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Working Paper

Human Well-Being over the Life Cycle: Longitudinal Evidence from a 20-Year Panel

LICOS Discussion Paper, No. 213

Provided in Cooperation with:
LICOS Centre for Institutions and Economic Performance, KU Leuven

Suggested Citation: Van Landeghem, Bert G.M. (2008) : Human Well-Being over the Life Cycle: Longitudinal Evidence from a 20-Year Panel, LICOS Discussion Paper, No. 213, Katholieke Universiteit Leuven, LICOS Centre for Institutions and Economic Performance, Leuven

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LICOS Discussion Paper Series

Discussion Paper 213/2008

Human Well-Being over the Life Cycle: Longitudinal Evidence from a 20-Year Panel

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Human Well-Being over the Life Cycle: Longitudinal Evidence from a 20-Year Panel

Bert G.M. Van Landeghem*

September 3, 2008

Abstract

This paper uses longitudinal data from the German Socioeconomic Panel (GSOEP) to analyze the course of subjective well-being over the life cycle. The paper finds that the U-shaped pattern of life satisfaction over age is less supported in a longitudinal analysis. Moreover, assets and material well-being seem to play an important role in determining the course of satisfaction over life time. The upsurge of happiness after mid-life seems to be more robust to model specifications, which might imply that the latter is inherent to mankind.

keywords: subjective well-being, life cycle happiness, ageing, birth cohorts, U-shape, German Socio-Economic Panel

JEL Codes: C23, I31, J10

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1 Introduction

What happens to peoples happiness as they age? Over the last decade, many researchers observed a U-shape of subjective well-being[1] in age in the cross-section, generally bottoming up between the late 30s and early 50s. The pattern has been found both for developed countries (Blanchflower & Oswald, 2004; Clark & Oswald, 1994; Di Tella *et al.*, 2001, 2003; Oswald & Powdthavee, 2006, 2007a,b; Theodossiou, 1998; Winkelmann & Winkelmann, 1998), as well as for transition and developing countries (Fafchamps & Shilpi, 2008; Powdthavee, 2003, 2005; Sanfey & Teksoz, 2007; Senik, 2004). From a psychologists' perspective, Mroczek & Spiro (2005) found positive affect being upward sloping over lifetime. However, as their sample includes individuals from the age of 40 onwards, their findings *confirm* rather than *contradict* the pattern found in the studies cited above.

During the last decade, a stream of subjective well-being research has emerged in the economics literature addressing a wide variety of questions[2]. However, the evolution of subjective well-being over age has not received much attention until recently, as age variables were often introduced as controls. One concern about the widely-observed U-shape is that the results might be clouded by cohort effects: young people are born in different times than older people. To address this concern, Blanchflower & Oswald (2008) introduce birth cohort dummies in their repeated cross-sectional data analysis, and the U-shape continues to appear for both Europe as well as the United States. Nevertheless, the latter authors have also pointed out that long panel data are needed to further investigate this issue and that (pooled) cross-sectional data can never be wholly persuasive, as the same person is not evaluated year after year.

[1] In this paper, the terms happiness, subjective well-being and life satisfaction are used interchangeably.

[2] See Di Tella & MacCulloch, 2006; Frey & Stutzer, 2002 or Graham, 2006 for comprehensive overviews.

Panel data evidence on subjective well-being over the life cycle has been provided for one country, the United Kingdom. Clark (2007) and Clark & Oswald (2007), who use the British Household Panel Survey (BHPS), find again a U-shape in subjective well-being, although the curve becomes flatter before the turning point.

This paper attempts to contribute to the scarce evidence on life cycle happiness[3] from panel data, by using longitudinal data from the German Socioeconomic panel on more than 30000 individuals for the period from 1985 to 2007. Germany, although being a European country, has a rather different history than the United Kingdom, being split up after the second World War and reunified in 1990. This allows us to perform the analysis in a quite different context.

The analysis shows that the U-shape is less supported in a longitudinal setting, and that the shape of the effect of ageing on subjective well-being seems to be sensitive to the specification. Moreover, the paper shows that assets and income might be important determinants of the evolution of well-being over the life-cycle, that the evolution of life cycle happiness can be different across regions or countries and that there might be a second turning point later in life. While the trajectory of well-being before mid-life seems to differ from other studies, the upsurge after mid-life seems to be more robust.

The remainder of the paper is organized as follows. Section 2 offers a conceptual background in order to frame this research within the economic science and the theory of life-cycle utility. Section 3 discusses the data, section 4 outlines the methodology and regression results and section 5 presents an overall reflection on the findings. Section 6 concludes.

[3]The paper will not deal with the question whether or not happiness data is an appropriate measure of welfare and to what extent happiness data should be used to guide policies. These issues are discussed broadly in the literature, e.g. by Frey & Stutzer (2007), Layard (2005) or Sen (1999)

2 Life Cycle Utility

Some guidance in the economic literature on the structure of well-being over age can be provided by the well-known life cycle model. However, it will turn out that economic theory leaves open room for every structure of well-being over age, and the more commonly assumed paths do not include the U-shape. Moreover, drawing conclusions from an economic model might be made even more challenging due to the discrepancy between the clear though narrow concept of *utility* in standard microeconomic theory on the one hand, and *subjective well-being* on the other hand.

2.1 The Baseline Model

Consider an agent who lives $T + 1$ periods, starting at period 0 and without any endowments. Under standard microeconomic assumptions, instantaneous utility u, solely depends on consumption C and can therefore be written as $u(C_t)$.

The functional relationship between utility and consumption is assumed to be increasing and concave:

$$\frac{\delta u(C_t)}{\delta C_t} > 0$$

$$\frac{\delta^2 u(C_t)}{\delta^2 C_t} < 0$$

Furthermore

$$\lim_{C_t \to 0} \delta u(c_t) = +\infty$$

$$\lim_{c_t \to +\infty} \delta u(c_t) = 0$$

An agent (or household) is assumed to plan its consumption path over lifetime at the beginning of the life cycle. For each period, a household earns income Y and can choose to save and thus accumulate assets A, or to consume more than one earns and

thus to decumulate assets or even to consume future income (to borrow). After adopting a transversality condition stating that $A_{T+1} = 0$, or that the household does not leave any assets nor debts after the end of life in period T, the agent's maximization problem can be formulated as follows:

$$\max U = \sum_{t=0}^{T} \frac{u(c_t)}{(1+\rho)^t} \quad \text{s.t.} \quad \sum_{t=0}^{T} \frac{Y_t}{(1+r)^t} = \sum_{t=0}^{T} \frac{C_t}{(1+r)^t} \tag{1}$$

where U denotes lifetime utility, $\rho \geq 0$ is a discount rate reflecting valuing consumption today more than consumption in the future, and where $r \geq 0$ is a rate of return to capital which equals the savings rate under the assumption of perfect credit markets.

The Lagrangean of the discrete intertemporal maximization problem in equation (1) can now be formulated as:

$$L(C_0, \ldots, C_T, \lambda) = \frac{u(c_t)}{(1+\rho)^t} + \lambda(\frac{Y_t - C_t}{(1+r)^t} \tag{2}$$

Equation (2) implies that:

$$u'(c_0) = u'(c_1)\frac{1+r}{1+\rho} = u'(c_2)\left(\frac{1+r}{1+\rho}\right)^2 = \ldots = u'(c_T)\left(\frac{1+r}{1+\rho}\right)^T \tag{3}$$

Even in this simple framework where one assumes perfect credit markets, where the evolution of income is completely predictable and where the utility function does not change over the life cycle, microeconomic theory leaves open much room to the evolution of utility over the life cycle. In case where $r \gg \rho$, one would expect increasing utility over the life cycle, while the reverse is true when $r \ll \rho$. A flat pattern of utility over the life cycle is expected when the interest rate and the discount rate are equal. More patterns can be simulated when assumptions of the model are altered, e.g. when liquidity constraints or uncertainty over income are introduced, or when one assumes that the utility function changes as one ages.

2.2 The Discrepancy between (Decision) Utility and Subjective Well-Being

An important standard assumption in microeconomic theory is the exclusive dependence of utility on consumption. However, if one is measuring utility by a life satisfaction or subjective well-being (SWB) indicator, one can expect to find many other indicators determining the course of utility over the life cycle.[4] Quite recently, a distinction has been made between decision utility (as used in microeconomic theory) and experienced utility (Kahneman & Thaler, 1991; Kahneman *et al.*, 1997). The concept of experienced utility has been extensively discussed in the literature and many different nuances have been proposed. An example to make clear the importance to distinguish experienced and decision utility in the context of this paper might be the case of risk aversion. In a decision utility framework (used in economic theory), risk aversion is modeled by a concave utility function. Experienced utility, however, can be expected to be dependent on risk *directly*. While consumption nowadays can be high, an agent's subjective well-being can be lowered if he is aware that his consumption pattern is subject to large fluctuations which are (partially) out of his control. The latter point could be supported by patterns found in subjective well-being data (that can be considered to reflect a variant of experienced utility), which reveal that a high unemployment rate, ceteris paribus, has a negative effect on one's life satisfaction (Clark, 2003; Di Tella *et al.*, 2001). Similarly, while expected changes in utility are often reflected in lifetime utility as shown in equation (1), expectations about future utility can have an impact on contemporaneous experienced utility: experienced utility then depends on *anticipated utility*.

An increase in income and wealth (let's call it *material well-being*) could therefore be expected to have a positive effect on one's instantaneous utility because of the anticipa-

[4]See the review papers cited in the introduction.

tion of a *higher level* or a *lower variation* in future utility, and not necessarily because of an increase in consumption.

In conclusion, this section has attempted to point out that:

- Material well-being can have its impact on life cycle utility through a multitude of channels and that
- unlike life cycle *utility* used in economic theory, life cycle *happiness* can be expected to not depend solely on current consumption.

This paper will not aim to disentangle all different channels through which material well-being influences life cycle happiness, but rather will focus on the course of life cycle happiness, and to what extent the observed pattern in the data is influenced by material well-being.

3 Data

The analysis will use data from the German Socioeconomic Panel (GSOEP), most likely the longest running household panel including a subjective well-being question. The panel runs from 1984 to 2007 for West Germany, and information on East German households is available from 1990 onwards (Wagner *et al.*, 2007). Rounds from 1985 to 2007 for West Germany, and from 1991 to 2007 for East Germany will be analyzed.

The subjective well-being question which is included in the GSOEP goes as follows:

> On a scale from 0 (completely dissatisfied) to 10 (completely satisfied), how satisfied are you with your life, all things considered?[5]

[5]Readers concerned whether or not answers to such survey questions offer reliable measures for life satisfaction may want to consult Krueger & Schkade (2007).

The analysis will be performed on a total of 32470 individuals.[6] 25717 individuals are observed in West Germany and 7121 in East Germany, and 358 seem to have crossed the border between the two whilst in the panel study.

As the German Socioeconomic Panel is characterized by attrition and refreshment, and as not each individual will respond to every relevant question each year, it is not possible to follow most of the individuals in all rounds: the average duration of an individual observed in the data is 6.39 years in West Germany and 5.98 years in East Germany. With the view on a balanced panel analysis, 2430 individuals are observed during all 24 rounds in West Germany and 1540 persons in all 17 rounds for East Germany.

4 Methodology and Results

4.1 Insights from (Pooled) Cross-Sections

The analysis starts with some pooled OLS[7] subjective well-being equations containing the individuals age and a squared term as main variables to investigate a U-shaped pattern of life satisfaction over age. The analysis is performed for the whole sample and West and East Germany separately, both with and without a set of control variables. The GSOEP is characterized by aggregate ageing over time (Frijters *et al.*, 2004). As to distinguish aggregate time fluctuations from ageing, time dummies are included in all equations throughout the analysis. Furthermore, all regressions have been reproduced including a cubed term of age as to account for a possible second turning point later in

[6] Although it is possible to perform the analysis on a higher number of observations for these regressions with fewer explanatory variables, the same set of observations is used throughout the (unbalanced panel) analysis as to prevent results to be driven by different observations rather than by a different specification.

[7] As Ferrer-i-Carbonell & Frijters (2004) have pointed out using the GSOEP, assuming cardinality rather than ordinality of happiness measures is not of great importance for the outcomes. Therefore, OLS estimators are used throughout this paper.

life. All regressions in tables 6 and 6, represented graphically in figures 6 and 6, show results which are in line with the expectations. The U-shape is persistent in a pooled OLS analysis across subsamples, whether or not sociodemographic characteristics are included. Results also show a diminishing increase and even a downward trend of well-being at higher age. To have a better insight into when the turning points occur, table 6 contains the local minima and maxima for the well-being equations shown in tables 6 and 6. These calculations show that subjective well-being, in all equations without sociodemographic controls, reaches a minimum at around 42 to 52 years of age if a cubed term is included. In cases where one does not allow for a backward bending curve, the turning point seems to be much higher and minima are reached between 56 and 65. The first turning point falls somewhat earlier in regressions where sociodemographic controls are included, and the discrepancy between regressions with and without cubed term are smaller (especially for West Germany).

Regressions including a cubed term reveal diminishing returns to age or even a second turning point later in life, and results are especially appealing when sociodemographic controls are included, with a turning point around 75 years of age for West Germany and 85 years of age for east Germany.

4.2 Controlling for Fixed Cohort Effects

It seems obvious that fixed cohort effects in a panel data setting can be controlled for by performing an individual fixed effects estimation, which basically boils down to demeaning all variables in the analysis at the individual level after which an OLS estimation can be applied. However, including age as a covariate in a fixed effects regression has some complications. Indeed, identification will only occur due to panel attrition or refreshment, or due to the omission of time dummies. Using a nonlinear transformation (such as the logarithm) would be hard to interpret and would impose restrictions on the functional form. Recently, however, Clark (2007) & Clark & Oswald (2007) have proposed a

straightforward though convenient and accurate way to dealing with this issue by using dummies representing age-bounded categories. Individuals can then move from one age category into another. This means however, that a long time dimension is required, a property for which the German Socioeconomic Panel is particularly well-known.

It might be useful to illustrate the above-mentioned technique with an example. Consider 2 individuals which are both in the panel from period $t = 0$ to period $t = 10$. The first is 20 years of age at start while the second one is 25. Demeaning a linear age variable at the individual level would imply a value of -5 for both of them at period $t = 0$ and of 5 at $t = 10$, and including a first-order term of an individual's age in a fixed effects regression would therefore be equivalent to including a linear time trend. In contrast, the course of a demeaned age category dummy is *age-dependent* rather than *time-dependent*, as illustrate the graphs of age dummy *25 to 28* for both hypothetical individuals in figure 6. The discussion in the previous subsection suggests that using age dummies needs not be seen as just a second-best option to dealing with age in a fixed effects framework. As allowing for more functional flexibility seems to be fairly important for the unbiasedness of estimates, the latter approach can be advisable even in a (pooled) OLS analysis.

Table 6 (and figure 6) show regressions controlling for individual fixed effects. Age categories comprise 4 years: 17-20, 21-24 ... 77+, and the omitted category is the age group 37-40. The results are striking. The clearly observed U-shape in the raw data in tables 6 and 6 is not observed any more. The curves are now upward sloping.[8] When performing F-tests on the equality of coefficients, the results show that the upward slope *before* the usual turning point is statistically significant. The inclusion of sociodemographic characteristics somehow flattens the upward slope, but there is no evidence for a U-shape and the upward slope before the turning point is still significant.

[8]Results for the East German subsample are less convincing, probably due to the smaller number of individuals as well as the considerably smaller time dimension.

4.3 Results from a Balanced Panel

When applying the fixed effects analysis to balanced panels, one observes an increase in standard errors and a less regular pattern of age over well-being, especially for East Germany (tables 6 and 6 and figures 6 and 6). However, the difference between balanced and unbalanced results can merely be expected by construction. Indeed, in a balanced panel, the youngest age category will only be represented in the earliest years of the panel, while older members are only observed in later years. The distribution of ages over time is much more equally spread in an unbalanced panel than in a balanced panel, as illustrated in figures 6 and 6 for West Germany. Simultaneous identification of time and age effects seems to be less obvious in a balanced panel setting, and unbalanced panel results might thus be preferred.

4.4 Assets, Income and Life-Cycle Well-Being

As seen in section 2, economic theory does not offer us much guidance in predicting the structure of well-being over the life cycle. However, combined with the discussion on *decision* versus *experienced* utility, it draws the attention to the fact that not only current consumption, but also assets might be of importance.

Unfortunately, apart from the year 2002, the GSOEP does not contain detailed wealth information.[9] It does, however, contain information about revenues on capital measured by the following questions:

> How high was the income received from interest, dividends, and profits from savings and securities in the last calendar year?

[9]Data is also available for the year 1988, but far less effort has been made to impute missing values.

> Did you or someone in your household receive income from letting or land or house / flat last year? Please state actual income, not the tax value for own use.

In some cases, respondents gave an exact amount, in other cases just a category in which the amount was situated. Values are imputed for those who only reported a category by the mean amount of exact values reported within this category. It is true that an increase or decrease in assets revenues does not mean that the amount of assets in portfolio has changed, nor that the change happens in the same direction, as it might well be that changes in revenues for assets are caused by different rates of return across years. This problem can partly be solved by including time dummies, although one then needs to assume that portfolios are homogenous. The latter assumption is not very credible as Sommers (2005) has pointed out that Germans' portfolio structure differs across age cohorts. It is therefore necessary to interpret the assets' revenues variable not in too strict a way as a proxy for assets, but rather as a measure of a state of one's financial situation. Another consideration might be that debts, or changes in debts, are not taken into account. However, it is reasonable to assume that if debts, unlike e.g. a mortgage, which are not strategic or foreseen, asset holdings will reduce as well (unless the expected profits on these assets is higher than the interest rate paid on the debt). A final concern might be that the value of a house should be included in the framework. Although Fuchs-Schuendeln & Schuendeln (2005) suggest a way to estimate a houses value, the value would be fixed over all years which makes the variable irrelevant in a fixed effects framework.

Due to the absence of consumption data, net household income will be used as a proxy for consumption in accordance with authors such as Luttmer (2005).

Table 6 (and figure 6) reproduce the results from table 6 (columns 4 to 6) but now including the log of monthly net household income and the log of assets' revenues during the previous calendar year as control variables. Furthermore, as one might expect that

both household income and assets' revenues are more direct channels to well-being for household heads than for the others, the samples are further divided into a category of household heads on the one hand, and a category of other household members on the other hand.

The overall results in table 6 show a decrease in T-statistics. Apart from the (West German) non-household head sample, associations between age and well-being are less pronounced before mid-life. The life satisfaction of West German households now comes closer to the findings of Clark (2007), who finds a rather flat pattern of life satisfaction before mid-life and an upsurge afterwards.[10]

5 Overall Reflections and Further Investigations

The results presented in the previous subsection, derived from the German Socioeconomic Panel, shed more light on the determinants of life cycle happiness. This section will outline and further elaborate upon the three findings which might be the most important of the analysis.

First, pooled OLS results presented in tables 6 and 6 suggest that allowing for a flexible functional relationship between one's age and one's happiness is crucial to avoid misspecification bias. In many SWB-studies where age variables have mostly been included as control variables, one imposes a second-order relationship. However, results in this paper show that including a cubed term reveals a second turning point in life at higher age, apart from the often found minimum around mid-life. Moreover, the less restrictive functional specification leads to estimates predicting a considerably earlier occurrence of the (first) local minimum in life time. Allowing for a flexible functional relationship might thus be important to obtain consistent estimates. The misspecifica-

[10] As for East German subsamples, the standard errors are rather large and the patterns quite irregular, and it might be that the number of person-year observations is somewhat too small to draw firm conclusions.

tion bias, however, decreases when a set of sociodemographic controls are added, which is some first ample evidence suggesting that the evolution of life cycle happiness can be accounted for by sociodemographic characteristics that are correlated with ageing.

Individual fixed effects regressions, in which fixed (birth cohort) characteristics are controlled for, show a shift of the pattern of ageing over the life cycle. Whereas pooled OLS regressions all show a clear, commonly observed U-shaped pattern, satisfaction with life seems to be rising over the life cycle (and again somewhat declining at higher age) when fixed effects are controlled for. These results are striking when comparing them with results from the British Household Panel Survey (BHPS), where one is still able to find a U-shaped pattern of life satisfaction over age, although somewhat flatter before the turning point. As to further illustrate the importance of fixed effects on life-cycle well-being in the GSOEP, table 6 shows reproductions of regressions of table 6 with and without fixed effects and 90% confidence intervals between brackets, where continuous higher-order terms of age have been replaced by age category dummies for the pooled OLS regressions. The confidence intervals show that the differences between pooled OLS and fixed effects estimates are not subject to statistical ambiguity, as the ranges of confidence intervals do clearly not intersect with each other for the younger age categories. Figure 6 graphically represents the difference between pooled OLS and fixed effects regressions as outlined in table 6 and can offer some insights on the *shape* of individual fixed effects on life cycle well-being. The graphs suggest that fixed (birth cohort) effects seem to increase well-being for the younger individuals. These results, however, need to be interpreted with caution and should not be generalized in any way, as it is important to realize that this pattern does only apply for this particular data set. Even if determinants of subjective well-being will not change over the next years, it is likely that the distribution of characteristics (including unobserved fixed characteristics) of the population will change over time, which might imply that the graphs in figure 6 may be reversed when the analysis will be repeated for the 20 coming years.

Third, there is some ample evidence that assets and consumption, respectively the state and control variable in the theory of life-cycle utility, can have an influence on life-cycle well-being. The evolution of well-being over age seems to become flatter before mid-life especially for West German household heads. As results for household heads have not been presented in the earlier stages of the analysis, one might wonder to what extent the difference in shape is caused by the choice of the subsample rather than by the inclusion of variables proxying assets and consumption. To investigate this issue, table 6 reports fixed-effects regressions with respectively no controls (apart from time dummies), some standard controls and finally including the household income and assets' revenues variables for West German household heads. 90% confidence intervals are reported instead of standard errors along with the estimated coefficients as the former might be more informative than the latter in this case. When comparing columns 1 and 3 of table 6, one can note that sociodemogaphic controls can have a considerable impact on life-cycle well-being, even after fixed characteristics have been controlled for. Although the statistical evidence is less powerful than in table 6, the overlaps between confidence intervals is rather small especially for the younger age categories. Comparing columns 2 and 3 also shows a changing pattern of well-being over the life-cycle when household income and assets' revenues are added to the set of controls. Although there is quite some overlap between confidence intervals, albeit less for lower ages, one needs to keep in mind the limitations of the proxies for assets and consumption as explained in 4.4. Figure 6 graphically represents the difference in coefficients of columns 2 and 3 in table 6. The graph in figure 6 suggests that material well-being is responsible for lower life satisfaction for younger as well as older household heads.

In summary, the overall picture of the results presented in this paper shows that the association between age dummies and life satisfaction heavily depends on the model specification and that it can vary for different regions and countries, suggesting the importance of *time-varying* as well as *time-invariant* factors to determine life satisfaction. In Easterlin's (2006) terminology, there does not seem to be an *Iron Law of Happiness*:

life cycle happiness is not predetermined, but depends on many sociodemographic factors. Nonetheless, the rise of well-being *after* mid-life seems to be much more robust across specifications, both in the GSOEP as well as in the BHPS, which suggests that an upsurge in happiness after midlife could be inherent to mankind.

6 Conclusion

In this paper, the course of subjective well-being over life time has been analyzed using an extensive longitudinal dataset, the German Socioeconomic Panel (GSOEP). The main findings of the paper are as follows:

- In pooled cross-sectional studies, a U-shaped pattern of subjective well-being over the life cycle is found and reappears in all models. Allowing for a more flexible relationship between age and well-being seems to be important to obtain unbiased estimates, and it offers some evidence that life satisfaction decreases at later age.
- Individual fixed effects regressions are ran to control for birth cohort effects: people are born in different times which might cloud the observed trajectory of subjective well-being over age in a pooled OLS framework. The results do not confirm the U-shaped relationship, but rather reveal an upward sloping life satisfaction over life time. The difference between poled OLS and fixed effects estimates is large and statistically significant. Fixed effects seem to be important to explain why younger people are happier than people in mid-life.
- Material well-being seems to *cloud* rather than to *cause* a U-shaped pattern in well-being, and there is some ample evidence that satisfaction triggered by material well-being is hump-shaped. Especially young West-German household heads seem to see their well-being lowered due to their financial situation. These findings are somewhat in line with results for the United States reported in Easterlin (2006),

who is unable to identify a U-shaped course of life-cycle well-being when income and marital status are not controlled for.

Framing these findings in the existing literature on subjective well-being and ageing, the following conclusions might be suggested:

- The individual fixed effects regressions from the GSOEP and the British Household Panel Survey (BHPS) are remarkably different in that the former do not display a U-shaped pattern while the latter do, albeit it only to a certain extent. This suggests the importance of country-specific effects apart from individual fixed effects.
- Related to this, In Easterlin's (2006) terms, there does not seem to be an *iron law of happiness*, i.e. the course of life satisfaction is not completely predetermined. Indeed, apart from differences across countries, the course of life-cycle well-being seem to be sensitive to controlling for unobserved fixed effects as well as for sociodemographic (time-varying) characteristics.
- Although comparisons of the different results presented in this study among each other and with other studies do not lead to firm conclusions on the trajectory of life satisfaction before the turning point, the upsurge after mid-life seems to be much more robust, which may suggest that this pattern is inherent to mankind.

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Table 1: Subjective Well-Being and Age: Pooled OLS Results (No Sociodemographic Controls)

	Age and Age Squared			Age cubed added		
	Whole Sample	West	East	Whole Sample	West	East
Age	-0.021579	-0.013926	-0.045722	-0.080960	-0.092231	-0.081645
	(8.81)***	(5.25)***	(8.16)***	(9.42)***	(9.88)***	(4.09)***
Age squared	0.000178	0.000108	0.000411	0.001474	0.001818	0.001192
	(6.90)***	(3.85)***	(6.86)***	(7.78)***	(8.83)***	(2.70)***
Age cubed				-0.000009	-0.000011	-0.000005
				(6.69)***	(8.13)***	(1.72)*
Constant	8.069939	7.783957	7.746276	8.880075	8.851603	8.240852
	(144.97)***	(129.24)***	(63.91)***	(74.05)***	(68.11)***	(29.99)***
Observations	206911	164342	42569	206911	164342	42569
R-squared	0.01	0.00	0.02	0.01	0.01	0.02

Notes: *sociodemographic controls* include the log of real household income, gender and education, marital status dummies, dummies for whether the marital status has changed during the last 3 months, a dummy for disability status, an unemployment dummy and the number of months being unemployed during the last 12 months. Robust t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%

Table 2: Subjective Well-Being and Age: Pooled OLS Results (Including Sociodemographic Controls)

	Age and Age Squared			Age cubed added		
	Whole Sample	West	East	Whole Sample	West	East
Age	-0.040549	-0.036387	-0.054787	-0.146721	-0.173524	-0.158239
	(13.25)***	(10.92)***	(7.49)***	(15.32)***	(16.55)***	(7.22)***
Age squared	0.000429	0.000394	0.000563	0.002677	0.003306	0.002722
	(13.92)***	(11.69)***	(7.76)***	(13.34)***	(15.04)***	(5.96)***
Age cubed				-0.000015	-0.000019	-0.000014
				(11.05)***	(13.10)***	(4.61)***
Constant	6.669494	6.768681	5.943711	8.121672	8.660817	7.317497
	(92.67)***	(86.38)***	(35.01)***	(58.12)***	(56.29)***	(23.55)***
Observations	206911	164342	42569	206911	164342	42569
R-squared	0.07	0.06	0.09	0.07	0.06	0.09

Notes: *sociodemographic controls* include the log of real household income, gender and education, marital status dummies, dummies for whether the marital status has changed during the last 3 months, a dummy for disability status, an unemployment dummy and the number of months being unemployed during the last 12 months. Robust t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%

Table 3: Subjective Well-being and Age: Local Minima and Maxima Derived from Pooled OLS Regressions

		No cubed term			Cubed term added		
		Whole Sample	West	East	Whole Sample	West	East
No Controls	Minimum	60.512	64.713	55.596	46.341	41.803	51.867
	Maximum				67.401	64.513	100.712
Controls added	Minimum	47.271	46.200	48.665	41.786	40.377	44.030
	Maximum				79.620	75.002	85.571

Table 4: Subjective Well-Being and Age: Individual Fixed Effects Estimations

	No sociodemographic controls			Some controls added		
	Whole Sample	West	East	Whole Sample	West	East
17-20	-0.285848	-0.320718	-0.163447	-0.167922	-0.183514	-0.128995
	(5.48)***	(5.52)***	(1.36)	(3.19)***	(3.12)***	(1.07)
21-24	-0.352365	-0.385665	-0.199205	-0.238826	-0.262825	-0.121724
	(8.22)***	(8.09)***	(2.01)**	(5.51)***	(5.44)***	(1.22)
25-28	-0.237769	-0.284862	-0.042739	-0.163055	-0.206286	0.018953
	(7.04)***	(7.58)***	(0.54)	(4.80)***	(5.46)***	(0.24)
29-32	-0.141564	-0.175774	0.039523	-0.103337	-0.135200	0.066777
	(5.62)***	(6.27)***	(0.68)	(4.11)***	(4.83)***	(1.16)
33-36	-0.061124	-0.070900	0.001084	-0.045661	-0.054942	0.012185
	(3.45)***	(3.58)***	(0.03)	(2.59)***	(2.78)***	(0.31)
41-44	0.070390	0.069961	0.045694	0.058289	0.057984	0.030414
	(3.97)***	(3.51)***	(1.18)	(3.30)***	(2.92)***	(0.79)
45-48	0.086214	0.107633	-0.040866	0.073269	0.095121	-0.054535
	(3.42)***	(3.81)***	(0.74)	(2.92)***	(3.38)***	(0.99)
49-52	0.128810	0.171003	-0.072508	0.122541	0.163451	-0.072982
	(3.84)***	(4.56)***	(0.98)	(3.67)***	(4.36)***	(0.99)
53-56	0.140471	0.176129	-0.033525	0.150107	0.186092	-0.027220
	(3.32)***	(3.72)***	(0.36)	(3.56)***	(3.94)***	(0.29)
57-60	0.256749	0.306931	0.044032	0.315140	0.358676	0.114954
	(5.02)***	(5.36)***	(0.39)	(6.17)***	(6.27)***	(1.02)
61-64	0.444308	0.454683	0.347099	0.460341	0.487026	0.297527
	(7.38)***	(6.74)***	(2.61)***	(7.66)***	(7.23)***	(2.25)**
65-68	0.538977	0.544491	0.457676	0.542569	0.567529	0.385488
	(7.79)***	(7.02)***	(3.00)***	(7.86)***	(7.33)***	(2.54)**
69-72	0.499188	0.522797	0.370802	0.513094	0.558312	0.298455
	(6.35)***	(5.93)***	(2.14)**	(6.54)***	(6.34)***	(1.74)*
73-76	0.441445	0.493247	0.234652	0.464658	0.540272	0.161644
	(5.00)***	(4.98)***	(1.21)	(5.27)***	(5.47)***	(0.84)
77-80	0.201070	0.262667	-0.052310	0.247063	0.336076	-0.113844
	(2.00)**	(2.33)**	(0.24)	(2.46)**	(2.98)***	(0.52)
Constant	7.602263	7.624064	6.446048	7.501269	7.510615	6.384307
	(345.51)***	(318.31)***	(155.33)***	(260.14)***	(238.47)***	(94.76)***
Observations	206911	164342	42569	206911	164342	42569
Individuals	32470	25707	7121	32470	25707	7121
R-squared	0.02	0.03	0.02	0.03	0.04	0.04

Notes: *sociodemographic controls* include marital status dummies, dummies for whether the marital status has changed during the last 3 months, a dummy for disability status, an unemployment dummy and the number of months being unemployed during the last 12 months. Absolute value of t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: Subjective Well-Being and Age: Individual Fixed Effects Estimates from an unweighted Balanced Panel

	No sociodemographic controls		Some controls added	
	West	East	West	East
17-20	-0.271038	-0.192197	-0.039131	-0.061581
	(2.06)**	(0.75)	(0.29)	(0.24)
21-24	-0.295589	-0.214648	-0.121542	-0.105297
	(3.02)***	(1.28)	(1.21)	(0.61)
25-28	-0.262265	0.014010	-0.162116	0.087957
	(3.52)***	(0.11)	(2.17)**	(0.69)
29-32	-0.180285	0.060320	-0.127557	0.099586
	(3.30)***	(0.67)	(2.35)**	(1.11)
33-36	-0.098277	0.020275	-0.082307	0.036089
	(2.60)***	(0.32)	(2.19)**	(0.58)
41-44	0.044438	0.075050	0.025261	0.040073
	(1.23)	(1.29)	(0.70)	(0.70)
45-48	0.058179	-0.034517	0.036628	-0.067785
	(1.13)	(0.42)	(0.72)	(0.83)
49-52	0.141132	-0.091713	0.121320	-0.109906
	(2.03)**	(0.82)	(1.75)*	(0.99)
53-56	0.161701	-0.073239	0.160709	-0.097465
	(1.81)*	(0.52)	(1.81)*	(0.69)
57-60	0.327808	0.041251	0.377632	0.087119
	(3.00)***	(0.24)	(3.47)***	(0.51)
61-64	0.449402	0.299193	0.479224	0.213909
	(3.47)***	(1.47)	(3.71)***	(1.06)
65-68	0.538964	0.476932	0.557321	0.358267
	(3.59)***	(2.03)**	(3.74)***	(1.54)
69-72	0.586614	0.362915	0.603779	0.238772
	(3.43)***	(1.36)	(3.55)***	(0.90)
73-76	0.526827	0.238418	0.550544	0.105952
	(2.74)***	(0.79)	(2.88)***	(0.36)
77+	0.394426	-0.124231	0.440577	-0.252523
	(1.77)*	(0.36)	(1.99)**	(0.74)
Constant	7.394678	6.157398	7.248342	6.231785
	(140.40)***	(37.14)***	(103.02)***	(31.34)***
Observations	39840	15641	39840	15641
Individuals	2430	1387	2430	1387
R-squared	0.04	0.02	0.05	0.05

Notes: *sociodemographic controls* include marital status dummies, dummies for whether the marital status has changed during the last 3 months, a dummy for disability status, an unemployment dummy and the number of months being unemployed during the last 12 months. Absolute value of t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: Subjective Well-Being and Age: Individual Fixed Effects Estimates from a Balanced Weighted Panel

	No sociodemographic controls		Some controls added	
	West	East	West	East
17-20	-0.172720	-0.397300	0.165820	-0.360982
	(0.57)	(1.01)	(0.57)	(0.87)
21-24	-0.396520	-0.110615	-0.131156	-0.093935
	(2.13)**	(0.40)	(0.73)	(0.34)
25-28	-0.240132	-0.000342	-0.089123	0.056862
	(1.78)*	(0.00)	(0.72)	(0.24)
29-32	-0.246798	-0.023335	-0.176253	0.003905
	(2.41)**	(0.14)	(1.87)*	(0.02)
33-36	-0.089305	-0.207360	-0.055351	-0.188009
	(1.43)	(1.01)	(0.94)	(1.01)
41-44	0.049409	0.089704	0.023019	0.060240
	(0.88)	(0.88)	(0.41)	(0.61)
45-48	0.006317	-0.071374	-0.015364	-0.110308
	(0.06)	(0.53)	(0.16)	(0.81)
49-52	0.147194	-0.140146	0.120683	-0.145516
	(1.21)	(0.82)	(1.05)	(0.85)
53-56	0.219800	-0.172611	0.201179	-0.177256
	(1.44)	(0.80)	(1.40)	(0.81)
57-60	0.448046	-0.011345	0.472108	0.101837
	(2.49)**	(0.04)	(2.82)***	(0.39)
61-64	0.564185	0.213857	0.565508	0.157839
	(2.53)**	(0.72)	(2.71)***	(0.53)
65-68	0.630958	0.418524	0.617792	0.338430
	(2.51)**	(1.23)	(2.66)***	(0.98)
69-72	0.661104	0.281395	0.635723	0.204803
	(2.37)**	(0.71)	(2.45)**	(0.51)
73-76	0.625061	0.142990	0.606603	0.059550
	(1.90)*	(0.33)	(1.98)**	(0.14)
77+	0.545242	-0.216266	0.544746	-0.293028
	(1.54)	(0.44)	(1.62)	(0.59)
Constant	7.350685	6.157643	7.080220	6.237471
	(91.96)***	(50.16)***	(51.98)***	(31.44)***
Observations	39820	15639	39820	15639
Individuals	2429	1385	2429	1385
R-squared	0.04	0.03	0.05	0.05

Notes: *sociodemographic controls* include marital status dummies, dummies for whether the marital status has changed during the last 3 months, a dummy for disability status, an unemployment dummy and the number of months being unemployed during the last 12 months. Absolute value of t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%

Table 7: Subjective Well-Being and Age: a Further Investigation into the Role of Assets and Income

	Whole Sample		West		East	
	No hh. head	Head	No hh. head	Head	No hh. head	Head
17-20	-0.166913	0.014341	-0.214215	-0.073769	-0.022906	0.391987
	(2.13)**	(0.13)	(2.44)**	(0.62)	(0.13)	(1.34)
21-24	-0.226087	-0.087230	-0.272604	-0.140735	-0.068602	0.142602
	(3.44)***	(1.38)	(3.72)***	(2.01)**	(0.46)	(0.95)
25-28	-0.148753	-0.062558	-0.202490	-0.116227	0.047314	0.179990
	(2.84)***	(1.33)	(3.47)***	(2.23)**	(0.39)	(1.64)
29-32	-0.096504	-0.023556	-0.145399	-0.058576	0.119591	0.153924
	(2.45)**	(0.69)	(3.31)***	(1.55)	(1.33)	(1.95)*
33-36	-0.041251	-0.025573	-0.052987	-0.039277	0.013681	0.038222
	(1.50)	(1.08)	(1.72)*	(1.48)	(0.22)	(0.72)
41-44	0.029481	0.061356	0.049900	0.046674	-0.047612	0.088034
	(1.07)	(2.60)***	(1.61)	(1.76)*	(0.79)	(1.70)*
45-48	0.061171	0.055246	0.090410	0.073090	-0.049359	-0.039640
	(1.56)	(1.64)	(2.04)**	(1.94)*	(0.58)	(0.53)
49-52	0.115989	0.111788	0.178560	0.131234	-0.105160	0.045912
	(2.22)**	(2.50)**	(3.05)***	(2.63)***	(0.92)	(0.46)
53-56	0.155731	0.145147	0.211463	0.143969	-0.032131	0.174746
	(2.38)**	(2.57)**	(2.87)***	(2.28)**	(0.22)	(1.39)
57-60	0.318663	0.381640	0.387956	0.375171	0.086611	0.448266
	(4.02)***	(5.61)***	(4.35)***	(4.93)***	(0.50)	(2.95)***
61-64	0.475441	0.577058	0.516586	0.554754	0.316641	0.667713
	(5.10)***	(7.22)***	(4.92)***	(6.20)***	(1.56)	(3.76)***
65-68	0.524692	0.716007	0.561612	0.689405	0.374248	0.813548
	(4.89)***	(7.80)***	(4.65)***	(6.71)***	(1.61)	(4.01)***
69-72	0.480987	0.717581	0.528882	0.712907	0.281834	0.752969
	(3.93)***	(6.89)***	(3.84)***	(6.11)***	(1.07)	(3.28)***
73-76	0.440503	0.699260	0.534514	0.718594	0.094278	0.648799
	(3.19)***	(6.00)***	(3.44)***	(5.50)***	(0.32)	(2.52)**
77+	0.218329	0.530960	0.324911	0.572077	-0.184989	0.363686
	(1.39)	(4.00)***	(1.84)*	(3.85)***	(0.54)	(1.25)
Constant	6.718853	6.184847	7.220554	6.358870	5.161337	4.890039
	(88.36)***	(95.47)***	(83.85)***	(87.68)***	(29.60)***	(29.38)***
Observations	100555	106345	79986	84345	20569	22000
Individuals	21827	19830	17438	15816	4479	4208
R-squared	0.04	0.04	0.04	0.04	0.04	0.05

Notes: *sociodemographic controls* include the log of real household income and the log of real assets' revenues, marital status dummies, dummies for whether the marital status has changed during the last 3 months, a dummy for disability status, an unemployment dummy and the number of months being unemployed during the last 12 months. Absolute value of t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%

Table 8: Subjective Well-Being and Age: Comparing Pooled OLS and Fixed Effects Estimates

		Pooled OLS		Fixed Effects
	West	East	West	East
17-20	0.526211	0.487842	-0.177911	-0.125683
	(0.457687 - 0.594736)***	(0.340696 - 0.634988)***	(-0.274421 - -0.081401)***	(-0.322942 - 0.071576)
21-24	0.256376	0.321798	-0.238503	-0.093937
	(0.199563 - 0.313190)***	(0.200791 - 0.442805)***	(-0.317802 - -0.159204)***	(-0.257997 - 0.070122)
25-28	0.200675	0.433318	-0.159625	0.081706
	(0.152613 - 0.248738)***	(0.328600 - 0.538036)***	(-0.221731 - -0.097518)***	(-0.047603 - 0.211016)
29-32	0.099661	0.377631	-0.095156	0.116832
	(0.058886 - 0.140436)***	(0.291849 - 0.463413)***	(-0.141234 - -0.049079)***	(0.022495 - 0.211169)**
33-36	0.057415	0.150925	-0.035339	0.028635
	(0.024380 - 0.090450)***	(0.083847 - 0.218002)***	(-0.067777 - -0.002901)*	(-0.036300 - 0.093570)
41-44	-0.065253	-0.065081	0.040955	0.014351
	(-0.097801 - -0.032705)***	(-0.130612 - 0.000450)	(0.008360 - 0.073550)**	(-0.048720 - 0.077422)
45-48	-0.105896	-0.217747	0.067652	-0.074293
	(-0.146100 - -0.065692)***	(-0.301576 - -0.133917)***	(0.021345 - 0.113959)**	(-0.164538 - 0.015952)
49-52	-0.084678	-0.161833	0.134220	-0.076816
	(-0.128706 - -0.040650)***	(-0.253071 - -0.070594)***	(0.072696 - 0.195744)***	(-0.197791 - 0.044159)
53-56	-0.048905	-0.090812	0.164583	-0.006331
	(-0.096065 - -0.001746)*	(-0.188996 - 0.007373)	(0.086969 - 0.242197)***	(-0.159375 - 0.146713)
57-60	0.173377	0.137292	0.354886	0.166946
	(0.123791 - 0.222962)***	(0.036209 - 0.238375)**	(0.260904 - 0.448868)***	(-0.018123 - 0.352015)
61-64	0.304846	0.325281	0.508485	0.368149
	(0.252754 - 0.356938)***	(0.228267 - 0.422296)***	(0.397848 - 0.619122)***	(0.151409 - 0.584889)***
65-68	0.391835	0.371317	0.600568	0.453403
	(0.336361 - 0.447309)***	(0.270844 - 0.471789)***	(0.473430 - 0.727706)***	(0.205139 - 0.701667)***
69-72	0.383665	0.345740	0.596870	0.356249
	(0.320291 - 0.447040)***	(0.230957 - 0.460524)***	(0.452269 - 0.741472)***	(0.074630 - 0.637868)**
73-76	0.374516	0.346490	0.584193	0.210447
	(0.302483 - 0.446549)***	(0.207280 - 0.485700)***	(0.421897 - 0.746488)***	(-0.106106 - 0.526999)
77+	0.190137	0.327933	0.380899	-0.076238
	(0.105511 - 0.274762)***	(0.146850 - 0.509017)***	(0.195811 - 0.565986)***	(-0.437328 - 0.284853)
Constant	5.811588	4.395808	6.652001	5.077119
	(5.704905 - 5.918271)***	(4.170095 - 4.621522)***	(6.570313 - 6.733690)***	(4.908641 - 5.245596)***
Observations	164342	42569	164342	42569
R-squared	0.060540	0.099716	0.040815	0.045035
Individuals			25707	7121

Notes: *sociodemographic controls* include the log of real household income, gender and education, marital status dummies, dummies for whether the marital status has changed during the last 3 months, a dummy for disability status, an unemployment dummy and the number of months being unemployed during the last 12 months. 90% confidence intervals in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 9: Subjective Well-Being and Age: Some Fixed Effects regressions for West German Household Heads

	No Controls	Some Controls	Adding Material Well-Being
17-20	-0.353764	-0.196053	-0.073769
	(-0.546018 - -0.161510)***	(-0.390478 - -0.001628)*	(-0.267965 - 0.120427)
21-24	-0.368494	-0.247980	-0.140735
	(-0.481928 - -0.255060)***	(-0.363270 - -0.132689)***	(-0.256073 - -0.025397)**
25-28	-0.268545	-0.195013	-0.116227
	(-0.353282 - -0.183808)***	(-0.280528 - -0.109497)***	(-0.201768 - -0.030687)**
29-32	-0.142039	-0.105326	-0.058576
	(-0.204340 - -0.079738)***	(-0.167675 - -0.042977)***	(-0.120880 - 0.003727)
33-36	-0.071546	-0.057913	-0.039277
	(-0.115527 - -0.027564)***	(-0.101768 - -0.014059)**	(-0.083040 - 0.004486)
41-44	0.073618	0.062769	0.046674
	(0.029747 - 0.117488)***	(0.019032 - 0.106505)**	(0.003035 - 0.090313)*
45-48	0.112816	0.100852	0.073090
	(0.050552 - 0.175079)***	(0.038723 - 0.162980)***	(0.011083 - 0.135097)*
49-52	0.164728	0.157322	0.131234
	(0.082207 - 0.247249)***	(0.074955 - 0.239689)***	(0.049057 - 0.213411)***
53-56	0.146942	0.156582	0.143969
	(0.042820 - 0.251064)**	(0.052650 - 0.260515)**	(0.040299 - 0.247639)**
57-60	0.312312	0.362050	0.375171
	(0.186623 - 0.438001)***	(0.236559 - 0.487542)***	(0.249983 - 0.500360)***
61-64	0.465998	0.505794	0.554754
	(0.318216 - 0.613780)***	(0.358299 - 0.653289)***	(0.407552 - 0.701956)***
65-68	0.589380	0.618929	0.689405
	(0.419634 - 0.759127)***	(0.449545 - 0.788313)***	(0.520322 - 0.858487)***
69-72	0.596378	0.628784	0.712907
	(0.403714 - 0.789042)***	(0.436559 - 0.821009)***	(0.521027 - 0.904788)***
73-76	0.588561	0.619091	0.718594
	(0.372736 - 0.804386)***	(0.403767 - 0.834415)***	(0.503647 - 0.933540)***
77+	0.415948	0.462006	0.572077
	(0.170316 - 0.661580)***	(0.216942 - 0.707069)***	(0.327477 - 0.816676)***
Constant	7.531599	7.398290	6.358870
	(7.470868 - 7.592331)***	(7.317934 - 7.478645)***	(6.239577 - 6.478163)***
Observations	84345	84345	84345
Individuals	15816	15816	15816
R-squared	0.023198	0.031104	0.036440

Notes: Notes: *sociodemographic controls* include, marital status dummies, dummies for whether the marital status has changed during the last 3 months, a dummy for disability status, an unemployment dummy and the number of months being unemployed during the last 12 months. 90% confidence intervals in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Figure 1: Subjective Well-Being and Age: Pooled OLS Results (No Sociodemographic Controls)

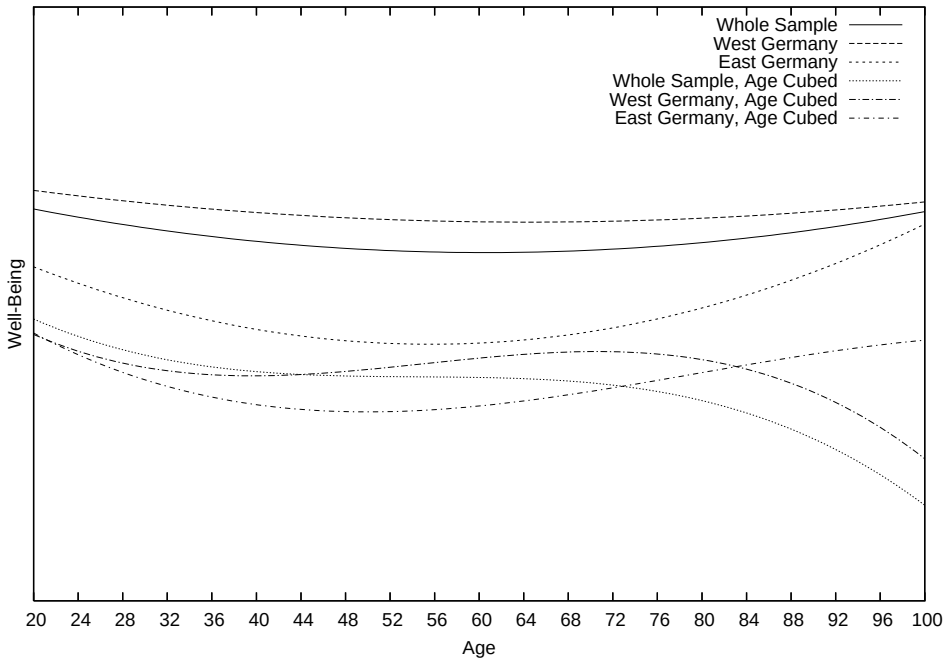

Figure 2: Subjective Well-Being and Age: Pooled OLS results (Including Sociodemographic Controls)

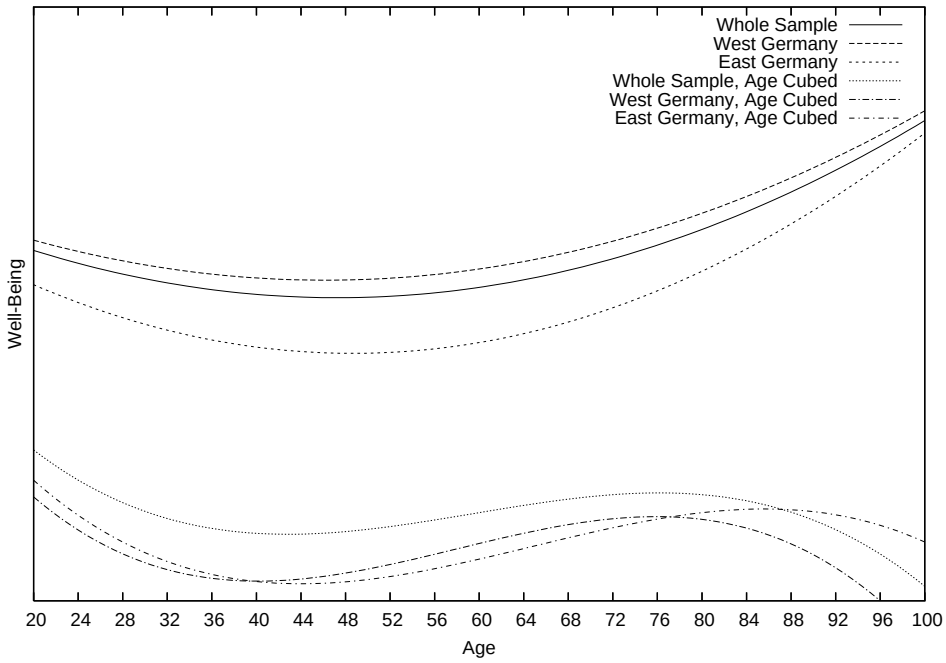

Figure 3: The Course of Age Category Dummy 25-28 over Time for a 20-Year-Old and a 25-Year-Old at Start

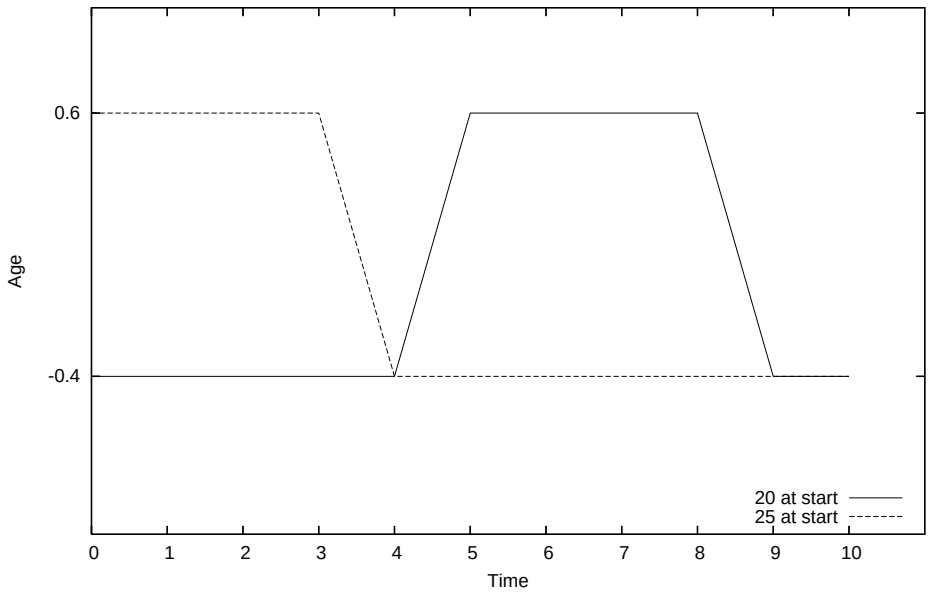

Figure 4: Subjective Well-Being and Age: Individual Fixed Effects Estimations

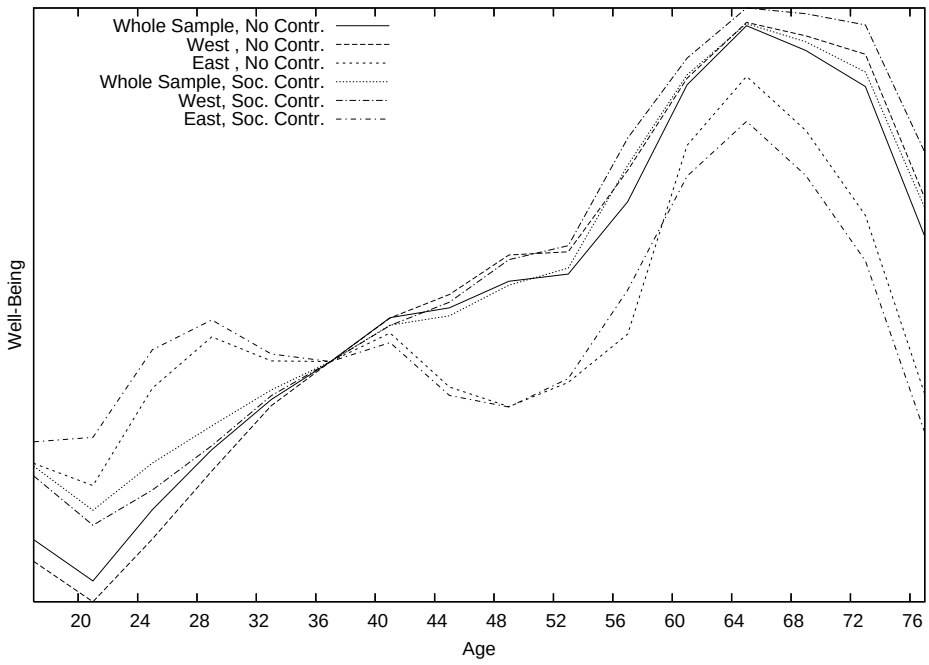

Figure 5: Subjective Well-Being and Age: Individual Fixed Effects Estimates from an Unweighted Balanced Panel

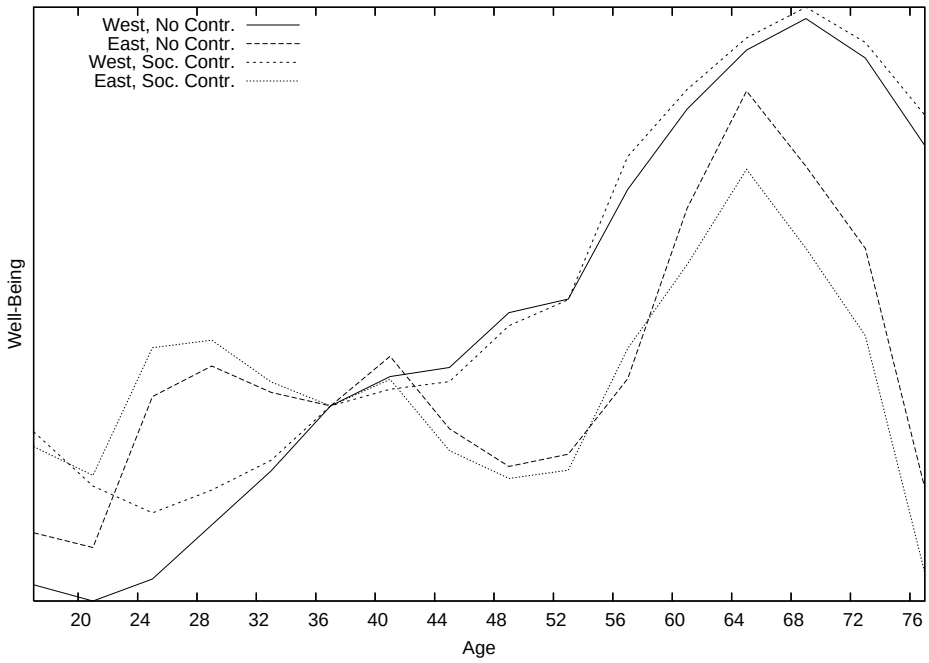

Figure 6: Subjective Well-Being and Age: Individual Fixed Effects Estimates from a Weighted Balanced Panel

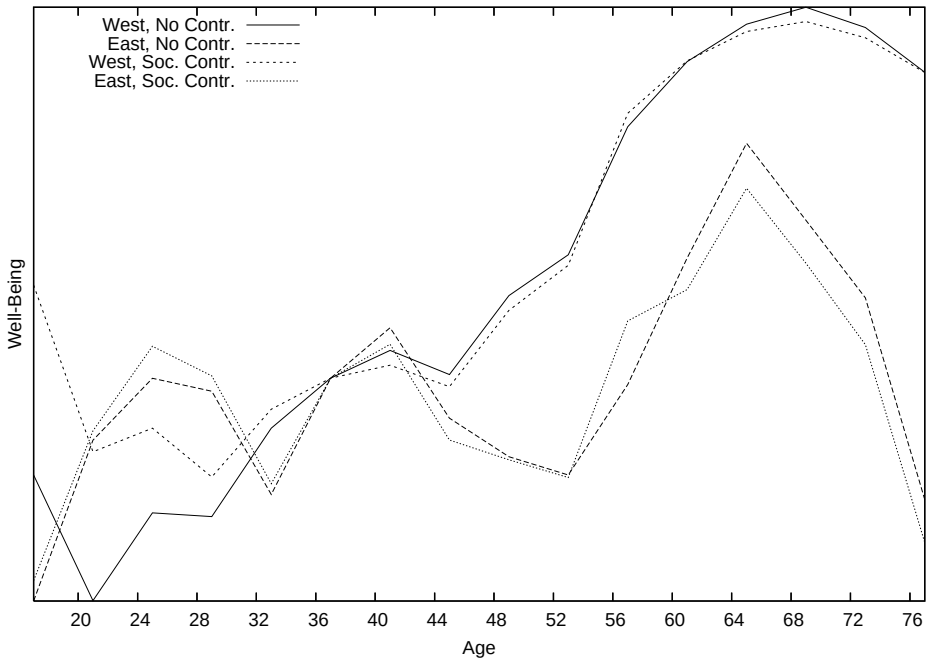

Figure 7: Distribution of Age in an Unbalanced Panel for West Germany

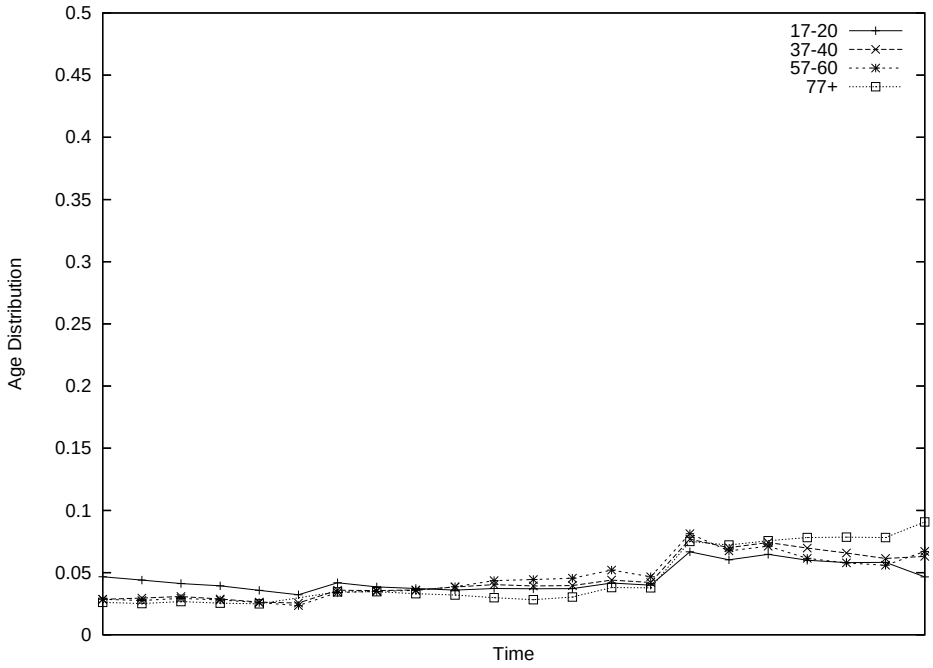

Figure 8: Distribution of Age in a Balanced Panel for West Germany

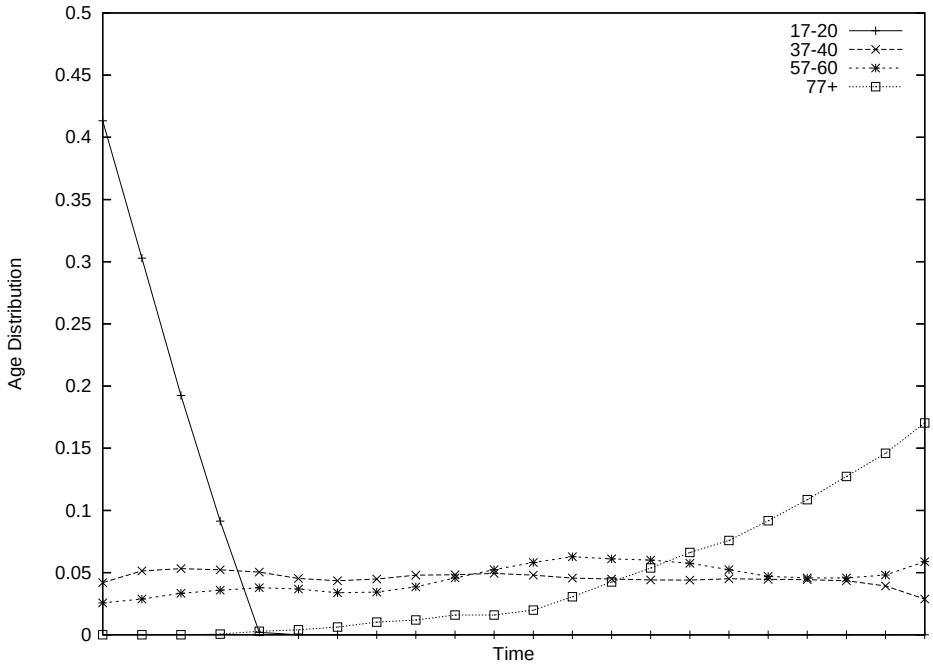

Figure 9: Subjective Well-Being and Age: a Further Investigation into the Role of Assets and Income

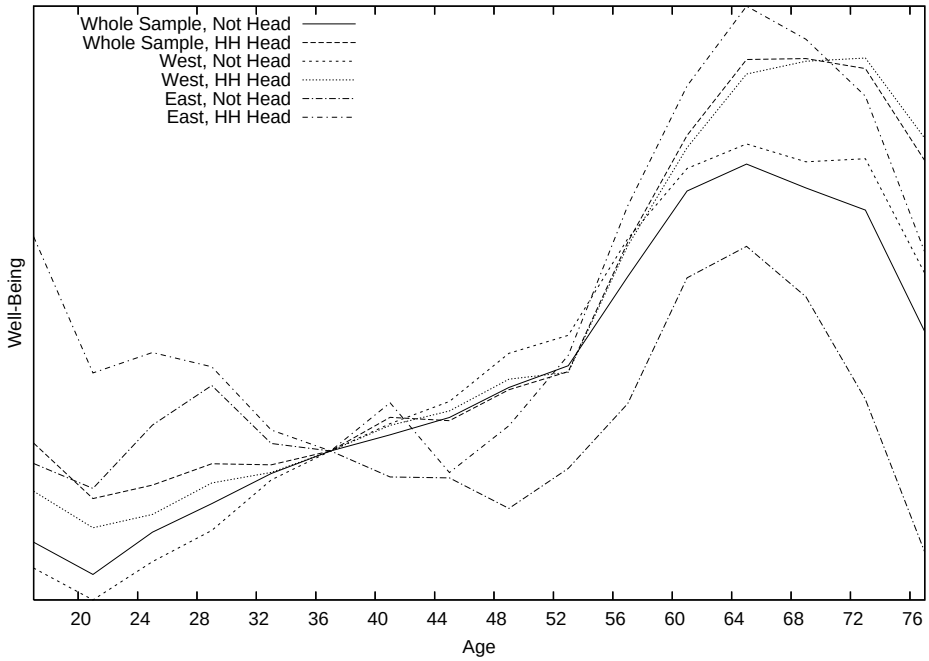

Figure 10: The Shape of *Fixed Birth Cohort effects* on Subjective Well-Being

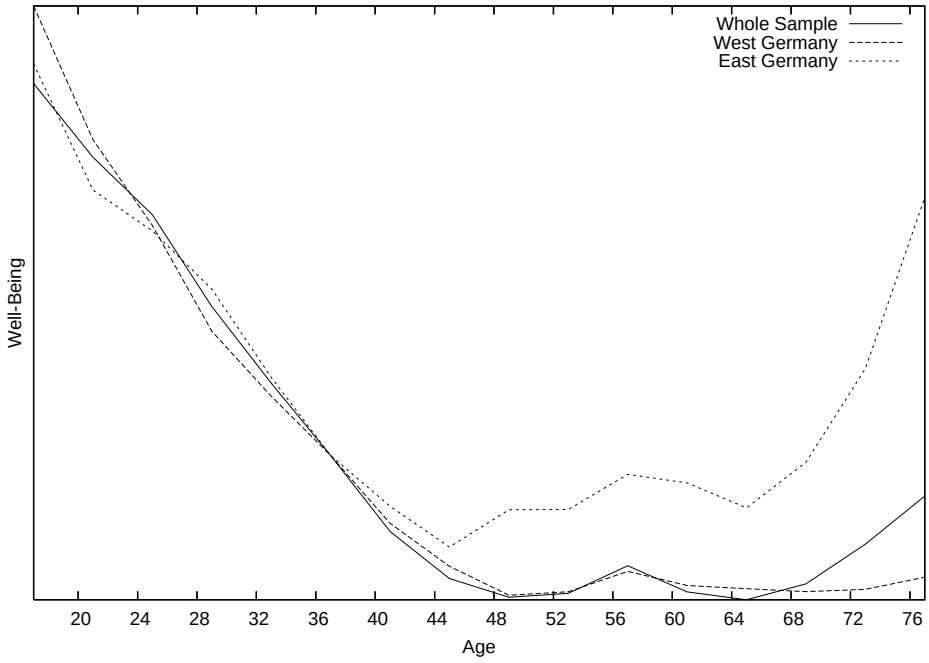
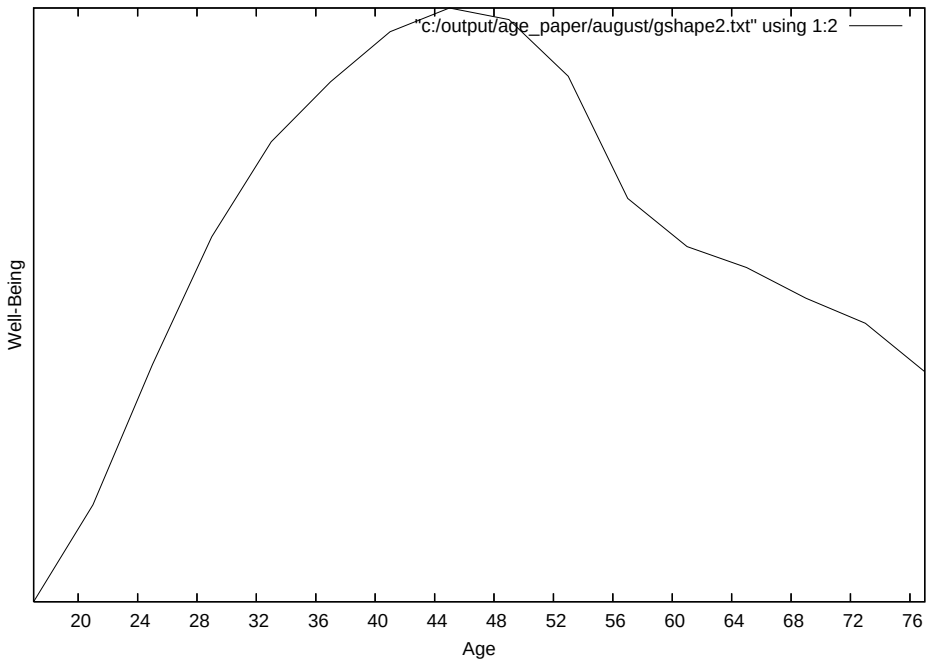
Figure 11: The Shape of *Material Well-Being Effects* on Subjective Well-Being