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Revisiting the age-happiness profile:
Estimating age, period and cohort effects

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Revisiting the age-happiness profile: Estimating age, period and cohort effects.

Cristina Santos[1]

September 14, 2011

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Abstract

This paper estimates age-happiness profiles using alternative specifications for age, period and cohort. It discusses the two main methods, fixed effects and constrained generalised linear models, which are used to identify age effects in the happiness literature. This paper will estimate and replicate the findings of previous studies which have used restrictions on the coefficients for age, period and cohort. This paper also proposes an alternative way of identifying the effects of age, period and cohort. Instead of imposing restrictions on the vector of parameters, it explores the discrete nature of the data and redefines age so that age, period and cohort effects can be estimated, even at the individual level. It relies on the fact that not all individuals are born/interviewed in the same day, which creates an exogenous source of age variation within the same birth year cohort. Once linear effects of age, period and cohort are accounted for this way, and once fixed effects can separably identify age and period effects, age-happiness profiles estimated using OLS. fixed effects or ordered probit fixed effects differ from those already found in the literature.

JEL classification: D69, D84, I30
Keywords: age-happiness profile, APC models, linear effects

1 Introduction

The happiness literature is now well-established in Economics. Easterlin (1974) explained the paradox of the low time series correlation between average GDP per capita and average happiness for any one country. When a country gets richer, that does not seem to increase individual satisfaction on average. This paradox was confirmed by cross sectional studies, from which Veenhoven (1991) was one of the first and most exhaustive, which showed that richer countries did not necessarily report higher average satisfaction levels than poorer countries. This may be because of differences in income inequality across countries and over time, when gains from income have a lower effect on happiness (in magnitude) than similar losses (as suggested by Kahneman & Tversky, 1979). Alternatively, this can be explained by rising aspirations and expectations, which offset any objective improvements in standards of living, neatly described as a hedonic treadmill by Brickman et al. (1978). The relative nature of happiness encouraged several individual level longitudinal studies to understand the determinants of happiness (see e.g. Helliwell, 2002; Ferrer-i-Carbonell & Frijters, 2004, for a review), and to understand the extent to which happiness is driven by changes in income. The analysis of happiness at the individual level in longitudinal studies proliferated and age-happiness profiles became a key parameter of interest in validating the focus Economics has had on income.

Age-happiness profiles are also important per se. Longevity is increasing and it is important to evaluate how happy older people are likely to be. Wilson (1967) concluded that younger age had a positive impact on happiness. Most studies in Psychology often find that age has no impact on happiness at all, which is consistent with the hedonic treadmill theory. The Economics literature has often produced a U-shaped age-happiness profile, where the dip is around the age 50 (for a review of the literature on age-happiness profiles, see Frijters & Beatton, 2008; Clark, 2002). While this paper does not aim to explain the reasons why happiness changes with age, it is worth speculating about what the age-happiness profile tells us, and which shape we should expect it to have. One can think of younger ages as moments in life when the opportunity set of individuals is largest, and in this sense, it is expected that younger people, with more choice, would be happiest. On the other hand, uncertainty and high expectations may play a large role in individual decision making and well-being, so that we should expect older people, for whom uncertainty has dissipated and expectations have been updated, to be happiest. Easterlin (2001) suggests that this pattern reflects unfulfilled overoptimistic expectations of the young, who adapt to present circumstances later in life.

Results seem to depend not only on the methodology used, which may explain the differences between studies in Psychology and Economics, but within Economics, they may also depend on other covariates and estimation methods. Even though age is by nature exogenous and each individual fixed effect is orthogonal to age by definition, age is associated with particular life events which have an impact on happiness. There is a vast literature showing how happier people are more likely to be employed and to have higher earnings, or more likely to get married and live longer. However, most studies in this literature have not accounted for fixed-effects. Exceptions include Clark (2002); Frijters & Beatton (2008); Winkelmann & Winkelmann (1998) who then find a strong negative relation between age and happiness, even though age and time effects cannot be dissociated.

Frijters & Beatton (2008) and Clark (2002) suggest that cohort effects may underlie the relation between age and happiness. While Frijters & Beatton (2008) argues that cohorts are "just a missing aggregate variable specific to an age-group but where we do not know what the missing variable is", other authors recognise that cohort effects are the true essence of social change (e.g. Yang et al., 2008; Cribier, 2005). The author of this paper tends to agree more with the second view, where age effects capture lifecycle regularities we observe across time (and actually not just the cumulative effect of life events which tend to happen at particular stages of one's life), cohort effects capture the evolving social context whose impact affect individuals in different stages of their lifecycle differently. Identifying both effects, and separably from each other, is then a key aspect of research in social sciences. Age and cohort effects are difficult to account for when time effects also exist, due to the linear dependence between the three variables. A lot of work has been done in Epidemiology, Demography and Sociology to analyse such models.

In these areas, the two most common approaches are constrained generalised linear models (CGLIM) and the intrinsic estimator (see e.g Yang et al., 2008, for a review of this literature). CGLIM often specify an outcome variable as a linear function of age, cohort and period variables, and then impose some constraints on the vector of parameters. These constraints are arbitrary and are needed because the model is underidentified. The intrinsic estimator decomposes the effect of the three variables into a full rank parameter vector space b_0 and a vector which defines the linear dependence between the three variables B_0 and which is thus unrelated to the outcome variable. The full rank coefficient vector is assumed orthonormal to B_0, so that it is invariant to the selection of constraints on B_0. So in effect, this methodology also imposes constraints on the parameters of our model, indirectly by assuming orthonormality.

In the economics literature, often cohorts are not accounted for or are defined as larger intervals of time than age or period (this falls under the CGLIM category of models which in this case assumes equality of cohort coefficients within a certain time interval). This works well if the changes in the experiences of different cohorts which would be relevant in happiness studies occur gradually and slowly over time, such as political and economic stability, life expectancy, social protection, and so on. However, if we define birth cohorts as ten-year intervals of birth years, we also expect their coefficients to be small and statistically insignificant because the years included in each interval are arbitrary, and so is the change from one interval to the next. What is more, Holford (1983) has shown how if the linear effect of all three variables is important, using unequally spaced intervals amongst the three variables can result in saw-tooth underlying effects, which are very difficult to explain. Other studies have assumed linear cohort effects were zero and estimated higher order effects. Needless to say, if the linear effect is not zero, higher order effects will be biased. other studies have used fixed effects to estimate age effects because the year of birth is a time invariant variable at the individual level. However, fixed effects does not separate age from period effects, so age effects are also biased. This paper will replicate the most common specifications of age, cohort and period effects in the economics literature and also proposes an additional method which estimates linear, as well as nonlinear, effects of age, period and cohort, when all three variables are defined in yearly intervals.

Our measure of age exploits the discreteness of the data and the fact that not all individuals are born/interviewed in the same day. As such, some individuals have had their birthday by the time of the interview while others have not. It is then possible to observe individuals belonging to the same birth year cohort with different ages purely due to exogenous reasons. This creates an exogenous source of age variation within the same birth year cohort, which breaks the linear dependence between the three variables. These linear effects, as well as nonlinear effects are thus identified with very few parametric assumptions, even at the individual level. We also try to separate the importance of other confounding factors in the age-happiness profile, such as attrition and unobserved heterogeneity. Results do differ with this method, and both attrition and unobserved heterogeneity matter in the estimation of age-happiness profiles.

The next section describes the linear dependence problem and how linear effects of all three factors are identified. If these variables were measured continuously, and not in yearly brackets, surely the linear dependence problem would subsist. However, we argue that this redefinition of age is a better measure of age and also allows for linear effects of age, year and cohort to be separately identified. Section 3 describes the data and how sample design of GSOEP facilitates this study. Section 4 estimates the age-happiness profile using alternative methods and discusses the results while Section 5 concludes.

2 Identifying the effects of age, period and cohort

We are interested in identifying the effects of age a, cohort c and period t on individual subjective well-being h. For individual i, these three factors are however linearly dependent as follows:

$$a_{it} = t - c_i \tag{1}$$

If h is well described by a general function $f(a,c,t)$ and an additively separable error term u, Eq. 1 implies:

$$h_{act} = f(a,c,t) + u = f(a_{ct}, t - a_{ct}, t) + u = g(a_{ct}, t) + u_{ct} \tag{2}$$

Even if we would like to estimate the impact of age on happiness by conditioning the analysis on cohort and period, Eq. 2 shows that the initial happiness equation f can always be rewritten as a function of age and either period or cohort. To see the implications of this, let h_z represent the partial derivative of h with respect to $z, z = a, c, t$. Eqs. 1 and 2 then show that the linear effect of age on happiness h_a equals $g_a = g_t$. This is because age and time grow at the same rate, for any given cohort. If birth cohort is omitted however, estimated effects of age will be biased in the following way:

$$E\left(g_a \mid t\right) = E\left(f_a \mid c,t\right) - E\left(f_c \mid t,a\right), \tag{3}$$

From Eq. 3, we see that, if the birth cohort effects are positive (negative), the age effect is underestimated (overestimated).

Identifying age, cohort and period effects is an issue that arises in several different contexts. Examples include the analysis of the incidence of particular infectious diseases (e.g. Holford, 1983; Clements et al., 2005), changes in national savings ratios (e.g Deaton & Paxson, 1999), scientific productivity of researchers and vintage capital model of trucks or personal computers (e.g. Hall et al., 2005), wage structure and college premium (e.g. Welch, 1979; MaCurdy & Mroz, 1995; Card & Lemieux, 2001; B. Fitzenberger & Schnabel, 2001), human capital and early career choices (e.g. Card & Lemieux, 2000) and job satisfaction (e.g. Jurges, 2003). Different studies adopt different identification strategies. The most common type of assumption specifies each of the three variables as polynomials and restricts some of their coefficients[1]. B. Fitzenberger & Schnabel (2001); Jurges (2003); Holford (1983); Clements et al. (2005) assume the linear effects of one of the factors is zero. They then estimate higher order effects of all three factors, and their interactions. Simpler models will assume that interactions between all three

[1] See MaCurdy & Mroz (1995); Hall et al. (2005) for good reviews.

factors are not important and estimate an additively separable model. This model either omits the linear effect of one of the factors, or excludes that factor from the specification altogether (Deaton & Paxson, 1999). All of these specifications have so far defined age, cohort and year in equally spaced intervals of the same length. Other authors have however proposed an additively separable model where the length of the observation periods of the three factors is no longer the same (see e.g. Card & Lemieux, 2000, 2001; Hall et al., 2005). However, Holford (1983) shows that using a model where age, cohort and period are modeled in intervals of different length can lead to a saw-tooth profile of our parameter of interest. Finally, a less common assumption was used in e.g. Welch (1979) and Berger (1985), where cohort effects would be fully characterised by a function of cohort size. This approach relies on having a sufficient statistic for one of the factors available, which may be difficult when our variable of interest is general satisfaction. Alternatively, other authors have used an instrumental variable approach (see e.g. Heckman & Robb, 1985). They propose identifying a variable that affects the dependent variable but, in the long run, is only correlated with one of the factors. In the context of happiness studies, this instrumental variable also proves to be difficult to find. In this paper, we compare different specifications of age, cohort and period effects in a linear regression model.

We further propose a way of estimating all linear effects when age, cohort and period are defined in equally spaced intervals. To do so, and because data are observed on a yearly basis, age a has been redefined as completed years of life while the definition of birth cohort and period remain the same. If an individual has had his birthday by the time the data are recorded, he is $t-c$ years old. If his birthday happens later in the year, he is just $t-c-1$ years old. Hence, as the usual measure of age in yearly longitudinal surveys, completed years of life will also be augmented by 1, but not for all individuals as soon as the calendar year changes. Depending on the exact time of the interview, individuals belonging to the same birth cohort have different completed ages in any given moment in time. This exogenous variation in age breaks the linear dependence between age, cohort and time, even at the individual level. This definition allows Eq. 1 to hold exactly for those whose birthday happens in the day of the interview. On the contrary, the usual definition of age is only close to the true relation for those who happen to be born in the first days of the year and the error increases with the lateness of the day of birth. Take individuals born in 1978 and in 1979 being observed in 1980. According to Eq. 1, individuals born in 1978 are all 2 years old and those born in 1979 are all 1 year old. However, individuals can have any age in the interval]0,2[if they are born in 1979 or any age between]1,3[if they are born in 1978. Our redefinition of age would assign completed years of either 0 or 1 to individuals born in 1979 and completed years 1 or 2 to individuals born in 1978.

You may argue that defining age as completed years of age is as arbitrary as defining it the usual way (which is the right way in continuous time). However, this definition breaks the linear dependence between the 3 variables, and has smaller measurement error.

To make this argument more precise, lets define the exact age at the time of the interview as

$$\text{age}_{\text{true}} = \text{beginning current year} + s \text{ - (beginning birth year} + b \text{)},$$

where s stands for the moment of the interview and b is the moment of birth. Both variables are defined as a fraction of a given year and they are both defined in a unit interval, e.g. $s, b \in [0, 1]$, where 0 means the beginning of a year and 1 the end of a year. While it is not controversial to assume $b \sim U(0, 1)$, it is assumed that the moment of the interview is also equally likely in any day of the year for the sake of illustration, so that $s \sim U(0, 1)$.

When age is defined as usual, i.e., as $\text{age}_{\text{usual}}$ = current year - birth year, the underlying error is

$$\text{error}_{\text{usual}} = b - s \in [-1, 1]$$

Given the assumptions made on b and s, we know this error has zero mean and variance $\frac{1}{6}$[2].

[2]The joint density of $b - s$ is $f(b-s) = 1 - |b-s|$. Hence the expected value of the error associated with the usual definition of age is E ($\text{error}_{\text{usual}}$) $= \int_{-1}^{1} (b-s)[1-|b-s|]\, d_{b-s} = 0$ and the variance is Var($\text{error}_{\text{usual}}$) =

However, when age is defined as completed years only, that is

$$\text{age}_{\text{completed}} = \begin{cases} \text{current year - birth year - 1} & \text{if} \quad s \leqslant b \\ \text{current year - birth year} & \text{if} \quad s > b \end{cases} \tag{4}$$

the underlying error is

$$\text{error}_{\text{completed}} = \begin{cases} b - s - 1 & \text{if} \quad s \leqslant b \\ b - s & \text{if} \quad s > b \end{cases} \in [-1, 0] \tag{5}$$

This error has mean $-\frac{1}{2}$ and variance $\frac{1}{18}$. This paper thus proposes a biased but lower variance estimator of age[3], which breaks the linear dependence between age, period and cohort, even at the individual level. All it requires is for the moment of the interview to sometimes happen before, and other times happen after each individual's birthday.

3 Data

The German Socio-Economic Panel (GSOEP) records, for most respondents, both the date of birth of the interviewees and the date in which interviews are held. It can happen that in a given calendar year t, individuals born in the same year and thus belonging to the same birth cohort c have different **completed years** when interviewed, depending on whether they have had their birthday by the time of the interview. Hence age is defined as in Eq. 4.

As discussed in the previous section, this definition of age seems more natural given the discreteness of the data. If age is just defined as $t - c$, it is augmented by 1 just because the calendar year changed. This applies to all individuals, whether they are exactly $t - c$ years, $t - c - 365$ days minus almost 6 hours old or $t - c + 365$ days and almost 6 hours old. By using the definition in Eq. 4, age effects are not confounded with artificial "year-shifting" effects. These are identified as long as the time of the interview

$\int_{-1}^{1} (b - s)^2 \left[1 - |b - s|\right] d_{b-s} = \frac{1}{6}$.

[3]The expected value was computed by solving $\text{E}\left(\text{error}_{\text{completed}}\right) = \text{E}\left[(b - s) - 1 | \, b - s \geqslant 0\right] P\left(b - s \geqslant 0\right) + \text{E}\left[b - s | \, b - s < 0\right] P\left(b - s < 0\right)$, and similarly for the variance.

is purely exogenous. Individuals interviewed after and before their birthday should be identical in all except their number of completed years.

Unfortunately, only the month of birth is observed while the day of birth would provide a more accurate definition of age. In practice, age ends up being defined as $t - c - 1$ if the day of the interview is prior to the 15^{th} of the month of birth and $t - c$ thereafter.

Figure 1 shows how interviews are spread throughout the year. Indeed, although they tend to be more concentrated in the first quarter, there is some variation in the month of the interview. One source of variation is purely exogenous and stems from the fieldwork design[4]. However, there are households being contacted more than once so that their interviews tend to be carried out later in the year. If these individuals are a selected sample, retrials can undermine this identification strategy. For this reason, we also carry out the analysis excluding the individuals interviewed later in the year. We also run fixed effects estimation of happiness equations to account for unobserved heterogeneity.

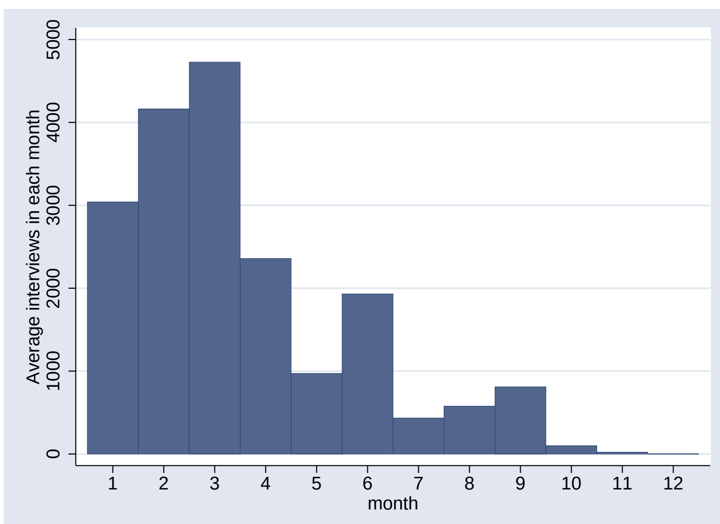

Figure 1: Average number of interviews conducted in each month over the 20-year period

Happiness is measured by the self-reported general satisfaction variable

[4]I thank Jan Goebel from DIW Berlin for all the information regarding this issue.

in the GSOEP. Interviewees are asked every year, at the end of the questionnaire, the following question:

> 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?

It is a discrete variable taking 11 integer values from 0 to 10.

Table 1 shows a cohort table with the sample we analyse. It represents average happiness level for individuals with a particular age in a particular year. Each row shows the evolution of the happiness mean at a given age, across time. With the usual age definition, each cell would correspond to a different cohort, all observed at a particular age, but this need not be the case with our definition. Each column reads cross sectional values for all ages in a given period. Kermack et al. (1934) notes that lifecycle trends are observed diagonally for each cohort. Again, with our definition, this is not necessarily the case because age does not increase by 1 between interviews, as the evolution across any diagonal assumes for each cohort. As an illustration, we signal in bold the possible ages an individual who is 20 years old in 1986 and another who is 41 in 1985 can have in the following years. This thus shows that we can identify age, cohort and period effects, even at the individual level. A cohort is now followed along a *thick* diagonal and not a line diagonal.

Table 1: Average Happiness for all ($age, period$) combinations - Cohort Table

	year of survey																		
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
20	7.26	**7.20**	**7.30**	7.24	7.38	7.29	7.06	6.95	7.02	7.25	7.14	7.19	7.28	7.11	7.32	6.86	7.07	7.10	6.99
21	7.28	7.49	**7.22**	**7.26**	7.30	7.37	7.23	6.99	7.01	6.98	7.05	7.24	7.23	7.04	7.20	7.19	7.14	6.89	7.18
22	6.83	7.33	**7.18**	**7.18**	**7.50**	7.50	7.04	6.90	6.96	6.97	7.19	7.21	7.17	7.24	7.21	7.28	7.21	6.82	6.93
23	7.06	7.44	7.21	**7.19**	**7.14**	**7.40**	7.20	7.12	7.11	7.08	7.04	6.98	7.18	7.07	7.27	6.96	7.18	7.21	6.93
24	7.58	7.28	7.28	7.09	**7.32**	**7.36**	**7.30**	6.96	6.94	7.07	7.00	7.05	7.07	7.11	7.15	7.38	7.20	7.15	7.10
25	7.22	7.54	7.24	7.15	7.04	**7.58**	**7.13**	**7.18**	7.20	7.05	7.03	7.06	7.08	7.12	7.09	7.14	7.33	7.23	6.96
26	6.89	7.55	7.24	7.13	7.03	7.36	**6.89**	**7.11**	**7.11**	7.07	7.11	7.20	6.94	7.16	7.09	7.18	7.03	7.05	7.03
27	7.26	7.05	7.16	7.22	7.10	7.49	6.89	**6.91**	**6.93**	**7.02**	7.12	7.12	7.00	7.27	7.38	7.01	7.19	6.94	6.80
28	7.18	7.19	6.97	7.14	7.28	7.39	6.95	6.99	**7.05**	**6.97**	**7.10**	7.10	6.87	7.16	7.27	7.34	7.18	7.16	7.10
29	7.25	7.30	7.26	7.01	7.15	7.44	6.87	6.93	6.87	**6.83**	**6.89**	**6.98**	7.11	7.04	7.13	7.12	7.34	6.97	6.94
30	7.23	7.30	7.25	7.10	6.98	7.31	6.91	6.86	6.93	6.89	**6.97**	**6.99**	**6.81**	7.10	7.15	7.19	7.12	7.08	7.01
31	7.24	7.26	7.14	7.13	7.25	7.11	6.87	6.92	6.83	7.00	6.92	**7.11**	**6.84**	**7.04**	7.20	7.03	7.24	7.19	7.11
32	7.42	7.31	7.05	7.09	7.08	7.38	6.66	6.71	6.81	6.67	7.08	6.88	**6.78**	**6.87**	**7.10**	7.12	7.04	7.00	7.01
33	7.10	7.47	7.34	7.19	7.02	7.24	6.88	6.64	6.78	6.87	6.87	6.96	6.76	**6.92**	**7.05**	**7.03**	7.15	6.95	6.89
34	7.19	7.28	7.22	7.21	7.18	7.18	6.72	6.90	6.69	6.56	6.87	6.88	6.75	6.89	**7.01**	**7.11**	**7.14**	7.07	6.80
35	7.33	7.40	7.04	7.18	7.08	7.36	6.76	6.77	6.94	6.66	6.96	7.00	6.70	7.08	6.92	**6.90**	**7.05**	**6.99**	6.82
36	7.36	7.41	7.10	6.89	7.01	7.42	6.67	6.77	6.68	6.76	6.90	6.98	6.88	6.80	6.91	7.03	**7.03**	**6.82**	**6.96**
37	7.44	7.33	7.15	7.12	7.15	7.32	6.95	6.74	6.72	6.47	6.90	6.75	6.93	6.94	6.86	6.93	6.97	**6.83**	**6.93**
38	7.04	7.30	7.14	7.28	7.00	7.11	6.87	6.91	6.87	6.77	6.66	6.96	6.67	6.93	7.00	6.88	7.02	6.88	**6.80**
39	7.15	7.18	7.10	7.17	7.06	7.24	6.60	6.71	6.93	6.70	6.86	6.60	6.87	6.76	7.04	7.02	7.03	6.90	6.68

Continued on next page

Table 1 – continued from previous page

	year of survey																	
40	7.26	7.12	7.06	6.75	7.23	7.43	6.68	6.76	6.79	6.80	6.77	6.75	6.43	6.85	6.84	6.90	6.91	6.64	6.88
41	**7.19**	**7.20**	6.98	7.33	7.28	7.54	6.96	6.70	6.82	6.68	6.85	6.68	6.58	6.60	6.93	6.79	6.89	6.72	6.73
42	7.24	**7.27**	**7.03**	7.23	7.43	7.21	7.10	7.10	6.69	6.85	6.68	6.72	6.61	6.78	6.57	6.73	6.81	6.78	6.51
43	7.32	**7.14**	**6.96**	**6.95**	7.12	7.23	6.77	6.94	6.95	6.68	6.70	6.76	6.72	6.76	6.67	6.61	6.88	6.65	6.45
44	7.11	7.24	**7.16**	**7.13**	**6.67**	7.42	6.86	6.77	6.62	6.81	6.67	6.69	6.45	6.74	6.63	6.75	6.52	6.74	6.46
45	7.34	7.12	7.22	**6.91**	**6.77**	**7.04**	6.93	6.97	6.73	6.84	6.82	6.73	6.60	6.67	6.85	6.67	6.70	6.32	6.60
46	7.17	7.32	6.88	6.97	**7.04**	**7.19**	**6.74**	6.96	6.75	6.49	6.91	6.66	6.72	6.67	6.48	6.62	6.56	6.68	6.26
47	7.33	6.97	7.12	6.94	7.18	**7.11**	**6.77**	**6.81**	6.92	6.82	6.55	6.79	6.57	6.67	6.74	6.47	6.77	6.60	6.43
48	7.20	7.21	6.99	7.13	7.08	7.22	**6.87**	**6.64**	**6.77**	6.93	6.70	6.64	6.71	6.52	6.88	6.67	6.58	6.51	6.26
49	7.25	7.23	7.04	6.93	7.03	7.21	6.63	**6.74**	**6.54**	**6.79**	6.92	6.67	6.52	6.68	6.74	6.83	6.55	6.33	6.18
50	7.42	7.02	7.07	7.06	6.94	7.27	6.89	6.69	**6.69**	**6.46**	**6.72**	6.69	6.42	6.54	6.52	6.66	6.84	6.33	6.34
51	7.03	7.07	6.69	7.01	7.09	7.27	6.89	6.70	6.56	**6.80**	**6.48**	**6.92**	6.65	6.34	6.68	6.34	6.77	6.68	6.41
52	6.69	6.99	6.99	6.71	7.04	7.08	6.85	6.82	6.70	6.64	**6.65**	**6.45**	**6.54**	6.69	6.54	6.48	6.54	6.66	6.58
53	6.95	7.04	6.89	6.99	6.64	7.13	6.71	6.76	6.75	6.59	6.70	**6.70**	**6.23**	**6.74**	6.68	6.49	6.42	6.39	6.59
54	7.09	7.04	6.62	6.90	6.83	6.71	6.43	6.77	6.63	6.74	6.55	6.67	**6.41**	**6.41**	**6.71**	6.75	6.81	6.31	6.47
55	7.46	7.09	6.96	6.86	6.86	7.04	6.61	6.72	6.59	6.75	6.52	6.52	6.69	**6.72**	**6.46**	**6.75**	6.80	6.58	6.19
56	7.31	7.44	7.20	7.15	6.87	6.95	6.93	6.56	6.63	6.46	6.71	6.57	6.47	6.64	**6.76**	**6.41**	**6.71**	6.77	6.54
57	7.26	7.25	7.34	6.62	6.99	6.97	6.51	6.73	6.75	6.64	6.64	6.64	6.59	6.68	6.66	**6.69**	**6.41**	**6.55**	6.47
58	7.13	7.26	7.22	7.23	6.77	7.24	6.89	6.70	6.76	6.49	6.74	6.68	6.55	6.64	6.64	6.57	**6.97**	**6.37**	**6.48**
59	7.50	7.14	7.12	7.26	7.09	6.99	7.02	6.91	6.49	6.92	6.66	6.88	6.69	6.55	6.62	6.45	6.63	**6.68**	**6.40**
60	7.23	7.66	7.38	7.08	7.25	7.50	7.02	7.13	6.79	6.47	6.82	6.65	6.92	6.97	6.70	6.73	6.85	6.39	**6.51**

Table 1 shows that average happiness is larger for younger cohorts than for older cohorts, at any moment in time. Figure 2 shows the lifecycle mean happiness for different cohorts and the overall happiness profile. The cohort specific lifecycle curves are not horizontal shifts of each other, nor are they parallel to the pooled sample's. Instead, both the mean and the variance around average happiness vary across cohorts. Cohort specific effects also tend to be decreasing, even if not all, whereas the pooled profile tilts back up at the end, producing a U-shape curve so often found in the literature (see e.g. Ferrer-i-Carbonell & Frijters, 2004). This suggests that cohort effects are likely to be important and excluding them from a happiness equation is likely to bias the estimates of the impact of age and year.

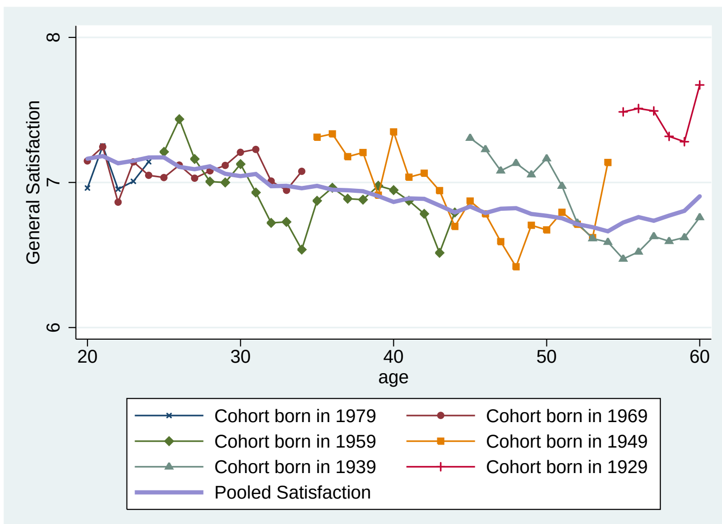

Figure 2: The happiness profile in age, following different cohorts

4 Estimation Results

This section shows the results of estimating happiness equations which specify age, cohort and period effects in different ways. Age is defined as in Eq. 4, calendar time is as usual the year of the interview, and cohort is also as usual the individual year of birth. We have also included some of the most common covariates in happiness studies. These are gender, *bundesland*, nationality, marital status, number of members in the household, educational diploma, labor force status, household income and self-reported satisfaction with health. The latter is a categorical variable ranging from 0 to 10, where 10 represents full satisfaction with health and 0 complete dissatisfaction.

In order to guarantee enough observations per cell, the sample is restricted to individuals of Turkish, Balkan[5], East German or West German background, and who stay in their initial *bundesland* throughout the sample period. Those who are still in schooling, on maternity leave, have been drafted or only have a very sporadic source of income are also excluded. Married but separated individuals are not accounted for either. Individuals are only followed after they have completed their 20 years of age and only until they reach 60 years of age. This is to prevent an over-representation of older individuals in the sample.

Table 2 presents the OLS estimation results. The first six columns show the results of basic specifications which do not include additional covariates. Column I shows the most common specification of happiness equations where cohorts are omitted, the age effect is modeled with a quadratic function and year dummies are included. Column II adds cohort effects by assuming constant cohort effects within 5-year intervals, as in Card & Lemieux (2001). Column III is a simplified version of B. Fitzenberger & Schnabel (2001) which models all three variable effects using cubic polynomials and assumes the cohort linear effect is zero. Column IV further includes the linear cohort effect so that we can compare and analyse the consequences of omitting the cohort linear effect. Columns V and VI use cohort and period dummies, but the former models age using a quadratic function while the latter uses age dummies. Column V is used to understand how much of the differences we observe between our estimates of the age and squared age coefficient are due to poor accounting for cohort effects while column VI tells us whether the quadratic approximation is a good one. Columns VII - XII repeat the first 6 columns but include the additional covariates. Robust standard errors are computed and errors are clustered at the individual level.

[5]The countries that used to form Yugoslavia are also grouped into one category, again for sample size considerations.

Results are striking. While the benchmark model yields the usual U-shape happiness profile with respect to age, with the inflexion point outside our age range, all other specifications suggest an increasing profile. The quadratic specification seems to be forcing a hump which the age dummies do not confirm. When we use age dummies, the age-happiness profile is increasing. When we add cohort 5-year interval dummies, cohort effects do not seem to vary much, which is to be expected given the arbitrariness of the cutoff points. However, cohort polynomials or dummies do point to statistically significant positive cohort effects, so that individuals born later are on average happiest. The linear cohort effect added to column III in column IV proves to be significant and both the magnitude and the significance of the coefficients on the remaining cohort terms change. Time effects are also statistically significant, so that all three effects seem to independently matter greatly in happiness studies. When we add regressors, all effects become less significant and smaller in magnitude, but the same shift in the pattern subsists, once we adequately account for cohort effects.

The estimates of the additional covariates do not yield surprising results[6]. Household net income has a very significant albeit small impact on happiness. The divorced individuals fare worst and the widowed are worse off than single individuals, even though age is in the equation. Households with 4 members or more are doing poorly, even after conditioning on income. The unemployed are the least happy group while the Full-time workers and the retired individuals are the happiest. Men are significantly less happy than women. Similar to other studies, educational differences are not consistently significant. There are also important regional and nationality differences. Health is the most important factor in explaining happiness.

All in all, estimating a happiness equation with age redefined and without conditioning on year of birth still yields a robust U-shape profile (but with an inflexion point outside the age range we analyse). These results clearly indicate that the age coefficient estimates from previous work are in fact a combination of positive cohort effects, what seems to be positive age effects and negative period effects. Looking at the standard errors of the age coefficients, one further sees that the true explanatory power of age is very

[6] These are available upon request.

reduced, once year of birth is adequately accounted for in the analysis.

Table 2: OLS estimates of a happiness equation, conditioning on age, birth cohort and calendar time

	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Age	-0.0304***	0.0192**	0.1590***	0.2381***	0.1244***		-0.0447***	0.0013	0.1659***	0.1465***	0.0024	
	(0.0050)	(0.0090)	(0.0260)	(0.0360)	(0.0270)		(0.0050)	(0.0080)	(0.0240)	(0.0310)	(0.0200)	
Age^2	0.0002***	-0.0003***	-0.0030***	-0.0034***	-0.0003***		0.0006***	0.0002**	-0.0039***	-0.0037***	0.0001*	
	(0.0000)	(0.0000)	(0.0010)	(0.0010)	(0.0000)		(0.0000)	(0.0000)	(0.0010)	(0.0010)	(0.0000)	
Age^3			0.0000***	0.0000***					0.0000***	0.0000***		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Age 21						0.1408***						0.0514
						(0.0460)						(0.0430)
Age 31						1.2882***						0.2267
						(0.2890)						(0.2200)
Age 41						2.2815***						0.3117
						(0.5490)						(0.4150)
Age 51						3.1213***						0.2975
						(0.8120)						(0.6130)
Age 60						4.1524***						0.6417
						(1.0470)						(0.7890)
[1929, 1934[		-0.1374						-0.0001				
		(0.0950)						(0.0780)				
[1939, 1944[		-0.204						-0.1581				
		(0.1340)						(0.1040)				
[1949, 1954[		-0.1718						-0.1608				

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Table 2 – continued from previous page

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
		(0.1990)						(0.1530)				
[1959, 1964[		-0.0423						-0.0529				
		(0.2690)						(0.2040)				
[1969, 1974[		0.216						0.1663				
		(0.3370)						(0.2550)				
[1979, 1984[		0.2585						0.314				
		(0.4060)						(0.3070)				
Cohort				0.0765***						-0.0187		
				(0.0280)						(0.0210)		
Cohort^2			0.0010***	0.0005					0	0.0001		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Cohort^3			0	0					0.0000**	0.0000*		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Born 1925					0.2634	0.3225					-0.1089	-0.0934
					(0.2660)	(0.2660)					(0.2530)	(0.2540)
Born 1935					0.7856**	0.9843***					-0.4035	-0.2875
					(0.3670)	(0.3670)					(0.3110)	(0.3110)
Born 1945					1.8715***	2.0816***					-0.3463	-0.2157
					(0.5970)	(0.5970)					(0.4700)	(0.4690)
Born 1955					2.8162***	2.9727***					-0.4104	-0.3439
					(0.8430)	(0.8430)					(0.6490)	(0.6490)
Born 1965					4.0657***	4.2213***					-0.2338	-0.1691
					(1.0930)	(1.0920)					(0.8360)	(0.8350)
Born 1975					5.4411***	5.6225***					0.121	0.2141

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Table 2 – continued from previous page

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
					(1.3510)	(1.3510)					(1.0270)	(1.0260)
Born 1983					6.6581***	6.8727***					0.4166	0.5395
					(1.5770)	(1.5750)					(1.2600)	(1.2590)
Year 1986	-0.0129	0.0065			0.4118***	0.4138***	-0.0329	-0.0223			-0.031	-0.0299
	(0.0260)	(0.0400)			(0.1090)	(0.1090)	(0.0260)	(0.0350)			(0.0840)	(0.0840)
Year 1991	-0.4011***	-0.4103***			-0.5054***	-0.5052***	-0.1821***	-0.1894***			-0.1829***	-0.1829***
	(0.0240)	(0.0250)			(0.0360)	(0.0360)	(0.0230)	(0.0240)			(0.0310)	(0.0310)
Year 1996	-0.4105***	-0.4731***			-1.0721***	-1.0729***	-0.1524***	-0.1934***			-0.1806	-0.1838
	(0.0250)	(0.0500)			(0.1580)	(0.1580)	(0.0240)	(0.0410)			(0.1200)	(0.1200)
Year 2001	-0.3321***	-0.4576***			-1.5587***	-1.5591***	-0.1273***	-0.2217***			-0.2028	-0.2037
	(0.0270)	(0.0850)			(0.2880)	(0.2880)	(0.0260)	(0.0650)			(0.2170)	(0.2170)
Year			-0.1504***	-0.2184***					-0.0868***	-0.0701***		
			(0.0150)	(0.0300)					(0.0140)	(0.0240)		
$Year^2$			0.0062***	0.0066***					0.0072***	0.0071***		
			(0.0010)	(0.0010)					(0.0010)	(0.0010)		
$Year^3$			-0.0001***	-0.0001***					-0.0002***	-0.0002***		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Constant	8.0714***	7.0747***	4.0644***	0.0652	0.5441	2.6856**	4.9267***	4.0280***	1.5889***	2.5630**	4.2898***	4.2309***
	(0.1020)	(0.4730)	(0.5480)	(1.5680)	(1.7150)	(1.1980)	(0.1310)	(0.3740)	(0.4640)	(1.1960)	(1.3020)	(0.9130)
R^2	0.014	0.016	0.014	0.014	0.018	0.018	0.292	0.293	0.293	0.293	0.294	0.295
Covariates	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

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Table 2 – continued from previous page

	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Profile	Decreasing	Inverted U	Inverted U	Inverted U	Increasing	Increasing	U-shaped	Increasing	Inverted U	Inverted U	Increasing	Unrelated

Significance levels : $*$: 10% $**$: 5% $***$: 1%

Robust standard errors in parentheses.

Additional covariates are gender, *bundesland*, nationality, marital status, educational diploma, labor force status, household income and self reported satisfaction with health and number of members in the household.

Omitted categories: 21 year olds, year 1984, cohort born between $[1924, 1929[$, cohort born in 1924.

4.1 Robustness Checks

The previous estimation results are subject to a number of criticisms. First of all and as already discussed, the exogeneity of the moment of the interview only holds if all the interviewees answered the first time they are contacted or if the reasons why they might not have replied in the first attempts are uncorrelated with happiness, conditional on all covariates[7]. Interviews being carried out later in the year might be contaminated with those individuals who are less available and with a higher valuation for time. In fact, Frijters & Beatton (2008) showed that there seem to be selective attrition and the average happiness of those who stay in the panel is lower than the overall average. If we think that those who need to be contacted again are also more likely to attrite in the future, we should worry. We reestimate the happiness equations for those that are interviewed only in the first months of the year to avoid including interviews where respondents had to be contacted more than once. We also look at those who stay in the panel for the whole 20 waves and also for those who answer the first and the last questionnaires to avoid such a loss of observations, to see how serious selective attrition is. Finally, we analyse how results change when we account for unobserved heterogeneity and/or the ordinal nature of the happiness variable by running fixed effects, ordered probit and ordered fixed effects logit estimations[8].

4.1.1 Late interviews

The regressions are repeated for only the first months of the year. This aims to withdraw from the sample those individuals who have to be contacted more than once because their interviews tend to be concentrated later in the year. Tables 3, 4 and 5 show the estimated age-happiness profiles when only the first three, four and six months respectively are used for estimation. In short, all results remain qualitatively the same, which indicates that this group of people does not seem to bias the estimates. In the basic specification,

[7] The number of attempts made for each interviewee is actually a piece of information which should be made public.

[8] We thank Paul Frijters and Ada Ferrer-i-Carbonell for useful discussions about their method explained in Ferrer-i-Carbonell & Frijters (2004) and for having made their Stata code available. All errors are my own.

an increasing age-happiness profile seems to be the result of positive cohort effects and negative period effects. However, in the full specification, most of these effects become statistically insignificant.

4.1.2 Stayers

The happiness equation is also estimated with a balanced sample to account for a possible selection bias. First only those individuals who answer all of the questionnaires are included and results are presented in Table 6. Only 2273 out of 33852 individuals satisfy this condition and so, the exercise is repeated with all the interviewees who answered the first and the last questionnaire. This more than doubles the number of individuals. Table 7 shows these results.

For both samples, the benchmark model continues to present a statistically significant U-shaped age-happiness profile. Most models where age is a quadratic function continue to exhibit an inverted U-shaped profile, except for the model with a complete set of cohort and period dummies, which if anything shows a negative relation. This is confirmed by the model which uses age-dummies, whose coefficients are not significant. These results do suggest that attrition is selective, confirming the results obtained in Frijters & Beatton (2008).

4.1.3 Alternative Estimation Methods: accounting for selection and the ordinal nature of the happiness variable

This section shows the results from fixed effects estimation, which accounts both for cohort effects, unobserved heterogeneity and attrition bias. Given our measure of age, both age and year effects can be identified. It also estimates our happiness equation using ordered probit to account for the ordinal nature of the happiness variable. It further estimates an ordered fixed-effects logit equation to simultaneously account for both issues. Table 8 shows the results.

Within Groups estimation is carried out. With age defined as in Eq. 4, the age and calendar time no longer grow at the same rate at the individual level, which makes it possible to estimate age effects separably accounting for period effects. The quadratic specification of age, including the additional regressors, still suggests a U-shaped age-happiness profile, which had already been found in Frijters & Beatton (2008), but the age of minimal happiness is very large; so in fact, these profiles are decreasing. However, again this may not be accurate at end points of the age range, because the models which specifies age effects using dummies shows a decreasing age-happiness profile. The negative profiles had already been found in Clark (2002), but he could not separate year from age effects. Cohort effects are automatically accounted for by the fixed effect. A fixed effects model would thus suggest that the age-happiness profile is negative, contrary to what we have found so far. This suggests that apart from important cohort effects, the estimation of happiness equations needs to take selective attrition seriously. These results are reinforced by the ordered fixed effects logit estimation results from the last two columns.

An ordered-probit is also conducted to account for the ordinal nature of the dependent variable. Due to the small number of observations, values lower or equal to 4 were grouped together. Results are not statistically significant.

5 Conclusion

This paper revisits the age-happiness profile and focusses specifically on how the specification of cohort effects impacts on the results. Accounting for age, cohort and year effects is always a challenge due to their linear dependence. We discuss the relative merits of alternative specifications and compare their results. We also propose an alternative definition of age which allows for individuals from the same birth year to be observed in a given year with different ages. When data are observed on a yearly basis, and relying on the fact that not all individuals are born nor interviewed on the same day, we can observe individuals born in the same year with two different ages in a particular moment. Defining cohort and period the usual way, but redefining age as completed years of age at the time of the interview breaks the linear dependence between the three factors. OLS results suggest that average happiness increases as individuals grow older, even though this is not a robust result. When cohorts are omitted, and hence the age coefficients are biased, the so often found U-shaped pattern emerges. This implies that cohort effects, even if not always significant, can have a substantial impact on the variable of interest and omitting them or inadequately accounting for them can render conclusions invalid.

The key element to implement this procedure is having enough variation in the month of the interview and the recording of individual birthday, preferable the day of birth which is not however available in this dataset. As long as adequate accounts of time have been made, spreading interviews throughout the year allows the econometrician to observe two individuals that are exactly the same in everything except in their number of completed years. Further, interviewing each individual in different moments of the year further allows the same individual being observed in two consecutive years with the same age or a 2-year difference in age. Moreover, recording the number of attempts made, before succeeding in contacting the interviewee, would help in identifying the group of people most likely to bias the results.

Skepticals may wonder that whichever way we find to account for age, period and cohort is always arbitrary because in continuous time, these three variables are still linearly dependent and only non-testable assumptions can allow us to estimate their impact. The point is that we are redefining age in a way which is not worse than the usual definition but has the benefit of allowing us to analyse the linear effects of three fundamental variables. We find that this is a route worth exploring and interview design should allow this to happen. The cost of this procedure is the introduction of a bias in age which mitigates the effects of age.

This paper also accounted for selective attrition and found that it matters in the estimation of age-happiness profiles. When estimation methods account both for cohort effects and selective attrition, then the age-happiness profile is found to be decreasing.

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Table 3: OLS estimates of a happiness equation, conditioning on age, birth cohort and calendar time: first 3 months only

	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Age	-0.0281***	0.0249**	0.1965***	0.2718***	0.1374***		-0.0461***	0.0009	0.1749***	0.1718***	0.023	
	(0.0060)	(0.0100)	(0.0300)	(0.0450)	(0.0350)		(0.0060)	(0.0090)	(0.0280)	(0.0380)	(0.0260)	
Age^2	0.0002***	-0.0003***	-0.0037***	-0.0041***	-0.0004***		0.0007***	0.0002**	-0.0039***	-0.0039***	0.0001	
	(0.0000)	(0.0000)	(0.0010)	(0.0010)	(0.0000)		(0.0000)	(0.0000)	(0.0010)	(0.0010)	(0.0000)	
Age^3			0.0000***	0.0000***					0.0000***	0.0000***		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Age 21						0.1481***						0.0947*
						(0.0570)						(0.0530)
Age 31						1.3983***						0.4551
						(0.3780)						(0.2880)
Age 41						2.4640***						0.7587
						(0.7200)						(0.5440)
Age 51						3.3642***						0.9651
						(1.0630)						(0.8030)
Age 60						4.4750***						1.4944
						(1.3720)						(1.0350)
[1929, 1934[		-0.1312						0.0093				
		(0.1070)						(0.0860)				
[1939, 1944[		-0.2393						-0.1593				
		(0.1500)						(0.1150)				

Continued on next page

Table 3 – continued from previous page

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
[1949, 1954[		-0.2151						-0.1607				
		(0.2230)						(0.1690)				
[1959, 1964[		-0.0711						-0.0555				
		(0.3010)						(0.2250)				
[1969, 1974[		0.2067						0.1769				
		(0.3770)						(0.2820)				
[1979, 1984[		0.2347						0.3182				
		(0.4530)						(0.3400)				
Cohort				0.0728**						-0.003		
				(0.0360)						(0.0280)		
$Cohort^2$			0.0011***	0.0008*					0.0002	0.0002		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
$Cohort^3$			0	0					0	0		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Born 1925					0.3859	0.462					0.0525	0.0675
					(0.2920)	(0.2930)					(0.2650)	(0.2650)
Born 1935					0.7129	0.9286**					-0.2773	-0.1695
					(0.4530)	(0.4530)					(0.3680)	(0.3680)
Born 1945					1.9611**	2.1981***					0.08	0.2043
					(0.7650)	(0.7640)					(0.5910)	(0.5910)
Born 1955					2.9769***	3.1545***					0.2088	0.2636
					(1.0950)	(1.0930)					(0.8360)	(0.8350)
Born 1965					4.2686***	4.4426***					0.587	0.632
					(1.4250)	(1.4240)					(1.0850)	(1.0840)

Continued on next page

Table 3 – continued from previous page

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Born 1975					5.7526***	5.9642***					1.1567	1.236
					(1.7650)	(1.7630)					(1.3390)	(1.3370)
Born 1983					6.6240***	6.8774***					1.4314	1.5473
					(2.1570)	(2.1540)					(1.7390)	(1.7380)
Year 1986												
Year 1991	-0.0746**	-0.1003*			-0.6225***	-0.6230***	0.0238	0.0075			-0.0743	-0.073
	(0.0370)	(0.0550)			(0.1760)	(0.1760)	(0.0340)	(0.0460)			(0.1350)	(0.1350)
Year 1996	-0.4659***	-0.5430***			-1.5998***	-1.6034***	-0.1104***	-0.1610**			-0.3373	-0.3384
	(0.0350)	(0.0890)			(0.3450)	(0.3440)	(0.0330)	(0.0690)			(0.2610)	(0.2610)
Year 2001	-0.3776***	-0.5185***			-2.1107***	-2.1149***	-0.1046***	-0.2090**			-0.4824	-0.4793
	(0.0360)	(0.1280)			(0.5160)	(0.5160)	(0.0340)	(0.0970)			(0.3900)	(0.3890)
Year			-0.1196***	-0.1857***					-0.0741***	-0.0714**		
			(0.0180)	(0.0380)					(0.0160)	(0.0300)		
$Year^2$			0.0017	0.002					0.0056***	0.0055***		
			(0.0020)	(0.0020)					(0.0010)	(0.0010)		
$Year^3$			0	0					-0.0002***	-0.0002***		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Constant	8.0463***	7.0126***	3.3584***	-0.5602	0.5025	2.8412**	4.9503***	4.0230***	1.2164**	1.3769	3.0493*	3.4010***
	(0.1170)	(0.4950)	(0.6150)	(2.0510)	(2.1050)	(1.4260)	(0.1470)	(0.3900)	(0.5180)	(1.5580)	(1.5960)	(1.0850)
R^2	0.017	0.019	0.016	0.016	0.021	0.022	0.297	0.299	0.298	0.298	0.3	0.301
Covariates	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Continued on next page

Table 3 – continued from previous page

	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Profile	Decreasing	Inverted U	Inverted U	Inverted U	Increasing	Increasing	U-shaped	Increasing	Inverted U	Inverted U	Unrelated	Unrelated

Significance levels : $*: 10\%$ $**: 5\%$ $***: 1\%$

Robust standard errors in parentheses.

Additional covariates are gender, *bundesland*, nationality, marital status, educational diploma, labor force status, household income and self reported satisfaction with health and number of members in the household.

Omitted categories: 21 year olds, year 1984, cohort born between $[1924, 1929[$, cohort born in 1924.

Table 4: OLS estimates of a happiness equation, conditioning on age, birth cohort and calendar time: first 4 months only

	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Age	-0.0290***	0.0201**	0.1649***	0.2396***	0.1239***		-0.0437***	0.0014	0.1674***	0.1606***	0.0115	
	(0.0060)	(0.0100)	(0.0280)	(0.0410)	(0.0310)		(0.0060)	(0.0080)	(0.0260)	(0.0350)	(0.0240)	
Age^2	0.0002***	-0.0003***	-0.0032***	-0.0036***	-0.0003***		0.0006***	0.0002**	-0.0039***	-0.0039***	0.0001*	
	(0.0000)	(0.0000)	(0.0010)	(0.0010)	(0.0000)		(0.0000)	(0.0000)	(0.0010)	(0.0010)	(0.0000)	
Age^3			0.0000***	0.0000***					0.0000***	0.0000***		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Age 21						0.1309**						0.068
						(0.0510)						(0.0480)
Age 31						1.2725***						0.3238
						(0.3410)						(0.2590)
Age 41						2.2678***						0.5211
						(0.6500)						(0.4900)
Age 51						3.0681***						0.5888
						(0.9600)						(0.7230)
Age 60						4.1266***						1.0325
						(1.2390)						(0.9320)
[1929, 1934[		-0.1005						0.0297				
		(0.1000)						(0.0810)				
[1939, 1944[		-0.1789						-0.1261				
		(0.1410)						(0.1100)				

Continued on next page

Table 4 – continued from previous page

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
[1949, 1954[		-0.1449						-0.1315				
		(0.2100)						(0.1610)				
[1959, 1964[		-0.0221						-0.0315				
		(0.2830)						(0.2150)				
[1969, 1974[		0.2439						0.1933				
		(0.3550)						(0.2680)				
[1979, 1984[		0.2655						0.3369				
		(0.4270)						(0.3240)				
Cohort				0.0725**						-0.0066		
				(0.0330)						(0.0250)		
$Cohort^2$			0.0009**	0.0005					-0.0001	0		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
$Cohort^3$			0	0					0.0000**	0.0000*		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Born 1925					0.4254	0.5026*					-0.0339	-0.0129
					(0.2710)	(0.2720)					(0.2560)	(0.2570)
Born 1935					0.8065*	1.0247**					-0.3221	-0.2023
					(0.4130)	(0.4130)					(0.3420)	(0.3420)
Born 1945					1.9302***	2.1622***					-0.1205	0.0113
					(0.6940)	(0.6930)					(0.5400)	(0.5390)
Born 1955					2.8625***	3.0441***					-0.0956	-0.0281
					(0.9900)	(0.9890)					(0.7570)	(0.7560)
Born 1965					4.0929***	4.2810***					0.1785	0.2436
					(1.2890)	(1.2870)					(0.9810)	(0.9790)

Continued on next page

Table 4 – continued from previous page

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Born 1975					5.4431***	5.6635***					0.6161	0.7128
					(1.5950)	(1.5940)					(1.2090)	(1.2070)
Born 1983					6.3422***	6.5932***					0.8088	0.9308
					(1.9300)	(1.9280)					(1.6110)	(1.6100)
Year 1986	0.1829***	0.1906***			0.3872***	0.3884***	0.1927***	0.1960***			0.2095***	0.2090***
	(0.0280)	(0.0320)			(0.0680)	(0.0680)	(0.0290)	(0.0310)			(0.0550)	(0.0550)
Year 1991	-0.2599***	-0.2799***			-0.5716***	-0.5749***	0.0328	0.0189			0.0017	-0.0005
	(0.0290)	(0.0380)			(0.0990)	(0.0990)	(0.0280)	(0.0340)			(0.0760)	(0.0760)
Year 1996	-0.2489***	-0.3208***			-1.1112***	-1.1178***	0.0867***	0.0405			-0.0164	-0.0213
	(0.0290)	(0.0690)			(0.2490)	(0.2490)	(0.0290)	(0.0550)			(0.1880)	(0.1880)
Year 2001	-0.1603***	-0.2933***			-1.5805***	-1.5889***	0.1033***	0.0052			-0.093	-0.095
	(0.0300)	(0.1060)			(0.4040)	(0.4040)	(0.0290)	(0.0810)			(0.3040)	(0.3040)
Year			-0.1642***	-0.2295***					-0.0966***	-0.0907***		
			(0.0160)	(0.0340)					(0.0150)	(0.0270)		
$Year^2$			0.0073***	0.0076***					0.0084***	0.0084***		
			(0.0010)	(0.0010)					(0.0010)	(0.0010)		
$Year^3$			-0.0002***	-0.0002***					-0.0003***	-0.0003***		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Constant	7.8630***	6.8628***	4.1916***	0.3116	0.5708	2.6710**	4.6810***	3.7818***	1.6625***	2.015	3.4716**	3.5931***
	(0.1080)	(0.4820)	(0.5770)	(1.8540)	(1.9640)	(1.3500)	(0.1390)	(0.3830)	(0.4910)	(1.4080)	(1.4860)	(1.0260)
R^2	0.016	0.017	0.015	0.015	0.019	0.02	0.292	0.293	0.293	0.293	0.294	0.295
Covariates	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

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Table 4 – continued from previous page

	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Profile	Decreasing	Inverted U	Inverted U	Inverted U	Increasing	Increasing	U-shaped	Increasing	Inverted U	Inverted U	Increasing	Unrelated

Significance levels : $*$: 10% $**$: 5% $***$: 1%

Robust standard errors in parentheses.

Additional covariates are gender, *bundesland*, nationality, marital status, educational diploma, labor force status, household income and self reported satisfaction with health and number of members in the household.

Omitted categories: 21 year olds, year 1984, cohort born between [1924, 1929[, cohort born in 1924.

Table 5: OLS estimates of a happiness equation, conditioning on age, birth cohort and calendar time: first 6 months only

	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Age	-0.0294***	0.0205**	0.1594***	0.2465***	0.1331***		-0.0444***	0.0023	0.1632***	0.1578***	0.0149	
	(0.0060)	(0.0090)	(0.0270)	(0.0390)	(0.0290)		(0.0050)	(0.0080)	(0.0250)	(0.0330)	(0.0220)	
Age^2	0.0002***	-0.0003***	-0.0030***	-0.0035***	-0.0003***		0.0006***	0.0002**	-0.0037***	-0.0037***	0.0001*	
	(0.0000)	(0.0000)	(0.0010)	(0.0010)	(0.0000)		(0.0000)	(0.0000)	(0.0010)	(0.0010)	(0.0000)	
Age^3			0.0000***	0.0000***					0.0000***	0.0000***		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Age 21						0.1434***						0.0607
						(0.0480)						(0.0450)
Age 31						1.3746***						0.3529
						(0.3160)						(0.2390)
Age 41						2.4729***						0.5828
						(0.6030)						(0.4510)
Age 51						3.3837***						0.6813
						(0.8900)						(0.6660)
Age 60						4.5152***						1.158
						(1.1490)						(0.8580)
[1929, 1934[		-0.1256						0.0133				
		(0.0960)						(0.0790)				
[1939, 1944[		-0.182						-0.1379				
		(0.1360)						(0.1060)				

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Table 5 – continued from previous page

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
[1949, 1954[		-0.1312						-0.1276				
		(0.2030)						(0.1550)				
[1959, 1964[		-0.0016						-0.0206				
		(0.2740)						(0.2070)				
[1969, 1974[		0.2746						0.2177				
		(0.3430)						(0.2590)				
[1979, 1984[		0.3103						0.3719				
		(0.4130)						(0.3130)				
Cohort				0.0844***						-0.0052		
				(0.0300)						(0.0230)		
Cohort^2			0.0009***	0.0005					0	0.0001		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Cohort^3			0	0					0.0000**	0.0000*		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Born 1925					0.2931	0.347					-0.1104	-0.1003
					(0.2670)	(0.2680)					(0.2550)	(0.2560)
Born 1935					0.8781**	1.0844***					-0.2951	-0.1779
					(0.3900)	(0.3910)					(0.3250)	(0.3250)
Born 1945					2.0656***	2.2858***					-0.0821	0.0476
					(0.6480)	(0.6480)					(0.5030)	(0.5030)
Born 1955					3.0919***	3.2614***					-0.0255	0.0403
					(0.9210)	(0.9200)					(0.7010)	(0.7000)
Born 1965					4.4194***	4.5947***					0.2811	0.347
					(1.1970)	(1.1960)					(0.9060)	(0.9050)

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Table 5 – continued from previous page

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Born 1975					5.8924***	6.0985***					0.7679	0.8629
					(1.4810)	(1.4800)					(1.1150)	(1.1140)
Born 1983					6.8449***	7.0807***					0.8868	1.007
					(1.7450)	(1.7430)					(1.3750)	(1.3730)
Year 1986	0.1637***	0.1783***			0.5048***	0.5073***	0.1314***	0.1388***			0.1686**	0.1683**
	(0.0270)	(0.0350)			(0.0910)	(0.0910)	(0.0280)	(0.0320)			(0.0700)	(0.0700)
Year 1991	-0.2413***	-0.2603***			-0.4702***	-0.4714***	-0.0211	-0.0356			-0.0502	-0.0518
	(0.0270)	(0.0310)			(0.0640)	(0.0640)	(0.0260)	(0.0290)			(0.0510)	(0.0510)
Year 1996	-0.2512***	-0.3286***			-1.0817***	-1.0865***	0.0139	-0.0386			-0.1056	-0.111
	(0.0280)	(0.0590)			(0.2030)	(0.2020)	(0.0270)	(0.0480)			(0.1530)	(0.1530)
Year 2001	-0.1665***	-0.3116***			-1.6060***	-1.6123***	0.0368	-0.074			-0.1946	-0.1975
	(0.0290)	(0.0950)			(0.3460)	(0.3460)	(0.0280)	(0.0730)			(0.2590)	(0.2590)
Year			-0.1503***	-0.2252***					-0.0873***	-0.0827***		
			(0.0160)	(0.0320)					(0.0140)	(0.0250)		
$Year^2$			0.0061***	0.0063***					0.0071***	0.0071***		
			(0.0010)	(0.0010)					(0.0010)	(0.0010)		
$Year^3$			-0.0001***	-0.0001***					-0.0002***	-0.0002***		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Constant	7.8773***	6.8290***	4.1277***	-0.3556	-0.0777	2.2236*	4.7480***	3.7981***	1.5692***	1.8447	3.3249**	3.5256***
	(0.1040)	(0.4730)	(0.5580)	(1.7200)	(1.8510)	(1.2830)	(0.1330)	(0.3740)	(0.4730)	(1.2990)	(1.3920)	(0.9690)
R^2	0.015	0.016	0.014	0.015	0.018	0.019	0.291	0.293	0.292	0.292	0.293	0.294
Covariates	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Continued on next page

Table 5 – continued from previous page

	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Profile	Decreasing	Inverted U	Inverted U	Inverted U	Increasing	Increasing	U-shaped	Increasing	Inverted U	Inverted U	Increasing	Unrelated

Significance levels : $*$: 10% $**$: 5% $***$: 1%

Robust standard errors in parentheses.

Additional covariates are gender, *bundesland*, nationality, marital status, educational diploma, labor force status, household income and self reported satisfaction with health and number of members in the household.

Omitted categories: 21 year olds, year 1984, cohort born between [1924, 1929[, cohort born in 1924.

Table 6: OLS estimates of a happiness equation, conditioning on age, birth cohort and calendar time: balanced panel

	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Age	-0.0297***	0.0219	0.1666***	0.1289***	0.0193		-0.0455***	0.008	0.1289***	0.0865**	-0.0069	
	(0.0080)	(0.0140)	(0.0380)	(0.0500)	(0.0360)		(0.0080)	(0.0120)	(0.0350)	(0.0440)	(0.0280)	
Age^2	0.0003***	-0.0002**	-0.0033***	-0.0030***	-0.0003***		0.0007***	0.0002*	-0.0025***	-0.0022**	0.0001	
	(0.0000)	(0.0000)	(0.0010)	(0.0010)	(0.0000)		(0.0000)	(0.0000)	(0.0010)	(0.0010)	(0.0000)	
Age^3			0.0000***	0.0000***					0.0000***	0.0000***		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Age 21						0.0701						0.0929
						(0.0690)						(0.0640)
Age 31						0.125						0.1084
						(0.3910)						(0.2950)
Age 41						0.1856						0.1419
						(0.7430)						(0.5530)
Age 51						0.0463						0.0975
						(1.0980)						(0.8140)
Age 60						0.0991						0.2526
						(1.4150)						(1.0470)
$[1929, 1934[$		-0.1573						-0.0801				
		(0.1390)						(0.1070)				
$[1939, 1944[$		-0.2686						-0.1461				
		(0.2060)						(0.1530)				

Continued on next page

Table 6 – continued from previous page

	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
[1949, 1954[		-0.1773						-0.0762				
		(0.3120)						(0.2310)				
[1959, 1964[		0.0605						0.1722				
		(0.4290)						(0.3140)				
[1969, 1974[		0.2964						0.4499				
		(0.5410)						(0.3970)				
[1979, 1984[		0.403						0.6564				
		(0.6520)						(0.4800)				
Cohort				-0.0363						-0.0409		
				(0.0380)						(0.0290)		
Cohort^2			0.0007	0.0010*					0.0004	0.0007		
			(0.0010)	(0.0010)					(0.0000)	(0.0000)		
Cohort^3			0	0					0	0		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Born 1925					-0.2031	-0.1726					-0.1295	-0.1303
					(0.4290)	(0.4300)					(0.3490)	(0.3500)
Born 1935					-0.7675	-0.6490					-0.6964	-0.6684
					(0.5370)	(0.5380)					(0.4250)	(0.4260)
Born 1945					-0.7802	-0.6533)					-0.7664	-0.7331
					(0.8290)	(0.8290)					(0.6270)	(0.6270)
Born 1955					-0.6372	-0.5482					-0.6883	-0.6867
					(1.1550)	(1.1550)					(0.8630)	(0.8630)
Born 1965					-0.6702	-0.5727					-0.7785	-0.7738
					(1.4860)	(1.4860)					(1.1100)	(1.1100)

Continued on next page

Table 6 – continued from previous page

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Born 1975					-0.167	-0.0489					-0.4483	-0.4248
					(1.8340)	(1.8340)					(1.3620)	(1.3620)
Born 1983					0.5771	0.7229					0.3735	0.4284
					(2.1140)	(2.1120)					(1.6300)	(1.6290)
Year 1986	0.4921***	0.014			0.5902	0.5922	0.3055***	0.5297***			0.2347	0.2343
	(0.0420)	(0.0370)			(0.5990)	(0.5990)	(0.0390)	(0.1430)			(0.4170)	(0.4170)
Year 1991	0.5215***	0.0023			0.6244	0.6241	0.4016***	0.5722***			0.3819	0.3806
	(0.0360)	(0.0810)			(0.4210)	(0.4220)	(0.0340)	(0.1000)			(0.2860)	(0.2860)
Year 1996	0.1745***	-0.4055***			0.234	0.2313	0.1093***	0.2104***			0.1012	0.0969
	(0.0350)	(0.1370)			(0.2480)	(0.2480)	(0.0330)	(0.0610)			(0.1590)	(0.1590)
Year 2001	0.2316***	-0.4177**			0.2602***	0.2589***	0.1169***	0.1359***			0.1222***	0.1211***
	(0.0310)	(0.1950)			(0.0770)	(0.0770)	(0.0280)	(0.0290)			(0.0380)	(0.0380)
Year			-0.0172	0.0127					0	0.0337		
			(0.0210)	(0.0400)					(0.0200)	(0.0310)		
$Year^2$			-0.0036**	-0.0038**					-0.0026	-0.0027*		
			(0.0020)	(0.0020)					(0.0020)	(0.0020)		
$Year^3$			0.0001*	0.0001*					0	0		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Constant	7.5589***	6.9586***	3.9571***	5.7902***	7.1384**	7.2771***	4.5953***	3.1212***	1.3530*	3.4180**	4.7178**	4.5645***
	(0.1580)	(0.7020)	(0.8480)	(2.1250)	(2.7810)	(2.0790)	(0.2150)	(0.6880)	(0.7000)	(1.6280)	(2.0520)	(1.5270)
R^2	0.011	0.013	0.01	0.01	0.017	0.018	0.297	0.299	0.296	0.296	0.301	0.302
Covariates	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Continued on next page

Table 6 – continued from previous page

	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Profile	Decreasing	Decreasing	Inverted U	Inverted U	Decreasing	Unrelated	U-shaped	Increasing	Inverted U	Inverted U	Unrelated	Unrelated

Significance levels : $*$: 10% $**$: 5% $***$: 1%

Robust standard errors in parentheses.

Additional covariates are gender, *bundesland*, nationality, marital status, educational diploma, labor force status, household income and self reported satisfaction with health and number of members in the household.

Omitted categories: 21 year olds, year 1984, cohort born between $[1924, 1929[$, cohort born in 1924.

Table 7: OLS estimates of a happiness equation, conditioning on age, birth cohort and calendar time: individuals who answer in first and last waves

	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Age	-0.0297***	0.0223	0.1667***	0.1261**	0.0162		-0.0451***	0.0084	0.1292***	0.0854*	-0.0081	
	(0.0080)	(0.0140)	(0.0380)	(0.0500)	(0.0360)		(0.0080)	(0.0120)	(0.0350)	(0.0440)	(0.0280)	
Age^2	0.0003***	-0.0002**	-0.0033***	-0.0030***	-0.0003***		0.0007***	0.0002*	-0.0026***	-0.0022**	0.0001	
	(0.0000)	(0.0000)	(0.0010)	(0.0010)	(0.0000)		(0.0000)	(0.0000)	(0.0010)	(0.0010)	(0.0000)	
Age^3			0.0000***	0.0000***					0.0000***	0.0000***		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Age 21						0.0705						0.0936
						(0.0690)						(0.0640)
Age 31						0.095						0.0939
						(0.3910)						(0.2950)
Age 41						0.1302						0.1161
						(0.7420)						(0.5520)
Age 51						-0.0419						0.0531
						(1.0970)						(0.8120)
Age 60						-0.0113						0.1966
						(1.4130)						(1.0450)
[1929, 1934[		-0.1579						-0.0809				
		(0.1390)						(0.1070)				
[1939, 1944[		-0.2661						-0.1477				
		(0.2060)						(0.1530)				

Continued on next page

Table 7 – continued from previous page

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
[1949, 1954[		-0.172						-0.0788				
		(0.3120)						(0.2310)				
[1959, 1964[		0.0668						0.1644				
		(0.4280)						(0.3140)				
[1969, 1974[		0.3042						0.444				
		(0.5410)						(0.3960)				
[1979, 1984[		0.4204						0.6537				
		(0.6520)						(0.4790)				
Cohort				-0.0391						-0.0422		
				(0.0380)						(0.0290)		
$Cohort^2$			0.0007	0.0010*					0.0004	0.0007		
			(0.0010)	(0.0010)					(0.0000)	(0.0000)		
$Cohort^3$			0	0					0	0		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Born 1925					-0.2339	(0.2035)					-0.1289	(0.1296)
					(0.4220)	(0.4230)					(0.3490)	(0.3500)
Born 1935					-0.8245	(0.7063)					-0.7117*	(0.6828)
					(0.5310)	(0.5320)					(0.4250)	(0.4250)
Born 1945					-0.865	(0.7395)					-0.7936	(0.7603)
					(0.8250)	(0.8250)					(0.6260)	(0.6260)
Born 1955					-0.7499	-0.6629					-0.7331	-0.7323
					(1.1510)	(1.1510)					(0.8620)	(0.8610)
Born 1965					-0.814	-0.719					-0.8367	-0.833
					(1.4820)	(1.4830)					(1.1080)	(1.1080)

Continued on next page

Table 7 – continued from previous page

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Born 1975					-0.347	-0.2328					-0.5257	-0.5039
					(1.8290)	(1.8290)					(1.3580)	(1.3580)
Born 1983					0.3882	0.5342					0.2892	0.3455
					(2.1100)	(2.1090)					(1.6270)	(1.6260)
Year 1986	0.4052***	0.0112			0.4447	0.4459	0.3061***	0.5287***			0.2118	0.2105
	(0.0410)	(0.0370)			(0.5630)	(0.5630)	(0.0390)	(0.1430)			(0.4160)	(0.4160)
Year 1991	0.4356***	-0.0007			0.4948	0.494	0.4028***	0.5725***			0.3672	0.3654
	(0.0350)	(0.0810)			(0.3860)	(0.3860)	(0.0340)	(0.1000)			(0.2850)	(0.2860)
Year 1996	0.0896***	-0.4092***			0.1184	0.1155	0.1119***	0.2125***			0.0948	0.0902
	(0.0330)	(0.1360)			(0.2130)	(0.2130)	(0.0330)	(0.0610)			(0.1580)	(0.1580)
Year 2001	0.1463***	-0.4246**			0.1573***	0.1562***	0.1177***	0.1363***			0.1208***	0.1197***
	(0.0270)	(0.1940)			(0.0450)	(0.0450)	(0.0280)	(0.0290)			(0.0380)	(0.0380)
Year			-0.0185	0.0136					-0.0001	0.0347		
			(0.0210)	(0.0390)					(0.0200)	(0.0310)		
$Year^2$			-0.0034**	-0.0036**					-0.0025	-0.0027*		
			(0.0020)	(0.0020)					(0.0020)	(0.0020)		
$Year^3$			0.0001*	0.0001*					0	0		
			(0.0000)	(0.0000)					(0.0000)	(0.0000)		
Constant	7.6446***	6.9419***	3.9836***	5.9555***	7.4857***	7.5638***	4.5893***	3.1218***	1.3659*	3.4966**	4.8255**	4.6461***
	(0.1570)	(0.7020)	(0.8460)	(2.1230)	(2.7420)	(2.0410)	(0.2140)	(0.6870)	(0.6990)	(1.6240)	(2.0470)	(1.5240)
R^2	0.011	0.013	0.01	0.01	0.017	0.018	0.296	0.298	0.296	0.296	0.301	0.302
Covariates	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

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Table 7 – continued from previous page

	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Profile	Decreasing	Decreasing	Inverted U	Inverted U	Decreasing	Unrelated	U-shaped	Increasing	Inverted U	Inverted U	Unrelated	Unrelated

Significance levels : $*$: 10% $**$: 5% $***$: 1%

Robust standard errors in parentheses.

Additional covariates are gender, *bundesland*, nationality, marital status, educational diploma, labor force status, household income and self reported satisfaction with health and number of members in the household.

Omitted categories: 21 year olds, year 1984, cohort born between [1924, 1929[, cohort born in 1924.

Table 8: Accounting for unobserved heterogeneity and the ordinal nature of the dependent variable

	Within Groups		**Probit**		**Ordered Fixed Effects Logit**	
Age	-0.0714***		0.0026		-0.1180***	
	(0.0210)		(0.0140)		(0.0320)	
Age^2	0.0002**		0.0001		0.0003***	
	(0.0000)		(0.0000)		(0.0000)	
Age 21		-0.0244		0.028		-0.0314
		(0.0440)		(0.0300)		(0.0700)
Age 31		-0.5821***		0.1302		-1.0125***
		(0.2210)		(0.1550)		(0.3450)
Age 41		-1.1590***		0.1882		-1.9226***
		(0.4150)		(0.2930)		(0.6500)
Age 51		-1.9002***		0.184		-3.0668***
		(0.6120)		(0.4330)		(0.9570)
Age 60		-2.1504***		0.3957		-3.5207***
		(0.7880)		(0.5580)		(1.2340)
Born 1925			-0.1096	-0.097		
			(0.1840)	(0.1850)		
Born 1935			-0.3651*	-0.2927		
			(0.2200)	(0.2200)		
Born 1945			-0.2924	-0.2125		
			(0.3320)	(0.3320)		
Born 1955			-0.3559	-0.3124		
			(0.4590)	(0.4590)		
Born 1965			-0.2391	-0.1928		
			(0.5900)	(0.5900)		
Born 1975			0.0024	0.0648		
			(0.7260)	(0.7260)		
Born 1983			0.1888	0.258		
			(0.9050)	(0.9040)		
Year 1986	-0.6473*	-0.6355*	0.3266	0.3278	-1.0050*	-0.9789*
	(0.3330)	(0.3340)	(0.2380)	(0.2380)	(0.5220)	(0.5230)
Year 1991	-0.4452*	-0.4354*	0.202	0.2022	-0.6506*	-0.6298*
	(0.2350)	(0.2350)	(0.1670)	(0.1670)	(0.3680)	(0.3680)
Year 1996	-0.1684	-0.1665	0.1710*	0.1688*	-0.28	-0.2723
	(0.1390)	(0.1390)	(0.0990)	(0.0990)	(0.2180)	(0.2180)
Year 2001	0.1065**	0.1054**	0.1506***	0.1489***	0.2019***	0.2011***

Continued on next page

Table 8 – continued from previous page

	Within Groups		Probit		Ordered Fixed Effects Logit	
	(0.0450)	(0.0450)	(0.0320)	(0.0320)	(0.0730)	(0.0730)
Constant	7.6234***	6.1821***				
	(0.9680)	(0.5840)				
R^2	0.114	0.116				
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Profile	Decreasing	Decreasing	Unrelated	Unrelated	Decreasing	Decreasing

Significance levels : $*$: 10% $**$: 5% $***$: 1%

Robust standard errors in parentheses.

Additional covariates are gender, *bundesland*, nationality, marital status, educational diploma, labor force status, household income and self-reported satisfaction with health and number of members in the household.

Omitted categories: 21 year olds, year 1984, cohort born between [1924, 1929[, cohort born in 1924.

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