

Klemm, Marcus

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## You Don't Know What You've Got till It's Gone! Unemployment and Intertemporal Changes in Self- Reported Life Satisfaction

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on Multidisciplinary Panel Data Research

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Marcus Klemm

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German Socio-Economic Panel Study (SOEP)

DIW Berlin

Mohrenstrasse 58

10117 Berlin, Germany

Contact: Uta Rahmann | [soeppapers@diw.de](mailto:soeppapers@diw.de)

# You don't know what you've got till it's gone! Unemployment and intertemporal changes in self-reported life satisfaction

Marcus Klemm

Ruhr Graduate School in Economics  
and  
Ruhr-University Bochum\*

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## Abstract

This paper uses concurrently and – for the first time – retrospectively reported life satisfaction from the 1984 to 1987 waves of the German Socio-Economic Panel to study the importance of different comparison standards for the empirical correlation of unemployment and subjective life satisfaction. It is found that unemployed individuals do not only report significantly lower concurrent satisfaction, but also recall reduced satisfaction from past unemployment well, and retrospectively upgrade their past satisfaction scores. Therefore, the short-term negative effects of unemployment on individual life satisfaction reported in the literature so far are likely underestimated. At the same time, the empirical findings cast doubts on the usefulness of subjective life satisfaction for the precise quantification of welfare effects because of changing comparison standards which greatly limit the intertemporal comparability of the data. For this reason, such data also appear to be of limited use for monitoring long-term economic or social development.

*Keywords:* life satisfaction; well-being; unemployment; longitudinal and retrospective studies

*JEL classification:* C23, C81, I31, J64

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# 1 Introduction

Over the last 10 to 20 years, economists have become increasingly interested in the study of individual life satisfaction, subjective well-being or happiness (Frey and Stutzer 2002, Di Tella and MacCulloch 2006). This strand of empirical research has contributed to a better understanding of many economic aspects of life, in particular with regard to the relationship between labor market outcomes and individual well-being. In particular, Clark and Oswald (1994), Gerlach and Stephan (1996), Carroll (2007), Winkelmann and Winkelmann (1998), and Kassenböhmer and Haisken-DeNew (2009) all show that – after controlling for income – unemployment is strongly negatively related to individual life satisfaction, and conclude that unemployment has very high non-pecuniary costs in addition to the associated income loss. Dolan et al. (2008) provide an extensive review of the economic literature on subjective well-being and its determinants since 1990. All of their reviewed articles that address unemployment agree on a detrimental effect of unemployment on life satisfaction.

The paper at hand contributes to the literature on individual well-being and unemployment in two ways. First, I use individual-level panel data including concurrent as well as – for the first time – retrospective life satisfaction to investigate the importance of different comparison standards for the empirical correlation of unemployment and life satisfaction. I find that individuals who become unemployed do not only report lower concurrent satisfaction scores, but also recall reduced satisfaction from past unemployment well and retrospectively upgrade their past satisfaction scores. Therefore, it seems likely that the negative correlation between unemployment and individual life satisfaction reported in the literature so far has been underestimated. Second, the paper addresses the methodological issue of intertemporal comparability of life satisfaction scores which has been considered as exogenous by most researchers. The empirical findings suggest that changes in the employment status largely distort the intertemporal evaluations of personal well-being, casting doubts on a general validity of subjective life satisfaction data for longitudinal studies.

Psychologists and sociologists have studied life satisfaction, subjective well-being or happiness<sup>1</sup> for a long time. In contrast, economists have been reluctant to use this self-reported information of individuals for good reasons. Traditionally, economists rather inferred utility from objectively observable choices (*revealed preferences*) than from subjectively reported information (*stated preferences*). Their skepticism comes from the belief that subjective data carry very low informational content. Bertrand and Mullainathan (2001) discuss the cognitive skills of survey participants, the strategic nature of answers given and the inconsistency of respondents' opinions as potential problems associated with such data. They conclude that because of these critical issues, subjective data are not useful as dependent variables, but can be useful as explanatory variables.

While the use of self-reported life satisfaction in empirical research must always be seen very critically, and results must be interpreted with due diligence, there are good reasons to believe that this research can deliver meaningful insights, and offer ways to test economic theories or to advise public policy (Stutzer and Frey 2010). Advocates of the use of this data believe that in the end, individuals are the best judges of their own level of life satisfaction. Frey and Stutzer (2002), Di Tella and MacCulloch (2006), and Diener (2009) all provide evidence from previous research on the significant informational value of life satisfaction data. Most importantly, it has been shown that self-reported life satisfaction corresponds well to other variables that are related to individual well-being, actual decision behavior, emotional expressions, ratings by other persons or brain activity (see also Clark et al. 2008b).<sup>2</sup>

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<sup>1</sup>The terms life satisfaction, well-being and happiness are used interchangeably here. They can be considered as different concepts in that individual well-being comprises the affective component happiness and the cognitive component life satisfaction (see, e.g., Dubé et al. 1998)

<sup>2</sup>The informational value first and foremost refers to *contrasts* in well-being across persons or time. It should not be regarded as an approximation of the *level* of well-being.

Still, empirical research based on subjective life satisfaction relies on very critical assumptions. So far, researchers have mainly investigated the assumptions of interpersonal comparability and of cardinality of the data.<sup>3</sup> Ferrer-i-Carbonell and Frijters (2004) argue that treating the data as cardinal or ordinal does not change the results of empirical estimations substantially, but that unobserved heterogeneity across individuals must be accounted for. As a consequence, current research accounts for unobserved time-invariant individual factors by using linear fixed-effects or non-linear fixed effects regression models (e.g., Kassenböhmer and Haisken-DeNew 2009, Clark et al. 2009, Boes and Winkelmann 2010, Geishecker and Riedl 2010, Baetschmann et al. 2011).

Another highly critical assumption has not been thoroughly investigated yet: the intertemporal comparability of self-reported life satisfaction. That is, a reported satisfaction score at one point in time is assumed to refer to the same “true” level of well-being as the same satisfaction score reported by the same individual at a different point in time. This assumption is critical, in particular in the context of panel studies where individuals are followed over time. For instance, researchers have frequently discussed adaptation and habituation of individuals to changes in life circumstances over time, in particular with regard to income (e.g., Clark et al. 2008b, Di Tella et al. 2010), but also regarding unemployment (Clark et al. 2008a). Adaptation and habituation are typically meant to refer to the “true” well-being of individuals. But if people rescaled their satisfaction scores over time, adaptation and habituation would only be observed with regard to their reported well-being and the informational content of these data would be greatly reduced. Against this background of “response shift” phenomena (Schwartz and Sprangers 1999), this paper investigates the intertemporal comparability of self-reported life satisfaction explicitly by comparing within-person variation in life satisfaction over time obtained from concurrent and retrospective accounts. Addressing the intertemporal comparability of life satisfaction scores is not only important from a methodological point of view, but may also be relevant for policy-makers who aim to improve people’s living conditions, and thus have an interest in monitoring economic and social developments over time (CMEPSP 2010, CAE-SVR 2010).

The remainder of the paper is organized as follows. Section 2 discusses the measurement of concurrent and retrospective life satisfaction and presents the corresponding data. Section 3 compares the results of fixed-effects life satisfaction regressions that differ only with regard to the identification of intertemporal changes in the dependent variable. Section 4 then focuses on retrospectively reported life satisfaction in order to gain insights into the differences presented in section 3. The last section concludes.

## 2 Concurrently vs. retrospectively reported life satisfaction

Empirical research on subjective life satisfaction has become popular despite being based on strong assumptions. Ferrer-i-Carbonell and Frijters (2004) name three general assumptions that underlie empirical studies on life satisfaction: (1) satisfaction is a valid proxy for individual welfare, (2) satisfaction is interpersonally ordinally comparable, and (3) satisfaction is interpersonally cardinally comparable. In addition, Stutzer and Frey (2010) discuss the inclusiveness of satisfaction measures, i.e., these measures are assumed to provide a broader picture of individual well-being. Addressing related questions, Pavot and Diener (1993) name reasonable stability of well-being levels over time as one fundamental assumption.<sup>4</sup> On top of these general assumptions, the empirical estimation results are prone to purely random measurement error that leads to attenuation bias, as well as systematic measurement error that leads

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<sup>3</sup>Empirical studies typically employ ordinal single-item measures are used, i.e., individuals answer to questions like “How satisfied are you?” or “Do you feel happy?” The answers are given on unipolar (“no”, “somewhat”, “very much”) or bipolar (“very bad” to “very good”) scales. Often the response scales consist of numerical values (Likert scales).

<sup>4</sup>Pavot and Diener (1993) further assume that individuals are able to remember their long-term level of well-being, and consciously base their reported well-being scores on this information.

to biased regression coefficients. The increasing amount of empirical work in this particular research area suggests that more and more researchers believe that these assumptions are either valid or can be adequately dealt with.

So far, another general assumption has not been addressed explicitly yet: self-reported life satisfaction is intrapersonally intertemporally comparable.<sup>5</sup> That is, a satisfaction score reported by an individual at a certain point in time corresponds to the same satisfaction score reported by the same individual at a different point in time. Schwartz and Sprangers (1999) stress that the assumption of stable individual evaluation standards is fundamental for the longitudinal analysis of individual well-being. However, this assumption might not be valid in many cases. For instance, individuals might recalibrate their personal well-being scales, redefine the importance of different factors for their overall well-being, or even entirely change their personal well-being concept (Schwartz and Sprangers 1999). Not accounting for time-varying evaluation standards most likely creates unobserved heterogeneity biases in empirical studies.

Addressing such “response shift” phenomena is particularly important in the context of fixed effects panel estimation which has become the state-of-the-art empirical strategy since Ferrer-i-Carbonell and Frijters (2004). In these estimation models, only within-person variation of the individual life satisfaction and the explanatory variables is used in order to account for time-invariant unobserved heterogeneity across individuals that could bias estimation results (e.g., personality traits). The interpretation of the empirical results then strongly depends on the assumption that the life satisfaction scores reported in different years are based on the same evaluation standards, i.e., the same scale. For instance, Clark et al. (2008a) argue that people return after some time to their original level of well-being following certain life events like getting married, getting divorced or having a child, but do not adapt to unemployment.<sup>6</sup> In contrast, Wunder and Schwarze (2010) argue that people adapt quickly to changes in living conditions by changing their evaluation standards which greatly reduces the informational value of life satisfaction scores. With panel data alone, it remains impossible to discover whether individuals return to an earlier “true” level of life satisfaction, or whether they change their reference system and report the same earlier satisfaction score but at a different “true” satisfaction level.

The German Socio-Economic Panel (GSOEP) offers individual-level data that can be used to address this issue more directly (see Haisken-DeNew and Frick 2005, for a detailed description of the GSOEP).<sup>7</sup> The GSOEP is a longitudinal survey that started in 1984. Since then, a typical question on life satisfaction has been surveyed each year. This question reads as follows: “*And finally, we would like to ask you about your satisfaction with your life in general. Please answer by using the following scale, in which 0 means totally unhappy, and 10 means totally happy. How happy are you at present with your life as a whole?*” In the following, the answers to this question are called “concurrent satisfaction”  $CS_{it}$ , i.e., life satisfaction of individual  $i$  in year  $t$  as reported in year  $t$ . In the first four waves of the GSOEP until 1987, the question that directly followed was: “*How happy were you a year ago with your life?*” The answers to this question are called “retrospective satisfaction”  $RS_{it}$ , i.e., life satisfaction in year  $t$  as reported in year  $t + 1$ .<sup>8</sup>

The variables measuring concurrent and retrospective life satisfaction  $CS_{it}$  and  $RS_{it}$  permit the calcu-

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<sup>5</sup>Di Tella and MacCulloch (2006) note that individuals might redefine their satisfaction scores over time, but discard this possibility based on aggregate data.

<sup>6</sup>The view that regardless of living conditions, people always return to a personal innate level of well-being is known as the “hedonic treadmill” (Brickman and Campbell 1971).

<sup>7</sup>The data was made available by the German Institute for Economic Research (DIW), Berlin (see Wagner et al. 2007, for an overview of the dataset).

<sup>8</sup>To my knowledge, there are no studies that use this information, or retrospective information on life satisfaction 10 years ago that is available in the GSOEP for the years 1999, 2000 and 2009. In contrast, GSOEP data on expectations about future life satisfaction have been used by, e.g., Frijters et al. (2009) or Schwandt (2009).

lation of annual differences in life satisfaction in two different ways:

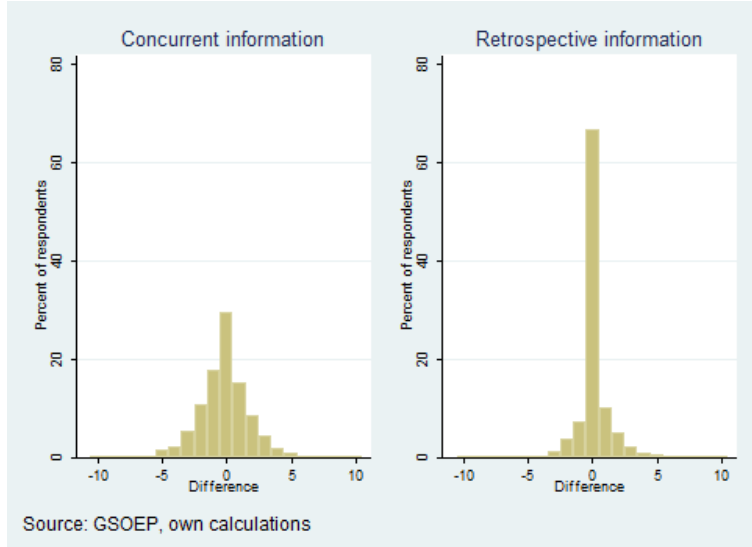
$$\Delta CS_{it} = CS_{it} - CS_{it-1}, \quad (1)$$

$$\Delta RS_{it} = CS_{it} - RS_{it-1}. \quad (2)$$

The first alternative describes what most of the empirical research on life satisfaction with micro-level panel data is based on. Since the information that is used to identify changes in life satisfaction over time comes from different points in time, it is possible that the reference system for the evaluation of life satisfaction changes between  $t-1$  and  $t$ . The second alternative uses retrospective information to identify the intertemporal change in well-being, i.e., they are elicited directly from the survey respondents. Since the information is reported at the same point in time  $t$ , one can confidently assume that the evaluation standards do not differ significantly.

Figure 1 presents histograms for these two intertemporal differences.<sup>9</sup> Two main aspects stand out: First, a much larger fraction of respondents reports that life satisfaction has not changed since last year when retrospective information is used. Consequently, variation is much smaller in this case:  $sd_{\Delta RS_{it}} = 1.34$  versus  $sd_{\Delta CS_{it}} = 2.02$ . The same observation is made when looking at the correlations of the satisfaction measures:  $corr(CS_{it}, RS_{it-1}) = 0.77$  versus  $corr(CS_{it}, CS_{it-1}) = 0.47$ . Second, with concurrent satisfaction, a larger fraction of respondents reports to be worse off (38%) than better off (32%), i.e., life satisfaction on average declines over time. In contrast, with retrospective satisfaction more respondents report to be better off (20%) than worse off (14%), i.e., life satisfaction increases on average. The hypotheses that  $\Delta RS_{it} = 0$  or  $\Delta CS_{it} = 0$  are strongly rejected at every conventional significance level.

FIGURE 1: Annual change in self-reported life satisfaction, 1984 - 1987



The average difference in life satisfaction at the reference point in time amounts to  $\frac{1}{N} \sum_{i=1}^N (RS_{it} - CS_{it}) = -0.23$ . That is, in retrospect, individuals downgrade their past life satisfaction. The hypothesis that  $RS_{it} = CS_{it}$  is also strongly rejected, i.e., there is a significant difference between concurrently and retrospectively reported life satisfaction.

The most important difference between  $\Delta CS_{it}$  and  $\Delta RS_{it}$  is most probably a difference in comparison standards. Hagerty (2003) reports the findings from a meta-analysis of 71 (cross-sectional) empirical studies on the intertemporal change in life satisfaction and finds that while people say that they themselves are more satisfied now than in the past, it is believed that – on average – people are worse off now, which

<sup>9</sup>The differences are calculated for the sample of individuals that is used for the empirical analysis in sections 3 and 4. The construction of the sample is described in the next section.



is in line with the pattern of Figure 1. He argues that only 10% of the individual evaluation of concurrent life satisfaction is based on the own past, while 90% is based on current mood and emotions, future aspirations, and comparisons with other people (see also Frey and Stutzer 2002).

Dubé et al. (1998) differentiate between social, temporal and telic comparisons. Social comparisons refer to people comparing themselves to other people, either similar or different (e.g., less or more fortunate). Temporal comparisons refer to people comparing their current situation to that at a different point in time (past or future). Telic comparisons refer to people comparing their current living conditions to their aims and aspirations (see Dubé et al. 1998, for a detailed discussion of comparison standards). McBride (2010) and Barr (2010) provide first experimental evidence of the importance of expectations, social comparisons and past experience for the relationship between monetary payoffs and reported satisfaction. Concerning the two satisfaction measures used here, it seems reasonable to assume that  $\Delta RS_{it}$  places relatively more weight on within-person temporal comparisons because this comparison standard is explicitly evoked in the question. Social and telic comparison standards should be very similar because  $CS_{it}$  and  $RS_{it-1}$  are reported at the same point in time. In contrast,  $CS_{it}$  and  $CS_{it-1}$  are reported at different points in time which makes it possible that social, temporal and telic comparison standards are different. However, Dubé et al. (1998), Steffel and Oppenheimer (2009), and Senik (2009) all report that intrapersonal are more important than interpersonal comparisons, which should limit the difference between  $\Delta CS_{it}$  and  $\Delta RS_{it}$ .<sup>10</sup>

The recall period constitutes another important difference. The reliability of retrospectively reported life satisfaction depends critically on individuals being able to remember their past well-being one year ago. Manzonni et al. (2011) provide a thorough discussion of prospective and retrospective survey design, and issues related to memory biases and recall period. From their discussion, one can conclude that despite its potential shortcomings, retrospective information provides a valuable addition to data obtained from prospective panel studies. Gibson and Kim (2010) note that especially long-term retrospective recall poses a serious problem to data accuracy, and Hagerty (2003) suggests that recall becomes difficult after 5 years. Therefore, a time horizon of one year does not seem too problematic, in particular because the last interview can serve as an anchor for the respondents. Powers et al. (1978) show that the problem of recall error is less severe when correlations between variables are considered, which is the focus of this paper in the next two sections.

Krueger and Schkade (2008) show that reliability measures are lower for satisfaction measures than for more clear-cut microeconomic data, e.g., income, but large enough to lend support to their use in empirical research. They report a correlation of life satisfaction measured two weeks apart of 0.6, and present test-retest correlations from other studies ranging from 0.4 for single-item measures to 0.8 for multiple-item measures (see also Pavot and Diener 1993). Here, the correlation between  $CS_{it-1}$  and  $RS_{it-1}$  measured approximately one year apart amounts to 0.5. While this correlation clearly does not represent a test-retest reliability, it suggests that, together with the correlations between  $CS_{it}$ ,  $CS_{it-1}$  and  $RS_{it-1}$  reported above, a significant degree of stability in life satisfaction exists, and that retrospectively reported satisfaction indeed captures a significant part of the variation in past well-being. In addition, it might be particularly useful in the case of subjective life satisfaction because the influence of mood and affect at the time of the interview is reduced (assuming that such influences are only short-lived and easily forgotten).

Another advantage of identifying intertemporal changes in life satisfaction from retrospective accounts is that basically any change in well-being can be detected. Di Tella and MacCulloch (2006) note that the use of concurrent life satisfaction for intertemporal comparisons could be limited because scores cannot

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<sup>10</sup>Dubé et al. (1998) also find that young, but not older adults mainly use telic comparisons. Steffel and Oppenheimer (2009) report that individuals who use social comparisons report being happier. Senik (2009) concludes that under-performing the comparison standard has larger effects on satisfaction than over-performing.

fall or rise any further once they reach the top or the bottom of the scale. This could be critical if – as in the GSOEP data – responses are clustered at relatively high values.<sup>11</sup> In this case, changes in living conditions might have asymmetric effects on (reported) life satisfaction (Boes and Winkelmann 2010). If individuals were the best judges of their own well-being as believed by the advocates of the use of data on subjective life satisfaction (see Frey and Stutzer 2002), it would follow naturally that individuals would also be the best judges of changes in their own well-being, at least within shorter time periods.

### 3 Differences in life satisfaction regression results

Neither the use of concurrent nor of retrospective data can generally be seen as the better choice for identifying intertemporal changes in life satisfaction because the two measures relate to different concepts. With regard to measures of emotions in general (incl. subjective well-being and life satisfaction), Larsen and Fredrickson (1999) stress that no single measure can be seen as the “gold standard”, and that – if possible – multiple measures should be used to increase confidence in the obtained results. Pavot and Diener (1993) argue in the same direction based on the finding that multiple-item measures of well-being display a slightly higher reliability than single-item measures. Therefore, both variables should be used in empirical research on life satisfaction if available.

The important question is if the choice for identifying intertemporal variations in life satisfaction matters for the estimation results of life satisfaction regressions. Congruence of results would increase confidence in the reliability of the findings obtained from life satisfaction research so far. Divergence of results would increase concerns about reliability and call for more research to investigate the reasons for these differences. From the discussion of section 2, these reasons could include different comparison standards, recall ability, or ex-post re-evaluation of past life satisfaction. However, it remains unclear in which direction particular results should diverge. For instance, random recall error would very likely lead to an attenuation bias when retrospective data is used, whereas a relatively stronger intertemporal comparison standard would likely reduce adaptation effects and could hence lead to stronger correlations. For instance, if unemployment was negatively correlated with both an individual’s life satisfaction and her reference point of the best living conditions imaginable, the correlation between unemployment and life satisfaction should be downward biased in absolute size for concurrent compared to retrospective data because the change of the comparison standard cannot be accounted for.

In order to investigate possible differences in estimation results, life satisfaction  $S_{it}$  of individual  $i$  at time  $t$  is regressed on a standard set of explanatory variables  $X_{it}$ . The general regression model can be written as

$$E(S_{it}|X_{it}) = f(X_{it}, \beta). \quad (3)$$

In order to control for time-invariant unobserved heterogeneity (e.g., personality traits), fixed effects models are estimated which is the standard approach in the literature. For ease of interpretation and because the assumption of cardinality of the life satisfaction measure does not appear to be critical (Ferrer-i-Carbonell and Frijters 2004), most of the discussion here focuses on the results from linear fixed effects models. In addition, results from non-linear “Blow-Up and Cluster”-estimations introduced by Baetschmann et al. (2011) are presented. This estimator improves upon earlier non-linear fixed effects models used for life satisfaction regressions (e.g., Ferrer-i-Carbonell and Frijters 2004, Kassenböhmer and Haisken-DeNew 2009) based on the conditional logit model of Chamberlain (1980).<sup>12</sup>

<sup>11</sup>In the sample studied here, more than 70% of respondents report a satisfaction value of 7 or higher on the 0 - 10 scale. Here, the sample average is 7.3 (see Table 1).

<sup>12</sup>Estimation results obtained from the regression model used by Kassenböhmer and Haisken-DeNew (2009) and from conditional logit estimations for being more or less satisfied than last year are reported in Tables A2 and A3 in the Appendix. The findings are robust to the choice of the estimation model. For completeness, Table A1 reports the results of random

The satisfaction measure  $S_{it}$  is either concurrent satisfaction  $CS_{it}$  as typically used in the literature, or “artificial” satisfaction  $AS_{it}$  which is constructed from concurrent and retrospective satisfaction data as follows: First,  $AS_{itj}$  is calculated by adding the retrospective changes in satisfaction  $\Delta RS_{it}$  to the concurrent life satisfaction score  $CS_{ij}$  from different base years  $j$ . Second,  $AS_{it}$  is calculated as the average “artificial” satisfaction score for year  $t$  over base years  $j$ . The measure is averaged over base years for descriptive purposes to reduce level differences that arise from using different base years. This procedure is irrelevant for the fixed effects estimations. For these, the important distinction is that the within-person variation in life satisfaction comes from “de-meaning” the data in the case of  $CS_{it}$ , and directly from the survey respondents in the case of  $AS_{it}$ .

$$AS_{it} = \frac{1}{J_i} \sum_j AS_{itj} \quad , \quad J_i \in \{1, 2, 3, 4\},$$

$$\text{with } AS_{itj} = \begin{cases} CS_{ij} - \sum_{k=1}^{j-t} \Delta RS_{j-k+1} & \text{if } t < j \\ CS_{it} & \text{if } t = j \\ CS_{ij} + \sum_{k=1}^{t-j} \Delta RS_{j+k} & \text{if } t > j \end{cases} \quad , \quad \forall t, j \in \{1984, \dots, 1987\}. \quad (4)$$

Table 1 shows that both satisfaction measures have – by construction – the same mean value of 7.26, but variation is slightly lower for the artificial satisfaction measure. In addition, the range of values is larger for the latter, particularly at the upper end of the distribution (-4.25 vs. 0, and 17 vs. 10).<sup>13</sup>

Table 1 also provides descriptive statistics for the standard explanatory variables  $X_{it}$  used in the regression analysis for my pooled sample. The specification is similar to those of, e.g., Ferrer-i-Carbonell and Frijters (2004) or Baetschmann et al. (2011).<sup>14</sup> It includes household income, which enters the regressions in logs, employment status, self-reported health status, and dummy variables for having a steady partner, children in the household and owning one’s home. In addition to these variables the regressions also include year dummies which, together with age and a quadratic of age, control for potentially different time trends of  $CS_{it}$  and  $AS_{it}$  as suggested by Figure 1.<sup>15</sup>

The potentially most critical assumption for the comparisons made here is that the retrospective satisfaction for year  $t$  reported by an individual in year  $t + 1$  matches the concurrently observed characteristics of that individual in the reference year  $t$ . Interviewees are asked to evaluate their life satisfaction “1 year ago”. In most cases, this time frame matches very well the time of the preceding interview. On average, 11.1 months lie between two interviews and for more than 90% of the interviews, this time period is between 9 and 15 months. Therefore, individuals have their last interviews as an “anchor” for the point in time they are supposed to remember.

The sample from the GSOEP waves of 1984 to 1987 that is used for the empirical analysis throughout this paper is constructed as follows: Only the working age population born between 1925 and 1965 (age 19 to 62) is included. Individuals in education (incl. vocational training) are classified as being employed, and pensioners as not working. There have to be at least two consecutive observations per person because only persons for whom potential differences in life satisfaction can be identified from concurrent and retrospective data at the same time are included. After excluding some observations

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effects linear and ordered logit regressions that do not control for unobserved heterogeneity although Hausman specification tests strongly reject the assumption of random effects.

<sup>13</sup>Theoretically, the boundaries of  $AS_{it}$  are -15 and 25. These would arise if at least one individual reported the most extreme opposite values for current and past life satisfaction in each year.

<sup>14</sup>Tables A6 and A7 in the Appendix report estimation results for different sets of explanatory variables. Except for the correlation of life satisfaction with the health variables, which is discussed in this section, all findings remain unchanged.

<sup>15</sup>Depending on the estimation model, only 1 or 2 year dummies are included because of collinearity with the age variable. Time and age effects cannot be disentangled in this setting. But the modeling of the time/age effect does not have a significant impact on the other correlations found (see last two columns Tables A6 and A7 in the Appendix).

with missing information on some of the variables used in the regression analysis (approximately 7% of all observations), the unbalanced panel comprises 27,139 observations of 7,342 individuals (20,337 observations of annual differences).<sup>16</sup>

TABLE 1: Descriptive statistics for the pooled sample, 1984 - 1987

	Mean	Std. dev.	Min	Max	Observations
Concurrent satisfaction	7.26	1.97	0.00	10.00	27,139
Lagged concurrent satisfaction	7.33	1.99	0.00	10.00	20,337
Retrospective satisfaction	7.09	1.95	0.00	10.00	20,337
Artificial satisfaction	7.26	1.83	-4.25	17.00	27,139
Female	0.50	0.50	0.00	1.00	27,139
Household equivalent income	1967	798	279	9470	27,139
Unemployed	0.05	0.21	0.00	1.00	27,139
Not working	0.22	0.41	0.00	1.00	27,139
Slightly hindered by health	0.24	0.43	0.00	1.00	27,139
Strongly hindered by health	0.08	0.27	0.00	1.00	27,139
Steady partner	0.75	0.43	0.00	1.00	27,139
Children in household	0.54	0.50	0.00	1.00	27,139
Homeowner	0.38	0.49	0.00	1.00	27,139
Months between interviews	11.11	1.47	5.00	21.00	27,139
Age	39.29	11.43	19.00	62.00	27,139

Notes: Number of observations differ for satisfaction measures due to different time periods.

Source: GSOEP, own calculations

Tables 2 and 3 report the results obtained for the classic concurrent and the new artificial life satisfaction measures  $CS_{it}$  and  $AS_{it}$  from the two different estimation models, carried out separately for males and females. The estimation results should not primarily be interpreted as causal relationships. The focus is on the comparison of the descriptive correlations obtained for the two different dependent variables.

Particular attention is paid to the employment status because the negative correlation between unemployment and well-being has become one of the main findings in this literature, suggesting that unemployment is involuntary in most cases (Clark and Oswald 1994, Gerlach and Stephan 1996, Winkelmann and Winkelmann 1998, Kassenböhmer and Haisken-DeNew 2009). In addition, unemployment – especially if involuntary or unexpected – could impact on individual evaluation standards for life satisfaction more than other – probably foreseen – life events like marriage, child birth or income changes. For instance, social norm effects can influence life satisfaction in different ways depending on the employment status (Clark et al. 2009). With regard to recall problems, Jürges (2007) finds that the ability to remember periods of unemployment correctly is positively related to the decline in satisfaction experienced. Akerlof and Yellen (1985) compare time-series of unemployment obtained from concurrent and retrospective information. The authors find that the ratio of recalled to official unemployment, which they interpret as a measure of the salience of unemployment, has declined substantially over time. However, they do not find significant differences between the two time-series for the core working population aged 25 to 54. Therefore, contrasting the results for  $CS_{it}$  and  $AS_{it}$  with regard to unemployment also appears to be reasonably valid.<sup>17</sup>

By and large, the estimation results do not differ much with regard to the choice of the dependent variable: Signs and statistical significance of the regression coefficients are identical for most variables, and the confidence intervals overlap. Acknowledging that self-reported measures of life satisfaction are subject to substantial noise, the comparison of the point estimates of the coefficients alone does not seem adequate. The results of the non-linear BUC-estimations are completely in line with the linear fixed effects estimations regarding sign, significance and trade-off ratios of the coefficients, which supports the finding of Ferrer-i-Carbonell and Frijters (2004) that treating the dependent variable as cardinal or

<sup>16</sup>The data used in this paper were extracted using the Add-On package PanelWhiz v3.0 (Nov 2010) for Stata. PanelWhiz was written by Prof. Dr. John P. Haisken-DeNew (john@panelwhiz.eu). The PanelWhiz generated do-file to retrieve the GSOEP data used here and any Panelwhiz plugins are available upon request. Any data or computational errors in this paper are my own. Haisken-DeNew and Hahn (2010) describe PanelWhiz in detail.

<sup>17</sup>From 1984 to 1987, Germany had a very stable economic environment with annual real GDP growth between 1.4% and 2.8%, and unemployment rates between 8.9% and 9.1%.

ordinal is not critical. Since the BUC-coefficients are not readily interpretable and marginal effects not meaningfully computable, the following discussion focuses exclusively on the linear models.

As usually found with panel data, income is positively related to life satisfaction (e.g., Frijters et al. 2004, Kassenböhmer and Haisken-DeNew 2009, Wunder and Schwarze 2010, Baetschmann et al. 2011). The estimated coefficients are almost identical for males and females, and slightly smaller when the intertemporal change in life satisfaction is reported by the individuals themselves, i.e., when the dependent variable is  $AS_{it}$ . While a relatively stronger intrapersonal intertemporal comparison could be expected to lead to the opposite finding because of less adaptation, recall problems likely lead to an attenuation bias when  $AS_{it}$  is used. It remains unclear how the overall net effect comes about. The next section aims at disentangling such different aspects. In any case, the congruence of the results obtained for two different measures establishes confidence in the finding that higher income, i.e., larger objective material well-being, is indeed positively related to subjective overall well-being.

TABLE 2: Results of different life satisfaction regressions - Males

<i>Estimation model:</i> Dependent variable:	<i>Linear FE</i>		<i>BUC</i>	
	$CS_{it}$	$AS_{it}$	$CS_{it}$	$AS_{it}$
Log household equivalent income	0.490*** (0.083)	0.393*** (0.074)	0.613*** (0.109)	0.664*** (0.143)
Unemployed	-0.964*** (0.132)	-1.260*** (0.127)	-0.888*** (0.134)	-1.770*** (0.186)
Not working	-0.336** (0.169)	-0.477*** (0.172)	-0.234 (0.191)	-0.360 (0.237)
Slightly hindered by health	-0.422*** (0.048)	-0.086** (0.040)	-0.549*** (0.064)	-0.190** (0.093)
Strongly hindered by health	-1.069*** (0.093)	-0.498*** (0.086)	-1.228*** (0.109)	-0.922*** (0.154)
Steady partner	0.440*** (0.110)	0.544*** (0.122)	0.564*** (0.141)	0.897*** (0.199)
Children in household	0.038 (0.077)	0.194** (0.078)	0.015 (0.106)	0.348** (0.158)
Homeowner	-0.135 (0.097)	-0.130 (0.104)	-0.130 (0.137)	-0.226 (0.224)
Months between interviews	-0.017 (0.013)	-0.015 (0.014)	-0.024 (0.019)	-0.035 (0.031)
Age	-0.037 (0.055)	0.303*** (0.052)	-0.046 (0.077)	0.677*** (0.122)
Age squared (/100)	-0.176*** (0.057)	-0.298*** (0.055)	-0.255*** (0.078)	-0.619*** (0.137)
Year dummies	Yes	Yes	Yes	Yes
Within/Pseudo R2	0.055	0.069	0.051	0.097
Model p-value	0.000	0.000	0.000	0.000
Observations	13,578	13,578	34,442	19,481
Individuals	3,677	3,677	3,357	2,058

Notes: Table reports coefficients from linear fixed effects and BUC estimations (Baetschmann et al. 2011). The dependent variable is either concurrent satisfaction, or artificial satisfaction based on concurrent and retrospective information. Std. errors in parentheses are adjusted for clustering on individuals. Significance levels: \*10% \*\*5% \*\*\*1%

Source: GSOEP, own calculations

The most diverging results in terms of coefficient size are found for employment and health status, and most likely for quite different reasons. For men only, being unemployed or not working is much more negatively related to life satisfaction for  $AS_{it}$  than for  $CS_{it}$ . The point estimates differ by approximately 30%, and the confidence intervals do not overlap. For illustration, the compensating variation for the non-pecuniary costs of unemployment (as calculated by Kassenböhmer and Haisken-DeNew 2009) would amount to  $0.964/0.49 = 1.97$  log points of income in the case of  $CS_{it}$  and to  $1.26/0.393 = 3.21$  log points in the case of  $AS_{it}$ . With such a large difference of more than 50%, it seems unlikely that non-pecuniary costs of unemployment can be identified reliably in this way. However, the general result of unemployment lowering individual well-being is strongly supported by the analysis presented here. In fact, it can be argued that the negative correlations reported in the literature have even been underestimated to some extent. For women, the negative association between unemployment and life satisfaction is weaker. Not working is not significantly correlated with reported well-being. For both variables, no differences are found concerning the choice of the dependent variable. This indicates that labor market status has a

TABLE 3: Results of different life satisfaction regressions - Females

<i>Estimation model:</i> Dependent variable:	<i>Linear FE</i>		<i>BUC</i>	
	<i>CS<sub>it</sub></i>	<i>AS<sub>it</sub></i>	<i>CS<sub>it</sub></i>	<i>AS<sub>it</sub></i>
Log household equivalent income	0.430*** (0.084)	0.362*** (0.088)	0.496*** (0.102)	0.609*** (0.141)
Unemployed	-0.495*** (0.110)	-0.492*** (0.108)	-0.581*** (0.128)	-0.918*** (0.171)
Not working	-0.090 (0.073)	-0.082 (0.071)	-0.137 (0.093)	-0.168 (0.138)
Slightly hindered by health	-0.340*** (0.045)	-0.101*** (0.036)	-0.435*** (0.058)	-0.241*** (0.079)
Strongly hindered by health	-0.798*** (0.089)	-0.356*** (0.075)	-0.886*** (0.100)	-0.703*** (0.142)
Steady partner	0.205* (0.119)	0.220 (0.143)	0.212 (0.146)	0.329* (0.170)
Children in household	0.038 (0.075)	-0.013 (0.077)	0.015 (0.102)	0.050 (0.153)
Homeowner	0.052 (0.093)	-0.052 (0.119)	0.036 (0.126)	-0.070 (0.197)
Months between interviews	-0.022 (0.014)	-0.031** (0.015)	-0.029 (0.018)	-0.060* (0.031)
Age	-0.247*** (0.059)	0.448*** (0.059)	-0.309*** (0.078)	0.815*** (0.124)
Age squared (/100)	0.044 (0.060)	-0.450*** (0.065)	0.040 (0.080)	-0.747*** (0.145)
Year dummies	Yes	Yes	Yes	Yes
Within/Pseudo R2	0.034	0.043	0.034	0.076
Model p-value	0.000	0.000	0.000	0.000
Observations	13,561	13,561	35,884	21,461
Individuals	3,665	3,665	3,351	2,122

Notes: Table reports coefficients from linear fixed effects and BUC estimations (Baetschmann et al. 2011). The dependent variable is either concurrent satisfaction, or artificial satisfaction based on concurrent and retrospective information. Std. errors in parentheses are adjusted for clustering on individuals. Significance levels: \*10% \*\*5% \*\*\*1%  
Source: GSOEP, own calculations

more important role to play in explaining the well-being of men than that of women.

For both women and men, the negative correlation between health status and life satisfaction is greatly reduced by about 50% when  $AS_{it}$  is used. This divergence arises because health as well as life satisfaction are self-reported measures. Subjective health status is employed here to show how current mood and affect influence reports of life satisfaction. A large fraction of the correlation found between subjective measures reported at the same time is very short-lived, and not recalled one year later. When more objective health indicators are used, e.g., the number of doctor visits or the number of nights stayed in a hospital, the results for the two different dependent variables turn out to be congruent again (see Tables A6 and A7 in the Appendix). More importantly, the estimated coefficients of the other variables are not sensitive to the choice of the health measures. This raises confidence in the reliability of the estimated correlations from concurrent as well as retrospective information, as argued by Powers et al. (1978).

Another recurrent finding from the happiness literature is that having a steady partner is positively related to life satisfaction.<sup>18</sup> Here, this is found to be strongly the case for men, but less pronounced for women. The estimated coefficients do not differ much with regard to the chosen dependent variable. Concerning children, a significant positive correlation with life satisfaction is found for men, and also for women when the number of children is used as the explanatory variable (see Table A7 in the Appendix). This finding is in contrast to much of the existing empirical evidence that rather dismisses the view that children increase parental well-being (see, e.g., Clark et al. 2008a). It suggests that major family changes, which are likely foreseen in many cases, could lead to changes in the global evaluation of life satisfaction, i.e., to different social and telic comparison standards. If asked explicitly to compare their life satisfaction development over time, individuals with children report to be more satisfied than before having (more) children. Owning a home is not significantly related to life satisfaction in any specification.

As noted above, age and time effects cannot be disentangled here. It appears that the combined effect is quite different for  $CS_{it}$  and  $AS_{it}$ , which Figure 1 indicates, too. However, the precise modeling of these

<sup>18</sup>Here, steady partner refers to married individuals and individuals who live in one household with their steady partner.

trends does not affect the estimation results as can be seen from Tables A6 and A7 in the Appendix which show that none of the discussed correlations change when age and age squared are excluded from the regressions. Concerning the time between interviews (the recall period for  $AS_{it}$ ), no significant relationship with life satisfaction is found for men and for the purely concurrent dependent variable  $CS_{it}$ . For women, the number of months between interviews is negatively correlated with life satisfaction.<sup>19</sup>

The empirical findings are robust to a number of sensitivity checks reported in the Appendix. These include different definitions of the dependent variables (Tables A2 and A3), different definitions of the estimation samples (Tables A4 and A5), and different sets of covariates (Tables A6 and A7), some of which have already been discussed. The results for the two different ways of identifying intertemporal changes in life satisfaction diverge more when positive and negative changes in life satisfaction are studied separately, which indicates that positive and negative changes in life satisfaction are not necessarily opposite outcomes of the same underlying satisfaction concept (Boes and Winkelmann 2010), or that the 0 to 10-scale of life satisfaction creates reporting biases (Di Tella and MacCulloch 2006). Excluding the very first wave of the GSOEP from the sample has the largest, but still unsubstantial impact on the empirical findings. Nevertheless, this suggests that individuals might need some practice to get acquainted with these questions. Restricting the sample to a balanced panel, to individuals with life satisfaction changes in both  $CS_{it}$  and  $AS_{it}$ , or to individuals with no annual changes larger than 5 points in either  $CS_{it}$  or  $AS_{it}$  leaves the empirical findings virtually unchanged. The same is true for changes in the set of the explanatory variables.

## 4 Recall and update of past life satisfaction scores

Apart from investigating if the results of multivariate life satisfaction regressions are sensitive to the choice of identifying within-person changes in life satisfaction over time from longitudinal or retrospective data, the data also allow an investigation of how individuals form their individual reports of life satisfaction. In particular, it can be investigated to what degree contemporaneous correlations between life satisfaction and explanatory variables fade out over time, and to what degree current life circumstances impact on the evaluation of past well-being. The first aspect is related to recall issues, the latter to ex-post updating. And both are related to the immediate influence of current mood or affect on reported well-being. While it is not possible to disentangle all of these effects completely, the following analysis provides some first insights.

To this end, retrospective life satisfaction  $RS_{it}$  is regressed on different sets of the explanatory variables used in section 3. In order to disentangle recall and updating effects,  $RS_{it}$  is regressed on covariates from the reference period  $t$  as well as on the same covariates from the reporting period  $t + 1$ .<sup>20</sup> In order to control for the influence of current mood and other unobserved influences on life satisfaction, concurrent life satisfaction in the reference as well as in the reporting period  $CS_{it}$  and  $CS_{it+1}$  are also added to the regressions. All regressions are linear fixed effects regressions because treating life satisfaction as a cardinal measure does not seem to be critical here (see discussion in section 3, and Ferrer-i-Carbonell and Frijters 2004) and facilitates interpretation. The regressions are again carried out separately for women and men. Because data from  $t$  and  $t + 1$  are used, the models only refer to life satisfaction reported for the years 1984 to 1986.

Tables 4 and 5 report the estimation results. The first two columns  $CS_{it}$  and  $AS_{it}$  replicate the results discussed in the previous section, excluding the data for 1987. The results in column (3) with  $RS_{it}$  as the

<sup>19</sup>Although there is no clear explanation or interpretation for this relationship, it is also irrelevant with regard to the findings discussed above (see Tables A6 and A7).

<sup>20</sup>Age, age squared and the months between interviews only enter the regression once.

dependent variable establish confidence in that retrospectively reported data can be used in correlation studies (Powers et al. 1978, Peters 1988, Manzonni et al. 2011). In particular, the correlations between employment status and life satisfaction are as strong and significant for retrospective as for concurrent life satisfaction. This coincides with the finding of Jürges (2007) that periods of unemployment are recalled better if they go along with larger reductions in life satisfaction. In contrast, the significant correlation of life satisfaction with household income and health status are largely reduced when retrospective data is used. The recall period, measured in months between the interview in year  $t$  and the interview in year  $t + 1$ , is significantly negatively related to retrospective life satisfaction. That is, individuals downgrade their past reports of well-being as time passes, and thus report that their life satisfaction improves over time on average (as depicted in Figure 1).<sup>21</sup>

Retrospective reports of life satisfaction are not only influenced by the life circumstances in the reference period, but also by the life circumstances in the reporting period. This is shown in columns (4) of Tables 4 and 5. For instance, poor health in the reporting period is strongly negatively, and having a steady partner in the reporting period is strongly positively related to retrospective satisfaction for both men and women. The correlations between concurrent satisfaction and retrospective satisfaction reported in columns (5) highlight the importance of the current situation for retrospective reports of well-being. Although retrospective life satisfaction is significantly positively correlated with concurrent life satisfaction in the reference as well as in the reporting period, this correlation is more than six times stronger for the latter. Therefore, the estimated coefficients from the specification of columns (4) will be biased if current living conditions are correlated with concurrent and retrospective satisfaction scores.

This dilemma is solved by including the concurrent satisfaction scores alongside the explanatory variables from the reference and the reporting period in the regressions. This specification has two advantages: First, since  $CS_{it+1}$  serves as an “anchor” for  $RS_{it}$  because both are reported at the same time, direct relations between current circumstances and the past evaluation of life satisfaction can now be disentangled from indirect relations via the evaluation of current life satisfaction. Second, the inclusion of concurrent life satisfaction scores also controls for other unobserved factors that could simultaneously influence retrospective satisfaction and the other included covariates.<sup>22</sup>

The last columns of Table 4 and 5 report the estimation results for this most extensive specification. While the correlations found for the explanatory variables from the reference period  $t$  correspond to those found in the other specifications, strong differences emerge for the variables from  $t + 1$ . The significant correlations of retrospective life satisfaction with income and health from the reporting period vanish. For women, very poor health is even significantly positively correlated with past satisfaction when current satisfaction is controlled for. This provides some evidence that individuals might redefine the past (consciously or unconsciously) due to changes in their current living conditions which leads to differences between concurrent and retrospective reports as found by Akerlof and Yellen (1985), Jürges (2007) and Manzonni et al. (2011) for unemployment spells.

Changes in the employment situation again have the strongest influences on life satisfaction evaluations. For men, the significant negative correlations between retrospective life satisfaction and being unemployed or not working in the reference period  $t$  are slightly reduced, indicating that some of the negative relationship found for concurrent satisfaction vanishes over time (due to short-lived mood effects, adaptation, or recall problems). Controlling for concurrent well-being, being unemployed or not working in the reporting period  $t + 1$  is significantly positively correlated with past life satisfaction. Comparing columns (4) and

<sup>21</sup>For illustration, one could speak of “inflation” being present in the artificial satisfaction measure  $AS_{it}$ , captured by the positive age/time trend in the estimations presented in section 3. The estimated coefficients of -0.018 to -0.025 suggest that past life satisfaction is downgraded by 0.25 points after 1 year, which would equal an “inflation rate” of 3% (0.25/7.3).

<sup>22</sup>The inclusion of  $CS_{it}$  is somewhat critical because it refers to a very similar life satisfaction evaluation as  $RS_{it}$  and might create an endogeneity problem. However, this procedure seems to be valid given the relatively low degree of correlation between the two measures. And excluding  $CS_{it}$  from the regressions does not change any results (see Tables A8 and A9).



TABLE 4: Estimation results for retrospective life satisfaction - Males  
(Linear fixed effects regressions)

<i>Dependent variable:</i>	$CS^{it}$	$AS_{it}$	$RS_{it}$	$RS_{it}$	$RS_{it}$	$RS_{it}$
<b>Covariates from year <math>t</math></b>						
Log household equivalent income	0.466*** (0.106)	0.349*** (0.085)	0.117 (0.108)	0.160 (0.110)	-	0.163* (0.091)
Unemployed	-1.095*** (0.174)	-1.305*** (0.160)	-1.099*** (0.166)	-1.107*** (0.170)	-	-0.882*** (0.155)
Not working	-0.402* (0.212)	-0.548*** (0.210)	-0.490** (0.215)	-0.457** (0.213)	-	-0.485*** (0.185)
Slightly hindered by health	-0.381*** (0.061)	-0.054 (0.044)	-0.017 (0.060)	-0.087 (0.062)	-	0.008 (0.050)
Strongly hindered by health	-0.914*** (0.124)	-0.415*** (0.101)	-0.306** (0.124)	-0.462*** (0.127)	-	-0.274*** (0.100)
Steady partner	0.351*** (0.135)	0.405*** (0.134)	0.302** (0.131)	0.304** (0.129)	-	0.337*** (0.116)
Children in household	0.095 (0.096)	0.245*** (0.086)	0.172* (0.101)	0.154 (0.102)	-	0.149* (0.083)
Homeowner	-0.099 (0.132)	-0.152 (0.126)	0.076 (0.141)	0.050 (0.138)	-	0.087 (0.127)
Months between interviews	-0.006 (0.012)	-0.016* (0.009)	-0.025** (0.012)	-0.024** (0.012)	-0.018* (0.010)	-0.018* (0.010)
Age	0.139** (0.068)	0.276*** (0.059)	-0.078 (0.070)	-0.106 (0.070)	-0.121** (0.058)	-0.118** (0.058)
Age squared (/100)	-0.274*** (0.083)	-0.229*** (0.070)	0.040 (0.086)	0.061 (0.086)	0.140** (0.068)	0.141** (0.068)
<b>Covariates from year <math>t + 1</math></b>						
Log household equivalent income	-	-	-	0.228** (0.105)	-	-0.066 (0.086)
Unemployed	-	-	-	-0.042 (0.154)	-	0.619*** (0.133)
Not working	-	-	-	0.363 (0.223)	-	0.598*** (0.209)
Slightly hindered by health	-	-	-	-0.275*** (0.060)	-	-0.008 (0.048)
Strongly hindered by health	-	-	-	-0.704*** (0.123)	-	0.020 (0.100)
Steady partner	-	-	-	0.349** (0.153)	-	-0.017 (0.148)
Children in household	-	-	-	0.095 (0.105)	-	0.031 (0.092)
Homeowner	-	-	-	0.081 (0.127)	-	0.157 (0.114)
<b>Concurrent life satisfaction in year <math>t</math> and <math>t + 1</math></b>						
Satisfaction in year $t$	-	-	-	-	0.108*** (0.015)	0.087*** (0.015)
Satisfaction in year $t + 1$	-	-	-	-	0.632*** (0.018)	0.641*** (0.017)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Within R2	0.048	0.069	0.025	0.036	0.367	0.391
Model p-value	0.000	0.000	0.000	0.000	0.000	0.000
Observations	9,901	9,901	9,901	9,901	9,901	9,901
Individuals	3,677	3,677	3,677	3,677	3,677	3,677

Notes: Table reports coefficients from linear fixed effects regressions. The dependent variable is either concurrent, artificial or retrospective life satisfaction for year  $t$ . Std. errors in parentheses are adjusted for clustering on individuals. Significance levels: \*10% \*\*5% \*\*\*1%  
Source: GSOEP, own calculations

TABLE 5: Estimation results for retrospective life satisfaction - Females  
(Linear fixed effects regressions)

<i>Dependent variable:</i>	$CS_{it}$	$AS_{it}$	$RS_{it}$	$RS_{it}$	$RS_{it}$	$RS_{it}$
<b>Covariates from year <math>t</math></b>						
Log household equivalent income	0.509*** (0.108)	0.482*** (0.091)	0.263** (0.113)	0.264** (0.116)	-	0.220** (0.097)
Unemployed	-0.378*** (0.132)	-0.389*** (0.129)	-0.369** (0.147)	-0.417*** (0.150)	-	-0.353*** (0.119)
Not working	-0.096 (0.095)	-0.072 (0.079)	0.089 (0.090)	0.067 (0.091)	-	0.023 (0.076)
Slightly hindered by health	-0.322*** (0.059)	-0.091** (0.041)	-0.124** (0.056)	-0.199*** (0.059)	-	-0.117** (0.047)
Strongly hindered by health	-0.768*** (0.111)	-0.237*** (0.082)	-0.171 (0.113)	-0.257** (0.115)	-	-0.061 (0.091)
Steady partner	0.236 (0.151)	0.232 (0.163)	0.230 (0.160)	0.207 (0.158)	-	0.337** (0.139)
Children in household	0.066 (0.098)	0.014 (0.085)	0.013 (0.094)	0.024 (0.097)	-	0.061 (0.082)
Homeowner	0.021 (0.122)	-0.113 (0.126)	-0.002 (0.121)	-0.007 (0.120)	-	0.054 (0.107)
Months between interviews	-0.012 (0.013)	-0.022** (0.010)	-0.023* (0.012)	-0.022* (0.012)	-0.018* (0.010)	-0.018* (0.010)
Age	-0.118* (0.071)	0.496*** (0.066)	-0.041 (0.073)	-0.086 (0.074)	0.004 (0.057)	-0.017 (0.058)
Age squared (/100)	0.013 (0.087)	-0.436*** (0.078)	-0.035 (0.089)	0.022 (0.090)	0.003 (0.067)	0.037 (0.068)
<b>Covariates from year <math>t + 1</math></b>						
Log household equivalent income	-	-	-	0.014 (0.111)	-	-0.138 (0.092)
Unemployed	-	-	-	-0.125 (0.149)	-	0.283** (0.130)
Not working	-	-	-	-0.114 (0.101)	-	0.031 (0.078)
Slightly hindered by health	-	-	-	-0.303*** (0.060)	-	-0.069 (0.045)
Strongly hindered by health	-	-	-	-0.401*** (0.120)	-	0.167* (0.097)
Steady partner	-	-	-	0.566*** (0.193)	-	0.393** (0.182)
Children in household	-	-	-	-0.047 (0.108)	-	-0.062 (0.086)
Homeowner	-	-	-	0.173 (0.123)	-	0.088 (0.109)
<b>Concurrent life satisfaction in year <math>t</math> and <math>t + 1</math></b>						
Satisfaction in year $t$	-	-	-	-	0.090*** (0.013)	0.082*** (0.013)
Satisfaction in year $t + 1$	-	-	-	-	0.641*** (0.017)	0.644*** (0.017)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Within R2	0.027	0.041	0.011	0.019	0.379	0.388
Model p-value	0.000	0.000	0.000	0.000	0.000	0.000
Observations	9,896	9,896	9,896	9,896	9,896	9,896
Individuals	3,665	3,665	3,665	3,665	3,665	3,665

Notes: Table reports coefficients from linear fixed effects regressions. The dependent variable is either concurrent, artificial or retrospective life satisfaction for year  $t$ . Std. errors in parentheses are adjusted for clustering on individuals. Significance levels: \*10% \*\*5% \*\*\*1%  
Source: GSOEP, own calculations

(6), it shows that current unemployment impacts on retrospective life satisfaction indirectly via concurrent life satisfaction (the “anchor”), and directly through a re-evaluation of past well-being. This latter effect can be interpreted as ex-post updating due to unemployment, i.e., men retrospectively upgrade their past satisfaction scores when they exit employment. A similar pattern is found for unemployed women, but not for the not working. For men, the size of this effect is approximately 70% of the recalled negative correlation of past satisfaction and past unemployment; it is even higher than 100% for the not working. Since the employment status in the reference period is accounted for, this applies to individuals who are employed, unemployed or not working in the reference period  $t$ . In line with the findings of Lucas et al. (2004) and Clark et al. (2008a), it can be concluded that men do not adapt to unemployment (see also Dolan et al. 2008), and that stronger intrapersonal comparisons lead to more pronounced effects of unemployment on well-being than more global evaluations of well-being, which could be due to changes in reference groups or social norms (Clark et al. 2009). Stavrova et al. (2011) provide evidence from 28 OECD countries that social norms are more important than personal norms to work for the negative effect of unemployment on life satisfaction. Here, these two effects cannot be fully disentangled, but the large upgrade of past satisfaction scores when currently unemployed suggests that the role that such norms play for the evaluation of personal well-being is context-dependent, i.e., individuals base their reported well-being on different norms depending on their current living conditions.

FIGURE 2: Illustration of correlation sizes between different life satisfaction measures and unemployment - Males

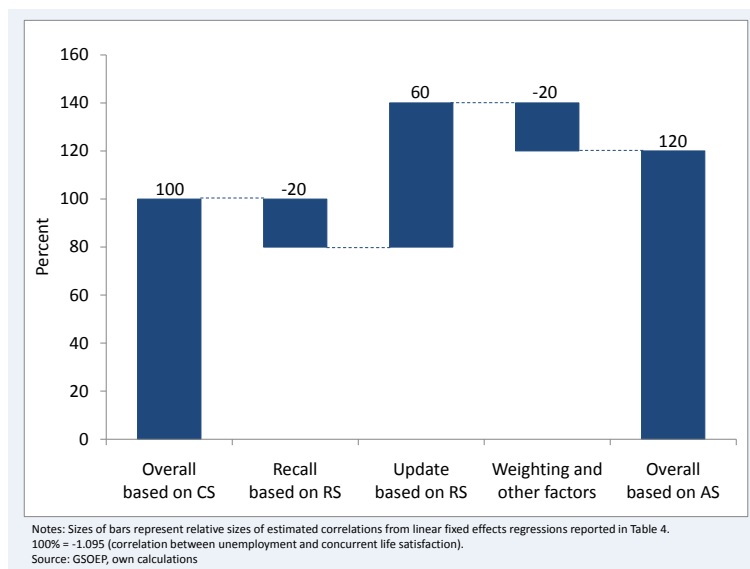


Figure 2 illustrates the different associations of unemployment with concurrent, retrospective and artificial life satisfaction for men. The correlation between being unemployed and the “classical” concurrent life satisfaction measure  $CS_{it}$  represents the benchmark of 100%. Approximately 80% of this correlation are recalled one year later which can be interpreted as the lasting effect. The reduction in correlation size can be attributed to the influence of short-lived mood influences, recall problems (especially if the corresponding unemployment spell is short, as shown by Manzoni et al. 2011) and adaptation effects. In contrast, unemployed individuals upgrade their past satisfaction scores by about 60% of the benchmark correlation. That is, the individuals themselves ex-post attribute a higher well-being to the “counterfactual” situation of being employed.<sup>23</sup> In sum, the difference between the correlations found for unemployment with concurrent and artificial life satisfaction amounts to about 20%. This overall

<sup>23</sup>With  $CS_{it}$ , life satisfaction when unemployed is reported by the unemployed whereas life satisfaction when employed is reported by the employed. With  $RS_{it}$ , unemployed as well as employed individuals report life satisfaction for both times of unemployment and times of employment. 56% of those ever unemployed are only unemployed in one year, 28% in two years, and only 16% in 3 or 4 years.

difference is the result of individuals weighting all of the discussed (plus more) aspects in the evaluation of their subjective well-being in an unknown way. While the empirical analysis presented here strongly supports the view that unemployment reduces individual life satisfaction, it also shows that quantifying the size of a particular correlation is subject to a large degree of uncertainty.

In order to check the robustness of the findings presented in this section, the regressions were run using a balanced panel only, excluding the first wave, excluding outliers (annual change in life satisfaction of more than 5 points), excluding concurrent satisfaction from the reference period  $t$ , and with random instead of fixed effects for descriptive purposes. The estimation results are presented in Tables A8 and A9 in the Appendix. Again, the results prove to be robust to the specification of the sample. Slightly diverging results only emerge when the first wave is excluded. In all regressions, a strong positive correlation of unemployment in the reporting period and retrospective life satisfaction is found.

## 5 Conclusion

In this paper, I use concurrently and retrospectively reported life satisfaction from the 1984 to 1987 waves of the German Socio-Economic Panel to contribute to the literature on individual well-being and unemployment in two ways: First, the individual-level data allow me to check the robustness of the empirical correlations between unemployment and life satisfaction reported in the literature so far with regard to the choice of identifying intertemporal within-person changes in life satisfaction from retrospective or longitudinal information. Second, retrospective evaluations of past life satisfaction are investigated to address the methodological issue of intertemporal comparability of life satisfaction scores reported by the same individual at different points in time.

Most of the estimation results from linear and non-linear fixed effects regressions of life satisfaction on a set of standard explanatory variables are not overly sensitive to the choice of identifying variations in the dependent variable from either concurrently or retrospectively reported life satisfaction. Signs, significance and confidence intervals of the correlations are similar for most variables. Larger differences emerge for self-reported health and the employment status. While the former finding can be confidently attributed to short-lived mood effects, a significantly larger negative correlation between unemployment and life satisfaction when intertemporal comparisons are elicited directly from survey respondents suggests that evaluation standards for subjective life satisfaction change over time. I find that unemployed individuals do not only report lower concurrent satisfaction scores, but also remember reduced well-being due to past unemployment well, and retrospectively upgrade their past satisfaction scores. Therefore, the negative effects of unemployment on individual life satisfaction reported in the literature so far are probably underestimated.

In addition, I show that changes in the employment status largely distort the subjective evaluations of personal well-being. While the well established negative relationship between unemployment and life satisfaction finds support here, the analysis presented casts doubts on a general validity of subjective life satisfaction data for longitudinal studies. In particular, quantifying the relationship between life satisfaction and different life circumstances is subject to a large degree of uncertainty. The main reason for this uncertainty is that comparison standards are unknown. If these standards, i.e., the reference system for the subjective evaluation of life satisfaction, change over time, life satisfaction scores of the same person from different points in time cannot be meaningfully compared. Such changes are likely the case on an individual as well as on an aggregate level. Therefore, subjective life satisfaction probably carries rather low informational value for monitoring long-term economic or social developments. Similar conclusions have been drawn by Dolan et al. (2008) from a literature review, by Wunder and Schwarze (2010) from the estimation results of dynamic panel data models for subjective life satisfaction, and

Deaton (2011) from the analysis of daily data about subjective well-being reported during the financial crisis between 2008 and 2010.

However, self-reported life satisfaction appears to be useful for studying short-term fluctuations (see also Wunder and Schwarze 2010, Deaton 2011). In this context, empirical research must pay close attention to the comparison standards used by individuals in their subjective evaluations, and the intertemporal stability of these standards (Schwartz and Sprangers 1999). For instance, before-after evaluations might most adequately be carried out with measures that mainly capture an intertemporal comparison. It is obvious that neither concurrent nor retrospective life satisfaction can be regarded as a “gold standard”. Ideally, empirical research on subjective life satisfaction would be based on different measures in order to increase the reliability of the results (Larsen and Fredrickson 1999). Therefore, a case can be made for eliciting intertemporal (and also other, e.g., interpersonal) comparisons from survey participants directly. In general, more research is needed to improve our understanding of how individuals form their subjective evaluations of life satisfaction, and how these might change over the life-cycle, or with particular life circumstances and events.

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## Appendix

TABLE A1: Robustness checks: Linear and non-linear random effects regressions

Estimation model: Dependent variable:	Males						Females					
	Linear RE		Ordered logit		Linear RE		Linear RE		Ordered Logit		Ordered Logit	
	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>
Log household equivalent income	0.431*** (0.056)	0.418*** (0.053)	0.369*** (0.060)	0.401*** (0.066)	0.602*** (0.058)	0.532*** (0.062)	0.647*** (0.057)	0.726*** (0.063)	-1.288*** (0.109)	-1.623*** (0.124)	-0.465*** (0.100)	-0.498*** (0.105)
Unemployed	-0.630*** (0.122)	-0.710*** (0.130)	-0.649*** (0.129)	-0.739*** (0.148)	-0.581*** (0.048)	-0.337*** (0.049)	0.187*** (0.048)	0.211*** (0.052)	-0.599*** (0.040)	-0.752*** (0.036)	-0.791*** (0.042)	-0.732*** (0.043)
Slightly hindered by health	-1.351*** (0.080)	-0.848*** (0.074)	-1.477*** (0.086)	-1.390*** (0.089)	-1.330*** (0.077)	-0.878*** (0.068)	-1.593*** (0.079)	-1.585*** (0.083)	0.479*** (0.062)	0.474*** (0.070)	0.364*** (0.070)	0.370*** (0.061)
Steady partner	0.009 (0.048)	0.067 (0.049)	0.019 (0.050)	0.015 (0.056)	-0.022 (0.050)	-0.066 (0.052)	-0.054 (0.051)	-0.073 (0.055)	0.009 (0.153***)	0.067 (0.122***)	0.009 (0.168***)	0.009 (0.177***)
Children in household	0.153*** (0.043)	0.122*** (0.047)	0.168*** (0.045)	0.206*** (0.050)	0.177*** (0.045)	0.146*** (0.053)	0.138*** (0.045)	0.154*** (0.050)	0.009 (0.010)	0.012 (0.012)	0.009 (0.013)	0.009 (0.013)
Months between interviews	-0.056*** (0.016)	-0.033** (0.016)	-0.078*** (0.016)	-0.075*** (0.018)	-0.059*** (0.016)	0.012 (0.016)	-0.059*** (0.015)	-0.037** (0.016)	0.075*** (0.020)	0.042** (0.020)	0.078*** (0.019)	0.050** (0.021)
Age squared (/100)	0.075*** (0.020)	0.042** (0.020)	0.107*** (0.020)	0.102*** (0.022)	0.074*** (0.020)	-0.018 (0.021)	0.078*** (0.019)	0.050** (0.021)	0.135 (0.032)	0.140 (0.032)	0.116 (0.030)	0.109 (0.030)
Year dummies	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	13.578 (3.677)	13.578 (3.677)	13.561 (3.665)	13.561 (3.665)
Overall/Pseudo R2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Model p-value	13.578	13.578	13.578	13.578	13.561	13.561	13.561	13.561	3.677	3.677	3.665	3.665
Observations	3,677	3,677	3,677	3,677	3,665	3,665	3,665	3,665				
Individuals												

Notes: Table reports coefficients from linear random effects and ordered logit regressions for individual life satisfaction. The dependent variable is either concurrent satisfaction, or artificial satisfaction based on concurrent and retrospective information. Std. errors in parentheses are adjusted for clustering on individuals. Significance levels: \*10% \*\*5% \*\*\*1%  
Source: GSOEP, own calculations

TABLE A2: Robustness checks: Different dependent variables - Males  
(Conditional logit regressions)

<i>Life satisfaction:</i> Based on:	<i>Higher than avg.</i>		<i>Better off</i>		<i>Worse off</i>	
	<i>CS<sub>it</sub></i>	<i>AS<sub>it</sub></i>	<i>CS<sub>it</sub></i>	<i>AS<sub>it</sub></i>	<i>CS<sub>it</sub></i>	<i>AS<sub>it</sub></i>
Log household equivalent income	0.517*** (0.100)	0.567*** (0.134)	0.450*** (0.129)	0.334** (0.169)	-0.279** (0.123)	-0.828*** (0.196)
Unemployed	-0.811*** (0.132)	-1.324*** (0.172)	-0.655*** (0.160)	-0.774*** (0.203)	0.674*** (0.153)	1.317*** (0.216)
Not working	-0.211 (0.176)	-0.327 (0.220)	-0.012 (0.215)	-0.474* (0.279)	0.017 (0.214)	0.696** (0.354)
Slightly hindered by health	-0.484*** (0.063)	-0.186** (0.083)	-0.351*** (0.081)	0.004 (0.113)	0.393*** (0.078)	0.331*** (0.122)
Strongly hindered by health	-0.984*** (0.106)	-0.641*** (0.147)	-0.786*** (0.141)	-0.156 (0.183)	0.911*** (0.134)	0.893*** (0.195)
Steady partner	0.431*** (0.129)	0.673*** (0.169)	0.028 (0.181)	0.063 (0.216)	-0.295* (0.165)	-0.336 (0.263)
Children in household	-0.023 (0.099)	0.227* (0.136)	-0.257* (0.135)	-0.027 (0.169)	0.050 (0.120)	0.031 (0.195)
Homeowner	-0.043 (0.129)	-0.289 (0.197)	-0.123 (0.163)	-0.013 (0.217)	0.058 (0.153)	0.280 (0.232)
Months between interviews	-0.004 (0.017)	-0.001 (0.026)	0.018 (0.027)	0.012 (0.037)	-0.004 (0.025)	0.035 (0.042)
Age	-0.081 (0.074)	0.490*** (0.105)	-0.401*** (0.101)	0.123 (0.135)	0.276*** (0.092)	-0.154 (0.161)
Age squared (/100)	-0.213*** (0.073)	-0.455*** (0.118)	0.282*** (0.106)	-0.180 (0.156)	-0.150 (0.096)	0.256 (0.178)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R2	0.038	0.051	0.019	0.013	0.018	0.051
Model p-value	0.000	0.000	0.000	0.000	0.000	0.000
Observations	12,574	7,809	7,193	3,789	8,095	3,084
Individuals	3,358	2,059	2,449	1,289	2,757	1,051

Notes: Table reports coefficients from conditional (fixed effects) logit regressions for individual life satisfaction being higher than the individual average (Kassenböhmer and Haisken-DeNew 2009), and being more or less satisfied than in the preceding year. The dependent variable is based on either concurrent or retrospective information. Std. errors in parentheses are adjusted for clustering on individuals. Significance levels: \*10% \*\*5% \*\*\*1%

Source: GSOEP, own calculations

TABLE A3: Robustness checks: Different dependent variables - Females  
(Conditional logit regressions)

<i>Life satisfaction:</i> Based on:	<i>Higher than avg.</i>		<i>Better off</i>		<i>Worse off</i>	
	<i>CS<sub>it</sub></i>	<i>AS<sub>it</sub></i>	<i>CS<sub>it</sub></i>	<i>AS<sub>it</sub></i>	<i>CS<sub>it</sub></i>	<i>AS<sub>it</sub></i>
Log household equivalent income	0.414*** (0.098)	0.582*** (0.125)	0.148 (0.121)	0.437*** (0.159)	-0.066 (0.121)	-0.537*** (0.199)
Unemployed	-0.408*** (0.122)	-0.848*** (0.157)	-0.117 (0.154)	-0.541*** (0.194)	0.186 (0.145)	0.934*** (0.237)
Not working	-0.105 (0.087)	-0.083 (0.122)	-0.048 (0.119)	-0.222 (0.150)	0.090 (0.113)	0.096 (0.189)
Slightly hindered by health	-0.371*** (0.057)	-0.211*** (0.069)	-0.188*** (0.072)	0.077 (0.103)	0.282*** (0.070)	0.482*** (0.110)
Strongly hindered by health	-0.797*** (0.100)	-0.691*** (0.128)	-0.680*** (0.133)	-0.204 (0.182)	0.790*** (0.126)	1.322*** (0.196)
Steady partner	0.259* (0.135)	0.377** (0.150)	-0.162 (0.179)	-0.587*** (0.225)	0.076 (0.166)	-0.188 (0.281)
Children in household	0.085 (0.100)	0.216 (0.138)	-0.167 (0.137)	0.252 (0.185)	0.056 (0.126)	-0.004 (0.215)
Homeowner	0.038 (0.122)	-0.030 (0.170)	0.109 (0.153)	0.148 (0.207)	-0.036 (0.149)	0.283 (0.254)
Months between interviews	-0.006 (0.017)	-0.064** (0.026)	0.034 (0.026)	0.013 (0.036)	-0.020 (0.024)	0.038 (0.042)
Age	-0.232*** (0.074)	0.632*** (0.106)	-0.192* (0.099)	0.078 (0.138)	0.184** (0.093)	0.129 (0.165)
Age squared (/100)	-0.012 (0.074)	-0.630*** (0.121)	0.050 (0.106)	0.001 (0.158)	-0.123 (0.098)	-0.014 (0.186)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R2	0.028	0.051	0.008	0.012	0.010	0.043
Model p-value	0.000	0.000	0.000	0.003	0.000	0.000
Observations	12,591	8,070	7,392	3,844	8,072	3,088
Individuals	3,353	2,123	2,515	1,305	2,744	1,049

Notes: Table reports coefficients from conditional (fixed effects) logit regressions for individual life satisfaction being higher than the individual average (Kassenböhmer and Haisken-DeNew 2009), and being more or less satisfied than in the preceding year. The dependent variable is based on either concurrent or retrospective information. Std. errors in parentheses are adjusted for clustering on individuals. Significance levels: \*10% \*\*5% \*\*\*1%

Source: GSOEP, own calculations

TABLE A4: Robustness checks: Different samples - Males  
(Linear fixed effects regressions)

Dependent variable:	Balanced panel		Excl. first wave		Change in CS and AS		Excl. outliers	
	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>
Log household equivalent income	0.499*** (0.088)	0.383*** (0.080)	0.507*** (0.101)	0.393*** (0.080)	0.531*** (0.111)	0.566*** (0.109)	0.356*** (0.076)	0.318*** (0.066)
Unemployed	-1.034*** (0.138)	-1.325*** (0.136)	-0.897*** (0.157)	-1.029*** (0.126)	-1.168*** (0.158)	-1.585*** (0.156)	-0.733*** (0.111)	-0.903*** (0.104)
Not working	-0.320* (0.172)	-0.509*** (0.180)	-0.360* (0.211)	-0.532*** (0.186)	-0.414** (0.200)	-0.526** (0.218)	-0.084 (0.154)	-0.189 (0.138)
Slightly hindered by health	-0.403*** (0.049)	-0.080* (0.042)	-0.417*** (0.057)	-0.106** (0.043)	-0.493*** (0.067)	-0.148** (0.064)	-0.397*** (0.045)	-0.088** (0.036)
Strongly hindered by health	-1.034*** (0.096)	-0.516*** (0.091)	-1.122*** (0.111)	-0.443*** (0.094)	-1.286*** (0.120)	-0.721*** (0.127)	-0.908*** (0.087)	-0.372*** (0.075)
Steady partner	0.455*** (0.115)	0.613*** (0.126)	0.509*** (0.155)	0.602*** (0.165)	0.438*** (0.135)	0.669*** (0.156)	0.387*** (0.100)	0.434*** (0.103)
Children in household	0.037 (0.079)	0.213*** (0.081)	0.071 (0.096)	0.108 (0.088)	-0.045 (0.103)	0.277** (0.115)	-0.015 (0.072)	0.122* (0.069)
Homeowner	-0.144 (0.101)	-0.144 (0.112)	-0.149 (0.116)	-0.140 (0.114)	-0.213* (0.129)	-0.192 (0.153)	-0.059 (0.087)	-0.091 (0.092)
Months between interviews	-0.018 (0.014)	-0.018 (0.014)	-0.026 (0.021)	-0.021 (0.016)	-0.021 (0.019)	-0.020 (0.022)	-0.012 (0.012)	-0.010 (0.012)
Age	-0.044 (0.057)	0.308*** (0.054)	-0.112 (0.074)	0.363*** (0.064)	0.045 (0.076)	0.398*** (0.082)	-0.026 (0.052)	0.313*** (0.049)
Age squared (/100)	-0.178*** (0.058)	-0.297*** (0.057)	-0.091 (0.082)	-0.377*** (0.070)	-0.237*** (0.081)	-0.383*** (0.092)	-0.169*** (0.054)	-0.315*** (0.053)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Within R2	0.056	0.075	0.049	0.067	0.072	0.090	0.047	0.055
Model p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	12,148	12,148	10,179	10,179	7,894	7,894	13,143	13,143
Individuals	3,037	3,037	3,677	3,677	2,148	2,148	3,653	3,653

Notes: Table reports coefficients from linear fixed effects regressions for different samples. The dependent variable is either concurrent satisfaction, or artificial satisfaction based on concurrent and retrospective data. Std. errors in parentheses are adjusted for clustering on individuals. Significance levels: \*10% \*\*5% \*\*\*1%

Source: GSOPF, own calculations

TABLE A.5: Robustness checks: Different samples - Females  
(Linear fixed effects regressions)

Dependent variable:	Balanced panel		Excl. first wave		Change in CS and AS		Excl. outliers	
	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>
Log household equivalent income	0.400*** (0.090)	0.415*** (0.092)	0.256** (0.100)	0.139 (0.096)	0.531*** (0.108)	0.513*** (0.123)	0.399*** (0.079)	0.351*** (0.076)
Unemployed	-0.489*** (0.115)	-0.474*** (0.114)	-0.588*** (0.133)	-0.507*** (0.105)	-0.607*** (0.135)	-0.705*** (0.145)	-0.335*** (0.101)	-0.418*** (0.097)
Not working	-0.080 (0.076)	-0.083 (0.075)	-0.206** (0.092)	-0.066 (0.078)	-0.158 (0.098)	-0.126 (0.106)	-0.063 (0.065)	-0.047 (0.066)
Slightly hindered by health	-0.352*** (0.047)	-0.102*** (0.038)	-0.328*** (0.055)	-0.095** (0.041)	-0.362*** (0.059)	-0.161*** (0.056)	-0.328*** (0.042)	-0.089*** (0.033)
Strongly hindered by health	-0.816*** (0.092)	-0.348*** (0.077)	-0.843*** (0.111)	-0.406*** (0.080)	-0.878*** (0.111)	-0.537*** (0.109)	-0.663*** (0.084)	-0.294*** (0.073)
Steady partner	0.224* (0.125)	0.194 (0.153)	0.235 (0.165)	0.277 (0.175)	0.264* (0.140)	0.261 (0.172)	0.114 (0.111)	0.170 (0.125)
Children in household	0.038 (0.078)	0.028 (0.080)	-0.025 (0.095)	-0.026 (0.084)	-0.019 (0.097)	-0.015 (0.116)	0.043 (0.071)	0.000 (0.071)
Homeowner	0.072 (0.096)	-0.072 (0.126)	0.090 (0.114)	-0.073 (0.130)	0.048 (0.117)	-0.128 (0.162)	0.059 (0.089)	-0.071 (0.107)
Months between interviews	-0.023 (0.014)	-0.028* (0.016)	-0.017 (0.022)	-0.042** (0.019)	-0.017 (0.019)	-0.025 (0.024)	-0.051** (0.013)	-0.018 (0.014)
Age	-0.256*** (0.061)	0.433*** (0.061)	-0.206*** (0.078)	0.436*** (0.070)	-0.166** (0.081)	0.577*** (0.091)	-0.213*** (0.055)	0.420*** (0.056)
Age squared (/100)	0.043 (0.061)	-0.432*** (0.067)	-0.002 (0.086)	-0.433*** (0.078)	-0.102 (0.082)	-0.581*** (0.105)	0.016 (0.056)	-0.422*** (0.061)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Within R2	0.035	0.043	0.027	0.035	0.046	0.059	0.034	0.043
Model p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	12,140	12,140	10,158	10,158	8,084	8,084	13,151	13,151
Individuals	3,035	3,035	3,665	3,665	2,178	2,178	3,646	3,646

Notes: Table reports coefficients from linear fixed effects estimations for different samples. The dependent variable is either concurrent satisfaction, or artificial satisfaction based on concurrent and retrospective data. Std. errors in parentheses are adjusted for clustering on individuals. Significance levels: \*10% \*\*5% \*\*\*1%  
Source: GSOEP, own calculations

TABLE A6: Robustness checks: Different sets of covariates - Males  
(Linear fixed effects regressions)

Dependent variable:	Income measures		Health measures		Family measures		Excl. age		Excl. recall period	
	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>
Log household equivalent income	0.450*** (0.087)	0.321*** (0.078)	0.480*** (0.087)	0.373*** (0.078)	0.525*** (0.086)	0.416*** (0.078)	0.500*** (0.086)	0.385*** (0.078)	0.504*** (0.086)	0.390*** (0.078)
Log personal income	0.053*** (0.018)	0.069*** (0.017)	-	-	-	-	-	-	-	-
Hours of leisure time	-0.000 (0.014)	-0.009 (0.012)	-0.010 (0.015)	-0.012 (0.013)	-0.001 (0.014)	-0.010 (0.013)	-0.002 (0.014)	-0.011 (0.013)	-0.002 (0.014)	-0.010 (0.013)
Unemployed	-0.603*** (0.187)	-0.801*** (0.139)	-0.980*** (0.139)	-1.327*** (0.133)	-0.954*** (0.136)	-1.258*** (0.131)	-0.982*** (0.136)	-1.300*** (0.136)	-0.961*** (0.136)	-1.266*** (0.131)
Not working	0.012 (0.187)	-0.037 (0.173)	-0.404** (0.184)	-0.469** (0.190)	-0.339** (0.170)	-0.496*** (0.173)	-0.399** (0.168)	-0.590*** (0.172)	-0.340** (0.171)	-0.495*** (0.173)
Slightly hindered by health	-0.394*** (0.049)	-0.087** (0.041)	-	-	-0.394*** (0.049)	-0.087** (0.041)	-0.399*** (0.049)	-0.095** (0.041)	-0.394*** (0.049)	-0.087** (0.041)
Strongly hindered by health	-1.041*** (0.095)	-0.502*** (0.090)	-	-	-1.048*** (0.096)	-0.510*** (0.090)	-1.045*** (0.096)	-0.505*** (0.091)	-1.047*** (0.096)	-0.509*** (0.090)
Doctor visits	-	-	-0.005*** (0.002)	-0.003*** (0.001)	-	-	-	-	-	-
Nights in hospital	-	-	-0.009*** (0.002)	-0.011*** (0.003)	-	-	-	-	-	-
Steady partner	0.433*** (0.111)	0.539*** (0.127)	0.403*** (0.113)	0.554*** (0.131)	0.456*** (0.111)	0.552*** (0.124)	0.456*** (0.111)	0.573*** (0.126)	0.438*** (0.111)	0.545*** (0.127)
Children in household	0.023 (0.078)	0.209** (0.081)	0.018 (0.082)	0.228*** (0.083)	-	-	0.038 (0.078)	0.233*** (0.082)	0.022 (0.078)	0.208** (0.081)
Number of children	-	-	-	-	0.064 (0.056)	0.178*** (0.055)	-	-	-	-
Household size	-	-	-	-	-0.054 (0.040)	-0.035 (0.038)	-	-	-	-
Homeowner	-0.126 (0.098)	-0.131 (0.106)	-0.098 (0.098)	-0.128 (0.108)	-0.117 (0.097)	-0.143 (0.107)	-0.147 (0.098)	-0.160 (0.106)	-0.143 (0.098)	-0.153 (0.106)
Months between interviews	-0.015 (0.014)	-0.015 (0.014)	-0.014 (0.014)	-0.013 (0.014)	-0.015 (0.014)	-0.016 (0.014)	-0.016 (0.014)	-0.016 (0.014)	-	-
Age	-0.064 (0.057)	0.276*** (0.053)	-0.043 (0.057)	0.300*** (0.054)	-0.054 (0.057)	0.287*** (0.053)	-	-	-0.041 (0.056)	0.305*** (0.053)
Age squared (/100)	-0.157*** (0.058)	-0.261*** (0.056)	-0.192*** (0.059)	-0.288*** (0.057)	-0.169*** (0.058)	-0.272*** (0.056)	-	-	-0.177*** (0.057)	-0.287*** (0.056)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Within R2	0.055	0.072	0.041	0.074	0.054	0.070	0.053	0.065	0.054	0.069
Model p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	13,021	13,021	12,635	12,635	13,021	13,021	13,021	13,021	13,021	13,021
Individuals	3,657	3,657	3,650	3,650	3,657	3,657	3,657	3,657	3,657	3,657

Notes: Table reports coefficients from linear fixed effects regressions. The dependent variable is either concurrent satisfaction, or artificial satisfaction based on concurrent and retrospective data. Std. errors in parentheses are adjusted for clustering on individuals. Number of observations differ due to missing values. Significance levels: \*10% \*\*5% \*\*\*1% Source: GSOEP, own calculations

TABLE A7: Robustness checks: Different sets of covariates - Females  
(Linear fixed effects regressions)

Changed covariates: Dependent variable:	Income measures		Health measures		Family measures		Excl. age		Excl. recall period	
	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>	CS <sub>it</sub>	AS <sub>it</sub>
Log household equivalent income	0.426*** (0.089)	0.370*** (0.092)	0.459*** (0.090)	0.379*** (0.092)	0.469*** (0.088)	0.421*** (0.091)	0.435*** (0.087)	0.371*** (0.091)	0.438*** (0.087)	0.375*** (0.091)
Log personal income	0.018 (0.025)	0.002 (0.024)	-	-	-	-	-	-	-	-
Hours of leisure time	0.010 (0.016)	0.036** (0.018)	0.012 (0.016)	0.038** (0.018)	0.010 (0.016)	0.036** (0.018)	0.010 (0.016)	0.032* (0.018)	0.010 (0.016)	0.036** (0.018)
Unemployed	-0.406** (0.196)	-0.499*** (0.186)	-0.473*** (0.113)	-0.483*** (0.106)	-0.519*** (0.112)	-0.514*** (0.105)	-0.521*** (0.113)	-0.544*** (0.106)	-0.522*** (0.113)	-0.514*** (0.106)
Not working	0.023 (0.173)	-0.082 (0.166)	-0.059 (0.078)	-0.097 (0.075)	-0.076 (0.076)	-0.100 (0.073)	-0.087 (0.076)	-0.117 (0.074)	-0.084 (0.076)	-0.091 (0.073)
Slightly hindered by health	-0.323*** (0.046)	-0.083** (0.037)	-	-	-0.321*** (0.046)	-0.083** (0.037)	-0.321*** (0.046)	-0.096*** (0.037)	-0.323*** (0.046)	-0.083** (0.037)
Strongly hindered by health	-0.779*** (0.093)	-0.337*** (0.078)	-	-	-0.779*** (0.093)	-0.339*** (0.078)	-0.779*** (0.093)	-0.334*** (0.078)	-0.781*** (0.093)	-0.339*** (0.078)
Doctor visits	-	-	-0.005*** (0.002)	-0.003** (0.001)	-	-	-	-	-	-
Nights in hospital	-	-	-0.002 (0.004)	0.001 (0.004)	-	-	-	-	-	-
Steady partner	0.229* (0.122)	0.222 (0.146)	0.253** (0.125)	0.227 (0.148)	0.254** (0.121)	0.223 (0.144)	0.225* (0.122)	0.275* (0.150)	0.232* (0.122)	0.225 (0.146)
Children in household	0.034 (0.078)	-0.002 (0.080)	0.038 (0.079)	0.007 (0.081)	-	-	0.023 (0.077)	0.071 (0.080)	0.028 (0.078)	-0.005 (0.080)
Number of children	-	-	-	-	0.058 (0.057)	0.147** (0.060)	-	-	-	-
Household size	-	-	-	-	-0.107** (0.043)	-0.080* (0.046)	-	-	-	-
Homeowner	0.067 (0.095)	-0.063 (0.121)	0.039 (0.095)	-0.083 (0.121)	0.128 (0.096)	-0.034 (0.121)	0.066 (0.095)	-0.093 (0.122)	0.068 (0.095)	-0.058 (0.122)
Months between interviews	-0.023 (0.014)	-0.030* (0.015)	-0.021 (0.015)	-0.027* (0.016)	-0.022 (0.014)	-0.029* (0.015)	-0.023 (0.014)	-0.030** (0.015)	-	-
Age	-0.246*** (0.060)	0.450*** (0.060)	-0.239*** (0.060)	0.451*** (0.060)	-0.243*** (0.060)	0.435*** (0.060)	-	-	-0.233*** (0.059)	0.462*** (0.060)
Age squared (/100)	0.041 (0.060)	-0.452*** (0.065)	0.037 (0.061)	-0.447*** (0.066)	0.034 (0.060)	-0.433*** (0.065)	-	-	0.036 (0.060)	-0.453*** (0.065)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Within R2	0.034	0.043	0.023	0.042	0.035	0.045	0.034	0.033	0.033	0.043
Model p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	13,026	13,026	12,731	12,731	13,026	13,026	13,026	13,026	13,026	13,026
Individuals	3,645	3,645	3,642	3,642	3,645	3,645	3,645	3,645	3,645	3,645

Notes: Table reports coefficients from linear fixed effects regressions. The dependent variable is either concurrent satisfaction, or artificial satisfaction based on concurrent and retrospective data. Std. errors in parentheses are adjusted for clustering on individuals. Number of observations differ due to missing values. Significance levels: \*10% \*\*5% \*\*\*1% Source: GSOEP, own calculations

TABLE A8: Robustness checks: Retrospective life satisfaction regressions - Males

Dependent variable: Retrospective satisfaction $RS_{it}$	Balanced panel	Excluding 1st wave	Excluding outliers	Without $CS_{it}$	Random effects regression
<b>Covariates from year <math>t</math></b>					
Log household equivalent income	0.160* (0.094)	0.171 (0.133)	0.143* (0.081)	0.201** (0.092)	0.146*** (0.055)
Unemployed	-0.880*** (0.157)	-0.805*** (0.223)	-0.766*** (0.119)	-0.981*** (0.157)	-0.888*** (0.105)
Not working	-0.489** (0.190)	-0.805** (0.330)	-0.344** (0.158)	-0.517*** (0.189)	-0.531*** (0.139)
Slightly hindered by health	0.011 (0.050)	-0.034 (0.072)	0.003 (0.045)	-0.027 (0.049)	-0.031 (0.033)
Strongly hindered by health	-0.259*** (0.100)	-0.265* (0.148)	-0.185** (0.092)	-0.358*** (0.101)	-0.250*** (0.067)
Steady partner	0.364*** (0.117)	0.634** (0.255)	0.219** (0.099)	0.364*** (0.118)	0.243*** (0.093)
Children in household	0.188** (0.084)	0.165 (0.123)	0.099 (0.072)	0.154* (0.084)	0.064 (0.061)
Homeowner	0.099 (0.129)	0.019 (0.178)	-0.025 (0.094)	0.079 (0.129)	-0.005 (0.074)
Age	-0.128** (0.059)	-0.234** (0.107)	-0.118** (0.051)	-0.107* (0.059)	0.009 (0.010)
Age squared (/100)	0.153** (0.068)	0.192 (0.125)	0.143** (0.060)	0.117* (0.068)	-0.005 (0.012)
Months between interviews	-0.019* (0.010)	-0.029* (0.016)	-0.012 (0.009)	-0.019* (0.010)	-0.013 (0.008)
<b>Covariates from year <math>t + 1</math></b>					
Log household equivalent income	-0.054 (0.088)	-0.032 (0.127)	-0.138* (0.078)	-0.059 (0.087)	-0.169*** (0.055)
Unemployed	0.640*** (0.134)	0.657*** (0.200)	0.482*** (0.121)	0.596*** (0.133)	0.713*** (0.094)
Not working	0.610*** (0.214)	0.241 (0.349)	0.443** (0.180)	0.592*** (0.210)	0.427*** (0.132)
Slightly hindered by health	0.002 (0.048)	-0.059 (0.069)	0.003 (0.044)	-0.020 (0.047)	-0.060* (0.032)
Strongly hindered by health	0.033 (0.102)	-0.122 (0.153)	0.028 (0.091)	-0.012 (0.100)	0.065 (0.071)
Steady partner	-0.020 (0.150)	-0.225 (0.239)	0.069 (0.128)	0.023 (0.148)	-0.159* (0.094)
Children in household	0.018 (0.094)	0.137 (0.147)	0.068 (0.077)	0.045 (0.092)	-0.105 (0.064)
Homeowner	0.182 (0.115)	0.055 (0.161)	0.059 (0.090)	0.155 (0.115)	0.103 (0.073)
<b>Concurrent life satisfaction in year <math>t</math> and <math>t + 1</math></b>					
Satisfaction in year $t$	0.089*** (0.016)	0.069*** (0.021)	0.049*** (0.011)	-	0.143*** (0.011)
Satisfaction in year $t+1$	0.640*** (0.018)	0.622*** (0.027)	0.718*** (0.014)	0.618*** (0.018)	0.688*** (0.013)
Year dummies	Yes	No	Yes	Yes	Yes
Within R2	0.391	0.360	0.500	0.384	0.387
Model p-value	0.000	0.000	0.000	0.000	0.000
Observations	9,111	6,502	9,812	9,901	9,901
Individuals	3,037	3,381	3,669	3,677	3,677

Notes: Table reports coefficients from linear fixed effects (columns 1 - 4), and linear random effects regressions (column 5). The dependent variable is retrospective life satisfaction for year  $t$  as reported in year  $t+1$ . Std. errors in parentheses are adjusted for clustering on individuals. Significance levels: \*10% \*\*5% \*\*\*1%  
Source: GSOEP, own calculations



TABLE A9: Robustness checks: Retrospective life satisfaction regressions - Females

Dependent variable: Retrospective satisfaction $RS_{it}$	Balanced panel	Excluding 1st wave	Excluding outliers	Without $CS_{it}$	Random effects regression
<b>Covariates from year <math>t</math></b>					
Log household equivalent income	0.220** (0.099)	0.231 (0.145)	0.245*** (0.084)	0.261*** (0.097)	0.207*** (0.062)
Unemployed	-0.369*** (0.121)	-0.251 (0.165)	-0.325*** (0.107)	-0.387*** (0.120)	-0.422*** (0.092)
Not working	0.008 (0.077)	0.052 (0.125)	0.015 (0.070)	0.016 (0.078)	-0.019 (0.053)
Slightly hindered by health	-0.115** (0.047)	-0.130* (0.071)	-0.111*** (0.042)	-0.146*** (0.047)	-0.106*** (0.033)
Strongly hindered by health	-0.059 (0.092)	-0.047 (0.140)	-0.108 (0.082)	-0.125 (0.091)	-0.217*** (0.064)
Steady partner	0.332** (0.141)	0.912*** (0.249)	0.282** (0.126)	0.350** (0.144)	0.141 (0.104)
Children in household	0.064 (0.084)	0.124 (0.116)	0.034 (0.072)	0.062 (0.082)	0.011 (0.057)
Homeowner	0.054 (0.109)	0.003 (0.152)	0.082 (0.096)	0.054 (0.109)	0.074 (0.079)
Age	-0.012 (0.058)	-0.182 (0.115)	-0.024 (0.052)	-0.032 (0.058)	0.021** (0.010)
Age squared (/100)	0.031 (0.069)	0.148 (0.134)	0.046 (0.061)	0.041 (0.069)	-0.016 (0.012)
Months between interviews	-0.018* (0.010)	-0.009 (0.017)	-0.011 (0.009)	-0.020* (0.010)	-0.011 (0.009)
<b>Covariates from year <math>t + 1</math></b>					
Log household equivalent income	-0.171* (0.094)	-0.166 (0.153)	-0.160* (0.081)	-0.136 (0.094)	-0.154** (0.062)
Unemployed	0.275** (0.132)	0.612*** (0.218)	0.253** (0.114)	0.261** (0.130)	0.282*** (0.092)
Not working	0.016 (0.079)	0.139 (0.113)	0.008 (0.069)	0.022 (0.078)	0.044 (0.052)
Slightly hindered by health	-0.065 (0.045)	-0.042 (0.065)	-0.076* (0.042)	-0.078* (0.045)	-0.059* (0.030)
Strongly hindered by health	0.186* (0.099)	0.153 (0.152)	0.102 (0.087)	0.160 (0.098)	0.035 (0.068)
Steady partner	0.403** (0.184)	0.378 (0.259)	0.311** (0.159)	0.430** (0.182)	0.081 (0.108)
Children in household	-0.065 (0.086)	-0.155 (0.130)	-0.093 (0.079)	-0.048 (0.087)	-0.002 (0.058)
Homeowner	0.079 (0.110)	0.045 (0.176)	0.071 (0.104)	0.089 (0.110)	0.039 (0.079)
<b>Concurrent life satisfaction in year <math>t</math> and <math>t + 1</math></b>					
Satisfaction in year $t$	0.083*** (0.014)	0.076*** (0.023)	0.057*** (0.011)	-	0.145*** (0.010)
Satisfaction in year $t+1$	0.643*** (0.017)	0.639*** (0.023)	0.705*** (0.013)	0.622*** (0.017)	0.692*** (0.012)
Year dummies	Yes	No	Yes	Yes	Yes
Within R2	0.386	0.379	0.477	0.382	0.383
Model p-value	0.000	0.000	0.000	0.000	0.000
Observations	9,105	6,493	9,828	9,896	9,896
Individuals	3,035	3,375	3,656	3,665	3,665

Notes: Table reports coefficients from linear fixed effects (columns 1 - 4), and linear random effects regressions (column 5). The dependent variable is retrospective life satisfaction for year  $t$  as reported in year  $t+1$ . Std. errors in parentheses are adjusted for clustering on individuals. Significance levels: \*10% \*\*5% \*\*\*1%  
Source: GSOEP, own calculations