18–22 or those above 80.

The first main finding was that the U-shape using conventional regressions disappeared when using fixed-effects because of a reverse causality issue: happiness-increasing variables, like getting a job, a high income, and getting married, appear to happen mostly to middle-aged individuals who were already happy. In all three data sets, this reverse causality shows up in cross-sections as inflated coefficients for income, marriage, and getting a job. In order to fit the actual age profile of happiness, the bias in coefficients for socio-economic variables forces the predicted age profile to become U-shaped. When one controls for fixed-effects, the non-linearity all but disappears for all three data sets.

The second main finding was that once one corrects the basic age–happiness profile in the raw data for the twin problems of age-related selectivity and increased honesty-in-reporting for individuals who are in a panel for many years, the age–happiness relationship bears no resemblance to a U-shape, but looks like a ‘late wave’. Relative to 20-year olds, there is not much change in happiness until around 55 after which happiness starts to increase, peaking around 67, with a quite sharp decline around the age of 75. One possible explanation for this is that life becomes stress-free around age 60 and that there are strong health deteriorations after 75.

The study finds that selectivity matters in two quite distinct ways: allowing for selectivity changes the found effects of other covariates because these other covariates change both by age and are dependent on happiness. Put simply: happiness-increasing things seem to happen in mid-life to individuals already somewhat happier. The second important selectivity effect is that individuals included in the panel are not random. Very old respondents in the panel are particularly happy and the middle-age respondents are particularly unhappy. This makes sense from a data-gathering point of view, because the most unhappy very old individuals are harder to interview (because they are quite likely very frail) and the happier middle-aged individuals are less likely to want to be in the panel (too busy). Finally, it is important to stress that the resulting lack of a happiness decline in middle age, once one allows for selectivity, is consistent with what is found from the few cohort studies that followed individuals for 50 years and in which there was also no marked decline in happiness in middle age.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.jebo.2012.03.008.

References

Alesina, A., Di Tella, R., MacCulloch, R., 2004. Inequality and happiness: are Europeans and Americans different? Journal of Public Economics 88 (9–10), 2009–2042.

Argyle, M., Kahneman, D., Diener, E., Schwarz, N., 1999. Causes and correlates of happiness. In: Well-Being: The Foundations of Hedonic Psychology. Russell Sage Foundation, New York, NY, USA, pp. 353–373.

Baetschmann, G., Staub, K.E., Winkelmann, R., 2011. Consistent Estimation of the Fixed Effects Ordered Logit Model. The Institute for the Study of Labor (IZA).

Beatton, T., Frijters, P., 2009. Do Changes in the Lives of Our Peers Make Us Unhappy? Working Paper Series. Queensland University of Technology, Brisbane, Australia.

Bell, D., Blanchflower, D.G., 2007. The Scots may be brave but they are neither healthy nor happy. Scottish Journal of Political Economy 54 (2), 166–194 (Article).

BHPS, 2010. British Household Panel Survey. Institute for Social & Economic Research, University of Essex.

Blanchflower, D.G., 2008. International Evidence on Well-Being. National Bureau of Economic Research.

Blanchflower, D.G., Oswald, A.J., 2001. Well-Being Over Time in Britain and the USA. University of Warwick, Department of Economics, The Warwick Economics Research Paper Series (TWERPS).

Blanchflower, D.G., Oswald, A.J., 2004. Well-being over time in Britain and the USA. Journal of Public Economics 88 (7/8), 1359 (Article).

Blanchflower, D.G., Oswald, A.J., 2007. Is Well-being U-Shaped Over the Life Cycle? University of Warwick, Department of Economics, The Warwick Economics Research Paper Series (TWERPS), 36 pp.

Blanchflower, D.G., Oswald, A.J., 2008. Hypertension and happiness across nations. Journal of Health Economics 27, 218–233.

Blanchflower, D.G., Oswald, A.J., 2009. The U-Shape without Controls. University of Warwick, Department of Economics, The Warwick Economics Research Paper Series (TWERPS).

Cantril, H., 1965. The Pattern of Human Concerns. Rutgers University Press, New Brunswick, NJ.

Clark, A.E., 2006. Born To Be Mild? Cohort Effects Don't Explain Why Well-Being is U-shaped in Age (vol. Working Paper N° 2006-35). Centre National de la Recherche Scientifique – École des Hautes Études en Sciences Sociales, École Nationale des Ponts et Chaussees – École Normale Superiure.

Clark, A.E., Frijters, P., Shields, M.A., 2008. Relative income, happiness, and utility: an explanation for the Easterlin paradox and other puzzles. Journal of Economic Literature 46 (1), 95–144.

Clark, A.E., Oswald, A.J., 1994. Unhappiness an unemployment. Economic Journal 104 (424), 648–659 (Article).

Costa, P.T., McCrae, R.R., 1980. Influence of extraversion and neuroticism on subjective well-being: happy and unhappy people. Journal of Personality and Social Psychology 38 (4), 668–678.

Dear, K., Henderson, S., Korten, A., 2002. Well-being in Australia. Social Psychiatry and Psychiatric Epidemiology 37 (11), 503–509.

Diener, E., Sandvik, E., Pavot, W., Fujita, F., 1992. Extraversion and subjective well-being in a U.S. national probability sample. Journal of Research in Personality 26 (3), 205–215.

Di Tella, R., MacCulloch, R.J., Oswald, A.J., 2001. Preferences over inflation and unemployment: evidence from surveys of happiness. American Economic Review 91 (1), 335–341 (Article).

Easterlin, R.A., Schaeffer, C.M., Macunovich, D.J., 1993. Will the baby boomers be less well off than their parents? Income, wealth, and family circumstances over the life cycle in the United States. Population and Development Review 19 (3), 497–522.

Ferrer-i-Carbonell, A., 2005. Income and well-being: an empirical analysis of the comparison income effect. Journal of Public Economics 89 (5–6), 997–1019.

Ferrer-i-Carbonell, A., Frijters, P., 2004. How important is methodology for the estimates of the determinants of happiness? Economic Journal 114 (497), 641–659.

Frey, B.S., Stutzer, A., 2002. What can economists learn from happiness research? Journal of Economic Literature 40 (2), 402–435.

Frijters, P., Johnston, D.W., Shields, M.A., 2011. Destined for (Un)Happiness: Does Childhood Predict Adult Life Satisfaction? Institute for the Study of Labor.

Frijters, P., Haisken-DeNew, J.P., Shields, M., 2004. Money does matter! Evidence from increasing real income and life satisfaction in East Germany following reunification. American Economic Review 94 (3), 730–740 (Article).

Gerdtham, U.-G., Johannesson, M., 2001. The relationship between happiness, health, and social economic factors: results based on Swedish microdata. Journal of Socio-Economics 30 (6), 553–557.

Goldberg, L.R., 1990. An alternative "description of personality", the Big-Five factor structure. Journal of Personality and Social Psychology 59, 1215–1229.

GSOEP, 2008. The German Socio-Economic Panel Study (SOEP). Retrieved December 22, 2008, from SOEP, DIW Berlin, D-10108, Berlin. http://www.diw.de/english/soep/soepoverview/27908.html.

Haisken-DeNew, J.P., Hahn, M., 2006. PanelWhiz: A Flexible Modularized Stata Interface for Accessing Large Scale Panel Data Sets (mimeo).

Hayo, B., Seifert, W., 2003. Subjective economic well-being in Eastern Europe. Journal of Economic Psychology 24 (3), 329 (Article).

Headey, B., Wearing, A., 1989. Personality, life events, and subjective well-being: toward a dynamic equilibrium model. Journal of Personality and Social Psychology 57 (4), 731–739.

Helliwell, J.F., 2003. How's life? Combining individual and national variables to explain subjective well-being. Economic Modelling 20 (2), 331 (Article).

HILDA, 2008. The Household, Income and Labour Dynamics in Australia (HILDA) Survey, Release 6. Retrieved October 6, 2008, from http://www.melbourneinstitute.com/hilda/.

Inkmann, J.A., 2010. Estimating firm size elasticities of product and process R&D. Economica 77 (306), 384–402.

Kassenboehmer, S.C., Haisken-DeNew, J.P., 2011. Heresy or Enlightenment? The Wellbeing Age U-Shape Effect is Really Flat! German Institute for Economic Research (DIW Berlin Deutsches Institut für Wirtschaftsforschung e.V.). Berlin. Retrieved from http://www.diw.de/documents/dokumentenarchiv/17/diw_01.c.83662.de/soep08_full_kassenboehmer_haisken.pdf.

Lyubomirsky, S., King, L., Diener, E., 2005. The benefits of frequent positive affect: does happiness lead to success? Psychological Bulletin 131 (6), 803–855.

Oswald, A.J., 1997. Happiness and economic performance. Economic Journal 107 (445), 1815–1831 (Article).

Oswald, A.J., Powdthavee, N., 2008. Does happiness adapt? A longitudinal study of disability with implications for economists and judges. Journal of Public Economics 92 (5–6), 1061–1077.

Palmore, E., Luikart, C., 1972. Health and social factors related to life satisfaction. Journal of Health and Social Behavior 13 (1), 68–80.

Powdthavee, N., 2003. Unhappiness and Crime: Evidence from South Africa. University of Warwick, Department of Economics, The Warwick Economics Research Paper Series (TWERPS), 36 pp.

Powdthavee, N., 2005. Unhappiness and crime: evidence from South Africa. Economica 72 (3), 531–547.

Sahoo, F.M., Sahoo, K., Harichandan, S., 2005. Five big factors of personality and human happiness. Social Science International 21 (1), 20–28.

Seifert, W., 2003. Subjective economic well-being in Eastern Europe. Journal of Economic Psychology 24 (3), 329–348.

Senik, C., 2004. When information dominates comparison: learning from Russian subjective panel data. Journal of Public Economics 88 (9/10), 2099 (Article).

Terza, J.V., 1987. Estimating linear models with ordinal qualitative regressors. Journal of Econometrics 34 (3), 275–291.

Theodossiou, I., 1998. The effects of low-pay and unemployment on psychological well-being: a logistic regression approach. Journal of Health Economics 17 (1), 85–104 (Article).

Van Landeghem, B.G.M., 2008. Human Well-Being Over the Life Cycle: Longitudinal Evidence from a 20-Year Panel. Katholieke Universiteit Leuven, LICOS Centre for Institutions and Economic.
van Praag, B.M.S., Frijters, P., Ferrer-i-Carbonell, A., 2000. A Structural Model of Well-being: With An Application to German Data, Tinbergen Institute, Tinbergen Institute Discussion Papers: 00-053/3.
Watson, N., Wooden, M., 2010. Data survey: the HILDA survey: progress and future developments. Australian Economic Review 43 (3), 326–336.
Winkelmann, L., Winkelmann, R., 1998. Why are the unemployed so unhappy? Evidence from panel data. Economica 65 (257), 1–15 (Article).
Wolpert, D.H., 2010. Why income comparison is rational. Games and Economic Behavior 69 (2), 458–474.
Wulfgramm, M., 2011. Can activating labour market policy offset the detrimental life satisfaction effect of unemployment? Socio-Economic Review 9 (3), 477–501.
Wunder, C., Wiencierz, A., Schwarze, J., Küchenhoff, H., Kleyer, S., Bleninger, P., 2009. Well-Being Over the Life Span: Semiparametric Evidence from British and German Longitudinal Data. Unpublished Discussion Paper No. 4155. Institute for the Study of Labor.