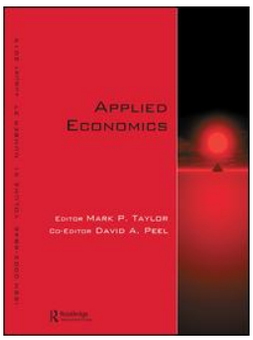

Routledge
Taylor & Francis Group

Applied Economics

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/raec20

What a drag it is getting old? Mental health and loneliness beyond age 50

Jan C. van Ours

To cite this article: Jan C. van Ours (2021): What a drag it is getting old? Mental health and loneliness beyond age 50, Applied Economics, DOI: 10.1080/00036846.2021.1883540

To link to this article: https://doi.org/10.1080/00036846.2021.1883540

Published online: 16 Feb 2021.

APPLIED ECONOMICS
https://doi.org/10.1080/00036846.2021.1883540

Routledge
Taylor & Francis Group

What a drag it is getting old? Mental health and loneliness beyond age 50

Jan C. van Ours [a,b,c]

[a]Erasmus School of Economics, Erasmus University Rotterdam and Tinbergen Institute, Rotterdam, The Netherlands; [b]Department of Economics, University of Melbourne, Parkville, Australia; [c]CEPR, London, UK

ABSTRACT

This paper studies mental health and loneliness in the Netherlands for individuals beyond age 50. The analysis is based on panel data over the period 2008 to 2018 and focuses on the effects of life events and ageing. It appears that mental health gets worse and loneliness increases if individuals lose their partner (through divorce or death) or become unemployed. On average, the mental health of males and high educated females improves at retirement. With respect to ageing, the main conclusions are that mental health improves while loneliness goes down at least up to the high 70s. From the perspective of mental health and loneliness, it does not seem to be a drag getting old.

KEYWORDS

Mental health; loneliness; age; old people

JEL

I31; J14

I. Introduction

Young people often have great expectations about their future. They may have a wonderful partner, a nice group of friends, a stimulating job, a challenging career ahead and excellent health. As they grow older, people may find out their life is not as great as they thought it was when they were young. Their wonderful partner has left them, their group of friends is scattered, their job is slightly disappointing, their career path has reached a dead-end at a lower level than expected and physically they start feeling a bit uncomfortable with small pains in certain parts of their body while sleepless nights are no longer rare events. The great expectations do not change overnight. It is a gradual process. Unmet expectations are not rare and around age 50 many people seem to have accepted this as a fact of life. Beyond age 50, physical health slowly deteriorates but for mental health and loneliness effects of ageing are not so clear.

The current paper uses panel data focusing on whether it is a drag getting old, i.e. whether mental health deteriorates and loneliness increases as people grow older. It is an interesting question whether age has a direct effect on mental health and loneliness or whether it has an effect through age-related life events. Whereas it is possible to establish causal effects of life events such as retirement by using, for example, a regression discontinuity design this is not the case for direct age effects. After all, age is changing gradually and there are no shocks to age itself which would be helpful in establishing a causal relationship. Furthermore, there is an identification issue. Every year an individual grows older a calendar year has gone by. Therefore, it is not possible to distinguish a linear trend in age from a linear trend in calendar time. If one only has cross-sectional information, it is by definition impossible to establish a calendar time effect since all individuals are observed at the same moment in time. With cross-sectional data, there is a different identification problem in the sense that a difference in age between two individuals is identical to the difference in the birth year between those individuals. Thus, it is not possible to distinguish a linear trend in age from a linear trend in the birth cohort. This is sometimes referred to as the Age-Period-Cohort (APC) identification problem. As will be discussed in more detail below, the current paper uses panel data and in all estimates, unobserved time-invariant differences between individuals are accounted for. This removes the cohort effect and leaves one identification issue, i.e. a possible linear trend in age is indistinguishable from a possible linear trend in calendar time.

Research on the effects of ageing on mental health and loneliness is related to research on happiness where there are quite a few studies on this

CONTACT Jan C. van Ours janvanours@gmail.com Erasmus School of Economics, Erasmus University Rotterdam and Tinbergen Institute, Rotterdam, The Netherlands

((Blanchflower and Oswald (2008) give an overview of early studies). Although the APC problem is unavoidable, it is not often discussed and frequently ignored. Identification of the separate effects requires imposing one or more restrictions on age or calendar time for which sometimes 5-year age intervals are chosen. Then, calendar time goes by gradually but an individual only goes from one age interval to the next every now and then. Alternatively, calendar time is grouped in intervals or both age and calendar time intervals are grouped.

Previous studies investigating the relationship between happiness and age find that happiness declines up to age 50 but have different findings on how happiness evolves later on in life. Blanchflower and Oswald (2008) use pooled cross-sectional information of life satisfaction from U.S. General Social Surveys and Eurobarometer surveys to distinguish cohort effects from age effects which they find to be U-shaped. Glenn (2009) comments on Blanchflower and Oswald (2008) arguing that the U-shape is the result of using inappropriate and questionable control variables. Blanchflower and Oswald (2009) respond to Glenn (2009) showing that the U-shape relationship between life satisfaction and age is present without including control variables. Whereas a U-shape relationship between happiness and age is often found in pooled cross-sectional data, the age effect in fixed effects panel data studies is often not U-shaped. Clark (2007) analysing BHPS (British Household Panel Study) data is an early study using individual fixed effects and age in five-year intervals. He finds that there is a U-shape pattern irrespective of whether or not fixed effects are included in the analysis. Other studies, for example, Gwozdz and Sousa-Poza (2010) who use GSOEP (German Socioeconomic Panel) data show that the introduction of fixed effects removes the age effect in happiness. De Ree and Alessie (2011) argue that without additional assumptions it is not possible to establish whether the age-happiness pattern is U-shaped; it is possible only to investigate whether this pattern is convex. Frijters and Beatton (2012) analysing GSOEP, BHPS and HILDA (Household, Income and Labour Dynamics in Australia) data find that with the introduction of fixed effects, happiness in the age range from 20 to 50 is constant. Around age 60, happiness strongly increases to go down again after age 75. Kassenboehmer and Haisken-DeNew (2012) introduce experience in the panel as an additional explanatory variable arguing that in the presence of an interviewer a respondent answers more truthful in later surveys. Using GSOEP-data they show that in pooled cross-sections it does not matter much but in a fixed effects panel analysis once experience in the panel – and its square – is introduced the U-shape relationship between life satisfaction and age disappears. In fact, there is no longer any significant age effect. Wunder et al. (2013) in their analysis of BHPS and GSOEP data use a spline function approach finding that there are three stages in this relationship with the U-shape providing a good approximation of the first two stages. In the third stage that starts when people are in their late 60s, there is a decline in well-being. Baetschmann (2013) extends the approach by De Ree and Alessie (2011) by adding time in the panel as an additional explanatory variable. Assuming that there is no calendar time effect, they conclude that life satisfaction is mildly decreasing up to age 55 followed by a hump shape with a maximum at age 70. When performing separate analyses by educational attainment Baetschmann (2013) find that highly educated people become happier as they age while less-educated people face a declining life satisfaction as they grow older. Wooden and Li (2016) use HILDA and similar to psychological studies they also investigate the relevance of distance to death. They find that over a large age range, life satisfaction does not change a lot. However, from about age 65 life satisfaction starts to decline. Proximity to death also has an effect but this effect is not very important. Schwandt (2016) uses GSOEP data introducing expectations about future life satisfaction in the analysis. He finds that people make systematic errors in predicting their life satisfaction such that young people incorrectly expect life satisfaction to increase whereas old people incorrectly expect life satisfaction to decrease. The main conclusion is that unmet expectations may be driving the age U-shape in well-being. Unmet aspirations are present more strongly in midlife but disappear later on in life. Cheng, Powdthavee, and Oswald (2017) use data from GSOEP, BHPS, HILDA and MABEL (Medicine in Australia Balancing Employment

and Life) mainly providing graphical evidence on changes in life satisfaction. If the age profile is U-shape, first differences should have a positive slope and should be zero in mid-life. This is indeed what the authors find. Concerning the APC problem, the authors state that they have not solved the problem: 'rather, we have ignored it, or perhaps more accurately we have bypassed it.'

Summarizing, many studies find a U-shape relationship between age and happiness but this is by no means a stylized fact. Quite a few studies mention the APC problem but more often than not the problem is simply ignored. Studies using happiness data also face other criticism. Bond and Lang (2019), for example, claim that due to the ordinal nature of the life satisfaction data interpersonal comparisons with only cross-sectional information are difficult and often impossible. The main reason is that with ordinal data it is almost impossible to establish that life satisfaction of one group of individuals stochastically dominates the life satisfaction of another group of individuals.

The current paper studies how age affects loneliness and mental health taking life events into account. Previous studies have a variety of outcomes on both indicators. For example, based on a cross-sectional dataset Yang and Victor (2011) compare the relationship between age and a self-reported measure of loneliness in 25 European countries. In every country loneliness among 60-plus individuals is more frequent than among 60-minus individuals although the magnitude of the difference is country-specific. Luo et al. (2012) study the relationship between loneliness, health and mortality using American panel data on adults aged 50 years and over. They find that feelings of loneliness are associated with increased mortality risk and depressive symptoms. Bell (2014) discusses the APC problem using British panel data on mental health finding that mental distress increases with age. Santini et al. (2016) using panel data of 50-plus individuals in Ireland find that feelings of loneliness worsen mental health. Richard et al. (2017) analyse Swiss cross-sectional data using a self-reported loneliness indicator finding that loneliness is more prevalent in young adults and 75-plus individuals. They also find a significant negative association between loneliness and indicators of physical and mental health. Thomson and Katikireddia (2018)use English repeated cross-sectional data finding that the relationship between mental health problems and age is inverse U-shaped with people in the age range 31–64 facing the most severe mental health problems. Das (2019) analyzes American and English panel data on older adults finding no relationship between loneliness and cardiovascular or metabolic outcomes.

The increase of loneliness with age may be related to key transitions that occur more frequently with increasing age such as retirement and the loss of a partner. There is no consensus with respect to the relationship between age and loneliness. Some studies find increasing loneliness at high age, other studies find a U-shape relationship with people of middle age to be least lonely while again other studies find a rather flat age-loneliness profile.

The current paper is set up as follows. Section 2 describes the panel data used in the empirical analysis focusing on the available information about the mental health and loneliness of people between ages of 51 and 80. Males have slightly better mental health and are somewhat less lonely than females. Nevertheless, on average most people are in good mental health while few people are lonely. On a cross-sectional level mental health improves between age 55 and 70 and at higher age goes down somewhat. Loneliness goes down with age initially but the decline levels off at later ages. Section 3 presents the set-up of the empirical analysis. Initially, the effect of calendar time is ignored in which case in linear mental health and loneliness equations age can easily be introduced as one of the explanatory variables. Then, the APC problem is addressed. Age effects and calendar time effects are specified in great detail after taking account of a trend effect that can be age-related as well as calendar time related. Section 4 discusses the empirical findings. Several life events have opposite effects on mental health and loneliness. Losing a partner through divorce or death or becoming unemployed has worsened mental health and increases loneliness while retirement has a positive effect on the mental health of males and high educated females and no effect on loneliness. In the estimates in which calendar time effects are ignored age has an inverse U-shape effect on

mental health with a maximum in the mid-70s. Age has a negative and significant effect on loneliness. From the APC-analysis it appears that the age and calendar time trend is positive for mental health and negative for loneliness. After taking out the trend effect, the remaining age pattern for mental health is U-shaped for mental health and without a clear pattern for loneliness. In contrast, the remaining calendar time pattern is rather flat, both for mental health and for loneliness. From a comparison of these patterns, it is concluded that age seems a much more important determinant than calendar time. Furthermore, there is an investigation on the functional form of the specification of the dependent variable, and the linear specification with fixed effects is replaced by a fixed effects ordered logit specification. Finally, there is an analysis of parameter heterogeneity by educational attainment. The main conclusion is that there are differences in the effects of age and life events by educational attainment but the overlaps are also substantial. Section 5 concludes that ageing seems to improve mental health and makes people less lonely.

II. Data

The Longitudinal Internet Studies for the Social science (LISS) panel is based on a sample of households drawn from the population register by Statistics Netherlands (see for details: https://www.lissdata.nl/about-panel). Households that could not otherwise participate were provided with a computer and Internet connection. Every month panel members complete online questionnaires of about 15 to 30 minutes. They are paid for each completed questionnaire. One member in the household provides the household data and updates this information at regular time intervals. The data used in the analysis are collected on an annual basis from 2008 to 2018. The survey is among individuals from age 16 onward but in the analysis, data are used from individuals age 51 onward. Since the sample is a bit thin at the higher end of the age distribution, the analysis is restricted to maximum age of 80. The main indicators of interest are mental health and loneliness. For mental health the international standard is used, i.e. the Mental Health Inventory (MHI-5) indicator which is based on two positive statements and three negative statements related to experiences in the past months. The positive statements are: I felt calm and peaceful; I felt happy. The negative statements are: I felt very anxious; I felt so down that nothing could cheer me up; I felt depressed and gloomy. Each statement gets a score from 0 to 5 based on the answer: never, seldom, sometimes, often, continuously. The MHI-5 score is calculated as follows. First, the scores of the negative statements are reversed, such that 0 indicates continuously negative feelings and 5 indicates no negative feelings. Then, the five scores are added up and rescaled to a 0–100 range. The advantage of the indicator is that people are not directly asked about mental health problems which they may be reluctant to report (Bharadwaj, Pai, and Suziedelyte (2017)).

For loneliness, a 6-item indicator is used based on three positive statements and three negative statements. The statements are related to friendship networks, sense of emptiness, missing people and feeling deserted (De Jong Gierveld and Van Tilburg (2006)). The positive statements are: There are plenty of people I can rely on when I have problems; there are many people I can trust completely; there are enough people I feel close to. The negative statements are: I miss having people around; I often feel rejected; I experience a general sense of emptiness. Each statement has a score from 0 to 2 based on the answer: no, more or less, yes. The scores of the negative statements are reversed. Loneliness is then computed as the sum of the scores of the six statements, resulting in a range from 0 (not lonely) to 12 (very lonely). The loneliness measure summarizes emotional and social loneliness. The questions measure the intensity of loneliness at the time of the surveys as the questions do not refer to a specific time period or point in time (unlike direct questions on loneliness that measure the frequency of loneliness).

Figure 1 displays the distributions of both indicators of main interest, separately for males and females. The left-hand side graphs show the distributions of mental health which are clearly skewed to the right. Statistics Netherlands defines a person to have no mental health problems if the MHI-5 indicator has a value of 60 or higher. On average, in the sample, this is the case for 89% of the males and 84% of the females. The right-hand side graphs of

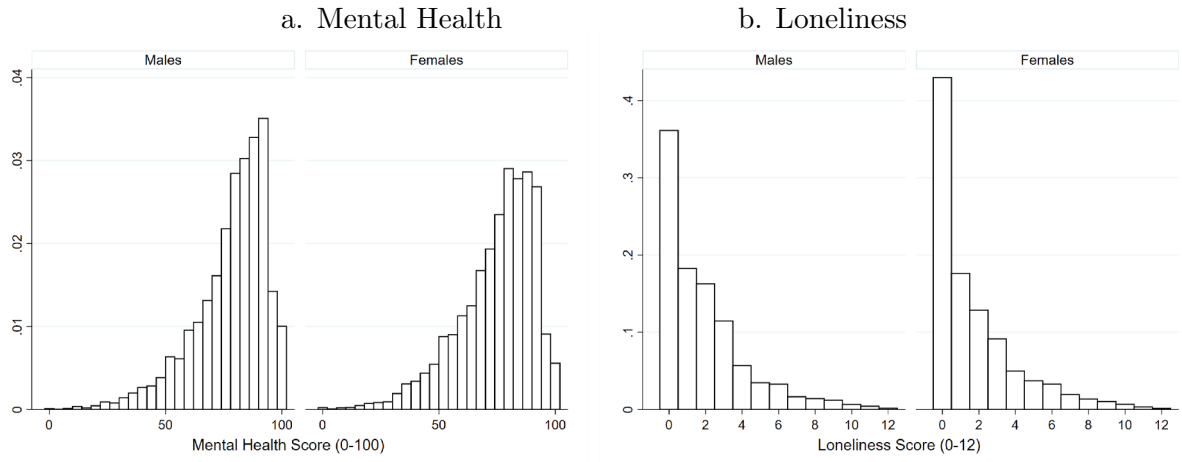

Figure 1. Distribution of mental health and loneliness of males and females; age 51 to 80.

Figure 1 show the distributions of loneliness which are skewed to the left. Few people have a high loneliness score. Of the males in the sample, 37% even has a score of zero while for females this is 43%. Statistics Netherlands defines a person to be lonely if the loneliness score has a value of 7 or more. This is the case for just 5.4% of both males and females.

In the analysis, three life events are taken into account based on changes in family status or labour market position, i.e. losing a partner through separation/divorce or death, losing a job and retiring. These life events may affect loneliness and mental health. For example, Kolodziej and García-Gómez (2019) analysing panel data from 11 European countries find that although the effects are heterogeneous on average retirement improves mental health. Retiring may affect life satisfaction (Picchio and van Ours (2020)). For many workers who become unemployed, happiness drops substantially (e.g. Clark and Oswald (1994); Winkelmann and Winkelmann (1998); Kassenboehmer and Haisken-Denew (2009); Clark (2003)). Forming or ending a relationship may make individuals happier or less happy (Chapman and Guven (2016), Chen and van Ours (2018)).

In wave 5 loneliness was measured differently from the other waves. Therefore, information about loneliness from wave 5 is ignored and the estimates are based on two samples, one for mental health and one for loneliness. Table 1 shows the descriptives for both samples. On average, males have a healthier mental status than females. Also

Table 1. Descriptives mental health sample and loneliness sample.

	Mental health		Loneliness	
Variable	Males	Females	Males	Females
Mental health/10	7.81	7.47		
Loneliness			1.91	1.74
Age/10	6.38	6.28	6.37	6.28
Partnered	0.76	0.67	0.75	0.67
Divorced/separated	0.11	0.14	0.12	0.14
Widow(er)	0.05	0.11	0.05	0.11
Single	0.08	0.08	0.08	0.08
Unemployed*10	0.26	0.21	0.27	0.21
Retired	0.48	0.31	0.48	0.32
Observations	12,248	12,621	11,421	11,808
Individuals	2,308	2,500	2,320	2,523

Note: Single = before partnering.

on average males are more lonely than females. The average age in the sample is about 63 to 64 and similar for males and females. Partner refers to marriage or cohabitation. Males are more likely to have a partner than females, i.e. about three-quarters of males have a partner whereas two-thirds of females have a partner. Females are more likely to be divorced or separated and more likely to have lost a partner through death. About 8% of the sample consists of singles. These are singles that have never formally partnered (since otherwise they would be divorced/separated or widow(er)). The probability to be unemployed is very low, about 2.6% of males and 2.1% of females were unemployed. On average, 48% of the males and 31% to 32% of the females are retired. The difference has to do with many females not having had a job and therefore they could not retire.

Figure 2 shows the unconditional relationship between age and mental health and age and

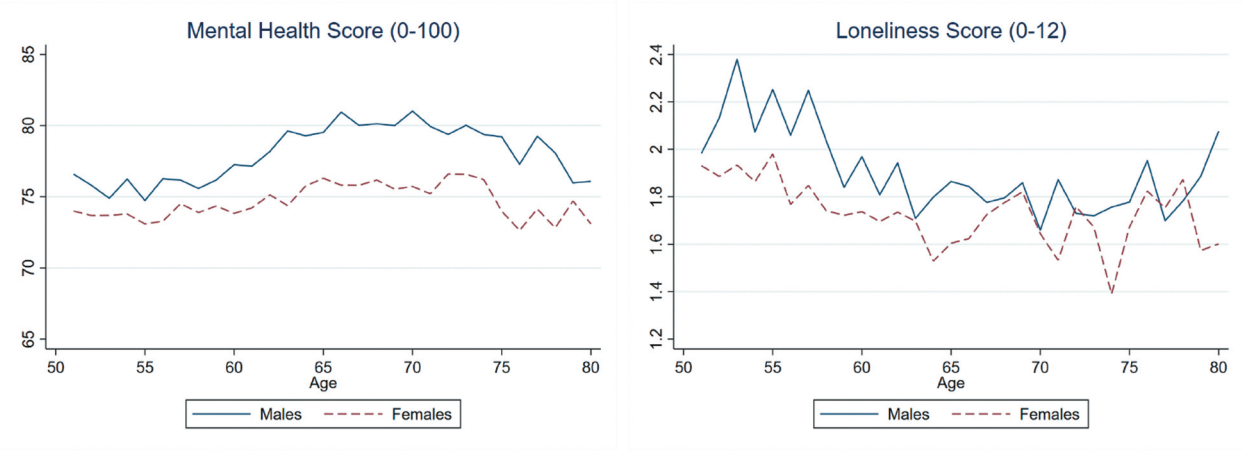

Figure 2. Mental health, loneliness and age; sample averages.

loneliness. The left-hand side graph shows that the highest score for mental health is for people aged 65–75 with a lower score at both ends of the age distribution. Mental health of females is worse than the mental health of males. The right-hand side graph of Figure 2 shows that males are somewhat more lonely than females while individuals older than 65 are less lonely than younger people. However, since the graphs are based on (pooled) cross-sectional information, it is not clear to what extent the graphical relationships represent the effects of life events, a true age effect, a calendar time effect, a cohort effect, or a mixture of all three.

III. Set-up of the analysis

Baseline estimates: ignoring calendar time effects

In the baseline estimates, there are two assumptions. First, despite having an ordinal nature the dependent variables are specified as cardinal variables. This implies that a linear specification can be used. Second, calendar time effects are ignored. This implies that if individuals are 1 year older the effect is picked up by a linear age term which represents a pure age effect. With these assumptions, the relationships between mental health and loneliness as dependent variables and life events and age as explanatory variables can be specified as:

$$H_{it} = \alpha_i + \beta X_{it} + \gamma_1 a_{it} + \gamma_2 a_{2t}{}^2 + \varepsilon_{it} \quad (1)$$

where H_{it} is the mental health of individual i in the year t (or alternatively loneliness of individual i in year t) and a_{it} represents age. A quadratic term in age is included to investigate possible nonlinear age effects. The α_i represent the individual fixed effects which account for known and unknown personal time-invariant characteristics. Furthermore, X_{it} represents a vector of family and labour market characteristics. Finally, β is a vector of parameters, γ_1 and γ_2 indicate the effect of age and age-squared, and ε_{it} is an error term. The analysis is done separately for males and females.

Since the equation includes individual fixed effects, the effect of family status and labour market status is identified on within-individual changes. Two changes in family status are distinguished. Both concern a change from having a partner to becoming single. The first variable 'divorced' represents a change from partnership to divorce which includes both a marital divorce and a separation in case of cohabitation. The effects of a change from single to partnership are assumed to have the opposite effect as divorce with the same magnitude. The second variable 'widow(er)' refers to the death of a partner. Also in labour market status, two changes are distinguished. The variable 'unemployed' represents a change from employment to unemployment and the variable "retired" refers to a change into retirement.

Detrending age and calendar time effects

In equation (1), the parameter estimates for γ_1 and γ_2 are interpreted as pure age effects, i.e. the effect of calendar time is ignored. However, it could be that calendar time does have an effect on mental health or loneliness. Furthermore, equation (1) only includes

a linear and a quadratic term in age. It could be that the effect of age requires a much more flexible specification. The same holds for the calendar time effects. To study the pattern of age and calendar time effects in more detail age and calendar time are detrended following De Ree and Alessie (2011) and Van Landeghem (2012). In this approach, age and calendar year are specified using additive dummy variables:

$$H_{it} = \alpha_i + \beta X_{it} + \sum_{\tau=2}^{t_{max}} \gamma_\tau D_\tau^T(t) + \sum_{\alpha=2}^{a_{max}} \delta_\alpha D_\alpha^A(a_{it}) + \varepsilon_{it} \quad (2)$$

where H_{it} is the mental health of individual i in year t (or alternatively loneliness of individual i in year t), a_{it} represents age. As before, the α_i represent individual fixed effects and X_{it} represents a vector of time-varying explanatory variables. Furthermore, the dummies for time (1,.,t_{max}) and age (1,.,a_{max}) are defined as follows: $D_\tau^T(t) = 1$ if $t = \tau$, 0 otherwise and $D_\alpha^A(a_{it}) = 1$ if $a_{it} = \alpha$, 0 otherwise. Finally, γ, δ and β are vectors of parameters and ε_{it} is an error term.

The age and time profiles can be restricted in such a way that the parameters of the dummy variables add up to zero over the relevant range and are orthogonal to a linear trend:

$$\tilde{D}_\tau^T(t) = D_\tau^T(t) + (\tau-2)D_1^T(t) - (\tau-1)D_2^T(t), \tau = 3, .., t_{max}$$

$$\tilde{D}_\alpha^A(a_{it}) = D_\alpha^A(a_{it}) + (\alpha-2)D_1^A(a_{it}) - (\alpha-1)D_2^A(a_{it}), \alpha = 3, .., a_{max}$$

Then,

$$H_{it} = \alpha_i + \beta X_{it} + \gamma t + \delta a_{it} + \sum_{\tau=3}^{t_{max}} \tilde{\gamma}_\tau \tilde{D}_\tau^T(t) + \sum_{\alpha=3}^{a_{max}} \tilde{\delta}_\alpha \tilde{D}_\alpha^A(a_{it}) + \varepsilon_{it} \quad (3)$$

where $\tilde{\gamma}_\tau$ $(\tau = 3, \ldots, t_{max})$ and $\tilde{\delta}_\alpha$ $(\alpha = 3, \ldots a_{max})$ are the vectors of restricted parameters that represent the calendar year profile and the age profile. The first two parameters of each parameter vector can be derived as follows:

$$\tilde{\gamma}_1 = \sum_{\tau=3}^{t_{max}} \tilde{\gamma}_\tau(\tau-2), \tilde{\gamma}_2 = -\sum_{\tau=3}^{t_{max}} \tilde{\gamma}_\tau(\tau-1)$$

$$\tilde{\delta}_1 = \sum_{\alpha=3}^{a_{max}} \tilde{\delta}_\alpha(\alpha-2), \tilde{\delta}_2 = -\sum_{\alpha=3}^{a_{max}} \tilde{\delta}_\alpha(\alpha-1)$$

So that the parameters satisfy the restrictions

$$\sum_{\tau=1}^{t_{max}} \tilde{\gamma}_\tau = 0, \sum_{\tau=1}^{t_{max}} \tilde{\gamma}_\tau \times t = 0 \sum_{\alpha=1}^{a_{max}} \tilde{\delta}_\alpha = 0, \sum_{\alpha=1}^{a_{max}} \tilde{\delta}_\alpha \times a = 0$$

Since in a fixed effects model t and a_{it} are perfectly correlated it is not possible to estimate γ and δ separately. Only the sum of the two is identified.

IV. Parameter estimates

Baseline estimates: ignoring calendar time effects

Panel a of Table 2 shows the baseline estimates in which calendar time effects are ignored. For both males and females age has a significant positive effect and age-squared has a significant negative effect implying that age has a nonlinear effect on mental health. According to these parameter estimates mental health has a maximum for males at age 75 and for females at age 78. Losing a partner causes a significant drop in mental health. The effect of becoming a widow(er) is larger than the effect of a divorce although as is indicated through the F-test on the marital status the magnitudes of the parameter estimates are not significantly different from each other. Becoming unemployed also causes a drop in mental health but this is significant only for females. The finding that becoming unemployed has no significant negative effect on the mental health of males is somewhat surprising as many studies do find such an effect. In the appendix, the baseline analysis is redone for prime age males and females (i.e. individuals aged 25 to 54). There it is shown that for prime age females but also for prime age males there is a significant negative mental health effect of job loss. Apparently for males, the mental health effects of job loss are less severe at a higher age.

Table 2 also shows that the mental health of males who retire increases significantly.

Table 2. Parameter estimates mental health and loneliness; baseline estimates.

	Males				Females			
a. Parameter estimates	Mental health		Loneliness		Mental health		Loneliness	
Age	2.09	(4.7) ***	−0.02	(2.7) ***	1.59	(3.2) ***	−0.02	(3.1) ***
Age-squared/100	−1.39	(4.1) ***	–		−1.01	(2.6) ***	–	
Divorced	−4.41	(2.7) ***	0.35	(1.7) *	−2.55	(1.3)	−0.16	(0.5)
Widow(er)	−7.60	(3.2) ***	0.36	(1.2)	−4.82	(2.8) ***	0.66	(3.0) ***
Unemployed	−1.19	(1.2)	0.29	(2.2) **	−3.22	(2.6) ***	0.18	(1.3)
Retired	1.35	(2.4) **	−0.09	(1.1)	0.87	(1.5)	−0.05	(0.8)
F-test Marital status	0.24		0.90		0.00		4.62 **	
Observations	12,248		11,421		12,621		11,808	
Individuals	2,308		2,320		2,500		2,523	
b. Correlation error terms	−0.109 ***				−0.125 ***			

Note: The F-test Marital status is on the equality of the effects of Divorced and Widow(er). All estimates contain individual fixed effects. Absolute *t*-statistics based on individual-level clustered standard errors are reported in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Nevertheless, it should be noted that the estimated parameters do not necessarily represent causal effects because reverse causality cannot be ruled out. It is possible, for example, that mental health problems lead to the loss of a partner through divorce or to job loss through dismissal. Also, some individuals may go on early retirement in anticipation of the increase in mental health related to retirement. Panel a of Table 2 also shows that loneliness goes down with age (the age-squared term was not significantly different from zero). Losing a partner or a job increases loneliness, but the latter effect is only significant for males. For males, the magnitude of divorce and become a widower are about the same. For females, the effect of becoming a widow is positive and significantly different from zero while the effect of a divorce is slightly negative but not significantly different from zero. Retiring has no significant effect on loneliness.

Mental health and loneliness are associated through ageing which has a positive effect on mental health and a negative effect on loneliness. Mental health and loneliness are also associated through the effects of life events. Most clearly is the death of a partner that has a significant negative effect on mental health and for females causes a significant increase in loneliness. In addition to observed life events and age, mental health and loneliness may be associated through unobserved shocks, events that are not registered in the dataset. Panel b of Table 2 shows that this indeed the case. The error terms of the mental health equations and loneliness equations are negatively and significantly correlated. Clearly, a negative shock to mental health coincides at least partly with a positive shock to loneliness and vice versa.

Detrending age and calendar time

When taking calendar time effects into account it is not possible to distinguish a linear trend in age from a linear trend in calendar time. However, after detrending a flexible age pattern and a flexible calendar time pattern can be estimated. The relevant parameter estimates are presented in Table 3. The effects of life events are very similar to those presented in Table 2. The age and calendar time trends are significantly positive for mental health and significantly negative for loneliness. The detrended age effects are shown graphically in Figure 3. Clearly, mental health has an inverse U-shaped relationship with age reaching a maximum around age 65. For loneliness, there are many fluctuations but there is no clear relationships with age. The detrended calendar time effects shown graphically do not have a clear pattern and compared to the magnitude of the age effects the calendar time effects are tiny.

The trend effect is by definition a composite of age and calendar time. This leaves the question of how the results in Table 3 can be interpreted in terms of the effects of ageing. For the detrended age and calendar time effects shown in Figure 3 it is clear that the range of fluctuations across calendar time is substantially smaller than the range of fluctuations across age. This suggests that age is more important than calendar time. If so, the trend effect is predominantly an age effect. This would imply that the drop in mental health after age 65 in the detrended part of

Table 3. Parameter estimates mental health and loneliness; detrending age and wave effects.

	Males				Females			
	Mental health		Loneliness		Mental health		Loneliness	
Age and calendar time trend	2.87	(6.0) ***	−0.20	(2.9) ***	2.90	(5.3) ***	−0.24	(3.3) ***
Divorced	−4.55	(2.8) ***	0.37	(1.8) *	−2.54	(1.3)	−0.15	(0.4)
Widow(er)	−7.69	(3.3) ***	0.38	(1.2)	−4.77	(2.8) ***	0.66	(3.0) ***
Unemployed	−1.25	(1.3)	0.31	(2.4) **	−3.07	(2.5) **	0.17	(1.2)
Retired	1.08	(1.8) *	−0.08	(0.9)	0.22	(0.4)	−0.06	(0.7)
Observations	12,248		11,421		12,621		11,808	
Individuals	2,308		2,320		2,500		2,523	

Note: All estimates contain fixed effects for individuals, age and calendar time (waves). The age and calendar time trend represents $(\delta + \gamma)/10$ (see Equation (3). Detrended age effects and detrended calendar time effects are graphically represented in Figure 3. Absolute *t*-statistics based on individual-level clustered standard errors are reported in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

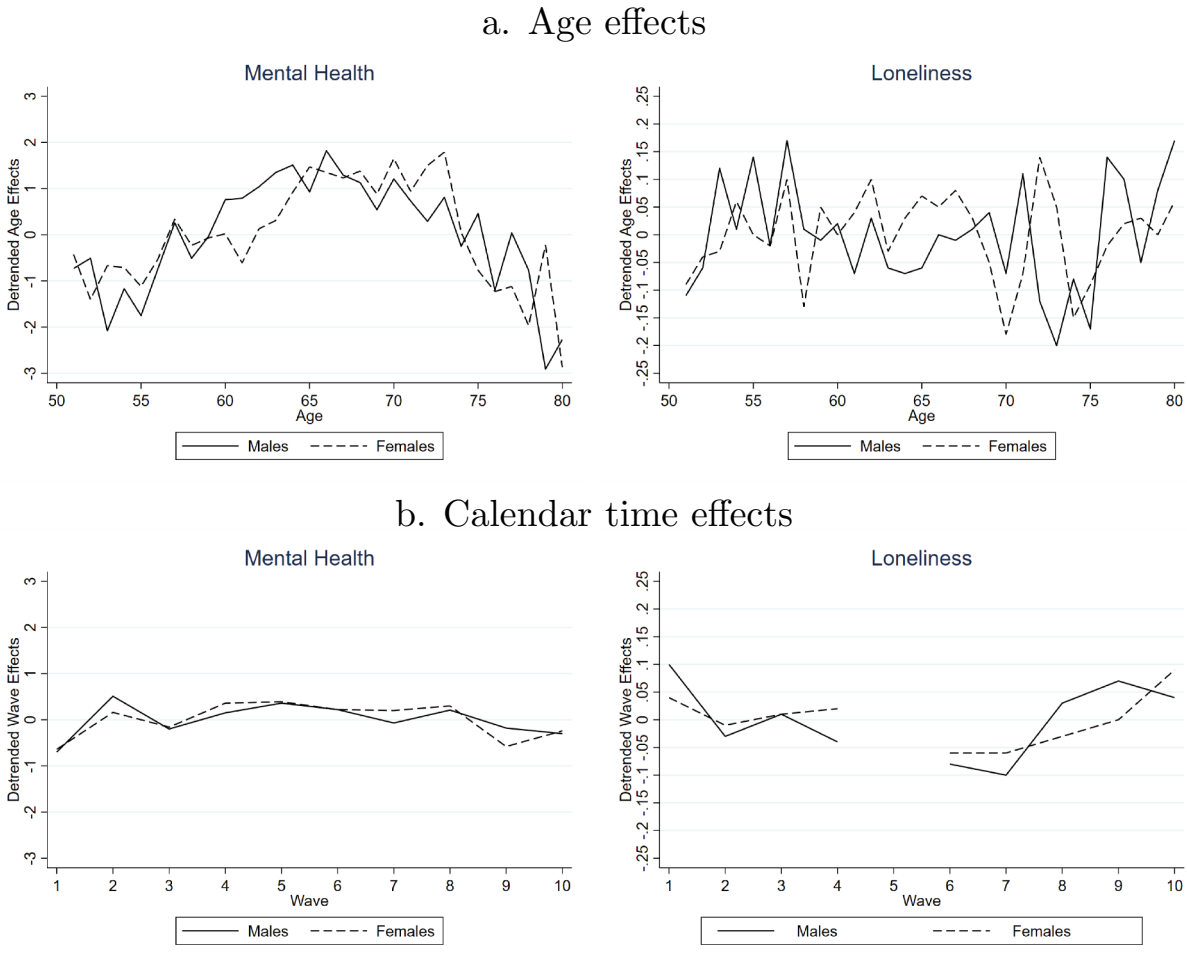

Figure 3. Detrended age and calendar time (wave) effects. Note: Effects based on the parameter estimates in Table 3.

the model is compensated by the increase due to the trend effect. For loneliness, there is no clear pattern in the detrended part of the model suggesting that the trend decline is at least partly do to an age effect implying that loneliness goes down with age.

The bottom line of the analysis in which the APC identification problem is accounted for is that the effect of calendar time on mental health and loneliness is limited. Ignoring the calendar time effect altogether and assuming that the estimated trend effect is largely due to an age effect seems to be a sensible assumption. Therefore, the remaining sensitivity analysis will use the baseline model as a starting point.

Fixed effects ordered logit

Both mental health and loneliness scales are ordinal scales which were analysed as if they were

cardinal. To investigate how sensitive the main findings are with respect to this assumption, a fixed effects ordered logit specification is used. This model takes unobservable time-invariant characteristics into account and only exploits the ordinal ranking of the dependent variables (Baetschmann, Staub, and Winkelmann (2015)). The relevant parameter estimates are presented in Table 4.

In terms of significance and sign of the parameter estimates there is hardly any difference compared to the baseline parameter estimates presented in Table 2. Age has a positive but non-linear effect on mental health with a maximum at age 75 for males and 77 for females. Age has a significant negative effect on loneliness; the effect is linear as the quadratic age terms were not significantly different from zero. Also, the parameter estimates of the life events are in line with the results presented in Table 2. In other words, the linear specification is an approximation but the logit model does not provide different insights into the relevant relationships.

Heterogeneity by educational attainment

The parameter estimates for males and females are very similar but there is some heterogeneity in the determinants of mental health and loneliness by gender. So far, the effect of educational attainment has not been investigated. After all, using individual fixed effects absorbs differences by educational attainment as among the age group 51 to 80 educational attainment does not change. However, it could be that there is parameter heterogeneity according to educational attainment. Therefore, the baseline analysis was replicated distinguishing between individuals with different educational attainments, i.e. low, intermediate and high education.

Figure 4 shows the relationship between mental health, loneliness and age by educational attainment. Among males, mental health scores are lower for low educated across the age range except in their early 70s when mental health is similar irrespective of educational attainment. Mental health initially increases with age while beyond early 70s mental health declines with age. The decline is stronger for low educated males. For females, there is a similar relationship with age but both the initial increase and later drop are less strong than for males. For females, there is hardly any difference according to educational attainment. The table at the bottom of the figure shows average mental health scores and loneliness scores by educational attainment. For males, low educated have a slightly poorer mental health while for females the differences are small. On average, loneliness is occurring more among low educated males while among female loneliness has the highest scores for low and high educated. Figure 4 also shows that on average low educated males are more lonely than males with intermediate or higher education except for around age 70 when there is not much of a difference by educational attainment. For males, loneliness goes down with age initially irrespective of educational attainment and increases with age beyond age 70 but only for low educated males. For females there is on average hardly any difference in the age pattern by educational attainment; there is a small decline but not so strong as for males and there is no increase at higher ages for females.

Table 5 shows the parameter estimates for the baseline specification applied to males and females with different educational attainment. For males,

Table 4. Parameter estimates mental health and loneliness; ordered logit estimates.

	Males				Females			
	Mental health		Loneliness		Mental health		Loneliness	
Age	0.41	(4.4) ***	−0.03	(2.7) ***	0.28	(3.1) ***	−0.04	(3.2) ***
Age-squared/100	−0.27	(3.8) ***	–		−0.18	(2.5) ***	–	
Divorced	−0.77	(2.8) ***	0.44	(1.8) *	−0.39	(1.5)	−0.12	(0.3)
Widow(er)	−1.38	(3.5) ***	0.54	(1.3)	−0.75	(3.1) ***	0.92	(3.2) ***
Unemployed	−0.21	(1.2)	0.38	(2.2) **	−0.52	(2.8) ***	0.29	(1.3)
Retired	0.27	(2.4) **	−0.15	(1.1)	0.17	(1.7) *	−0.14	(1.1)
Observations	11,749		9,791		12,126		9,719	
Individuals	1,941		1,733		2,103		1,769	

Note: All estimates contain individual fixed effects. Absolute *t*-statistics based on individual-level clustered standard errors are reported in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

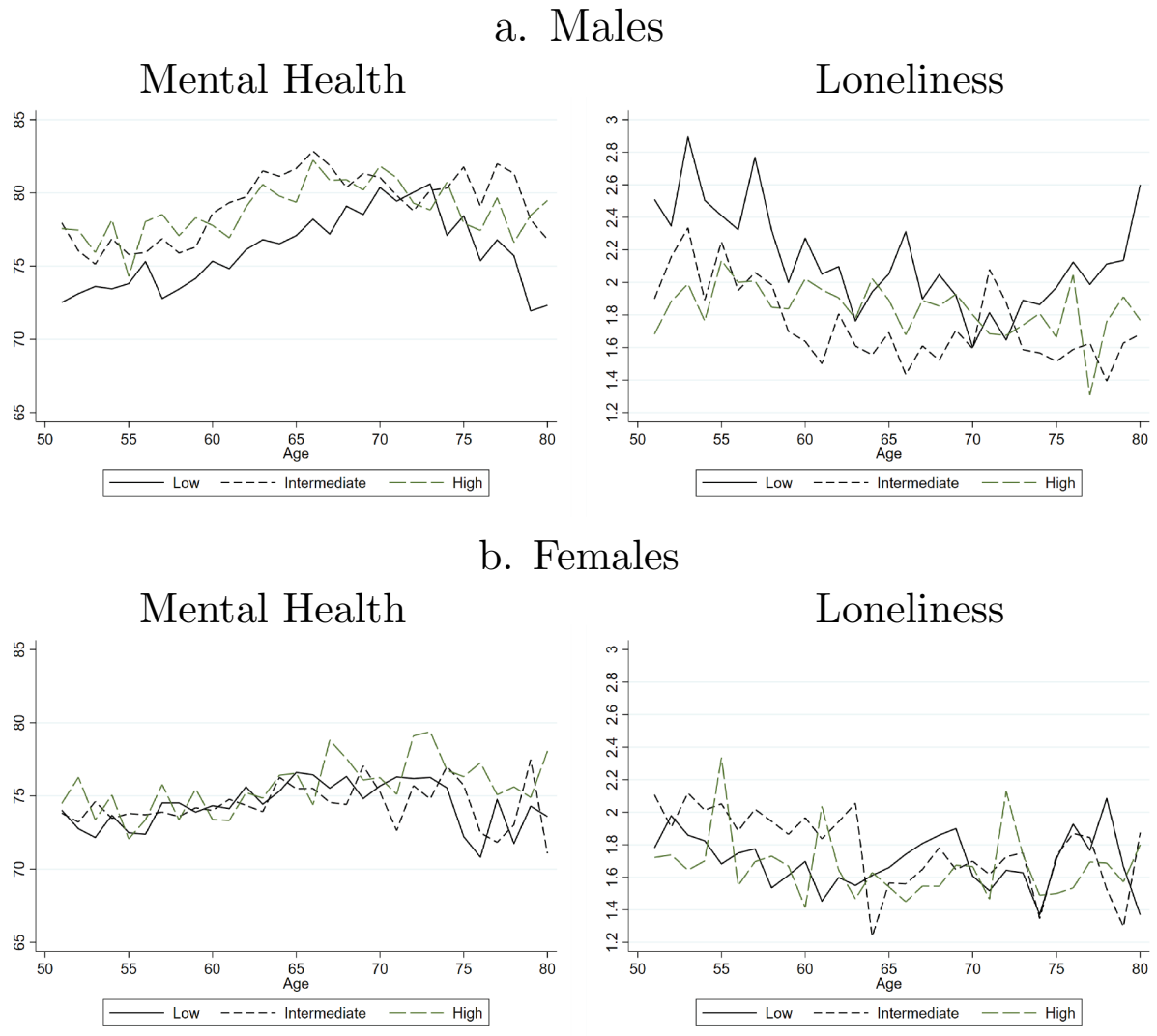

Figure 4. Mental health, loneliness and age; sample averages by educational attainment and gender.

age has a significant positive but non-linear effect on mental health. For low educated males, the mental health scale has its maximum at age 75, for males with intermediate education this is age 80 and for males with high education, the maximum mental health is at age 72. For females, the non-linear age effect on mental health is present only for low educated females for whom mental health has a maximum score at age 73. For females with intermediate education, the age-squared term is insignificantly different from zero but if this would be ignored the parameter estimates suggest that maximum mental health is at age 97 suggesting that over the observed age interval mental health is increasing across the board. For high educated females, there is no significant age effect at all. The effects of life events are not very different by educational attainment. Losing a partner has a negative effect on mental health for all educational categories. The effect of becoming a widow(er) is often but not always larger than the effect of a divorce. Becoming unemployed has a negative effect on mental health as well except for males with intermediate education. Retirement does not affect the mental health of low educated males and females and females with intermediate education.

For loneliness, there are differences by educational attainment but there is no systematic pattern. Age has a negative effect on loneliness except for high educated males. The effect of a divorce on mental health is significantly negative only for high educated males whereas the effect of a divorce on loneliness is significantly positive only for males with intermediate education. The death of

Table 5. Parameter estimates mental health and loneliness; by education.

	Males				Females			
a. Low education	Mental health		Loneliness		Mental health		Loneliness	
Age	1.65	(2.0) *	−0.03	(2.4) **	1.93	(2.4-) ***	−0.03	(2.9) ***
Age-squared/100	−1.10	(1.7) *			−1.31	(2.1) **		
Divorced	−1.46	(0.4)	−0.11	(0.2)	−3.24	(0.8)	−0.13	(0.7)
Widow(er)	−7.39	(1.7) *	0.78	(1.1)	−4.03	(1.6)	0.75	(2.5) **
Unemployed	−2.75	(1.4)	0.27	(1.0)	−3.69	(1.8) *	0.09	(0.5)
Retired	−0.03	(0.3)	0.10	(0.7)	0.42	(0.5)	0.08	(0.7)
Observations	3913		3634		5713		5315	
Individuals	811		815		1167		1186	
Correlation error terms	−0.082 ***				−0.134 ***			
b. Intermediate education								
Age	1.92	(2.6) ***	−0.02	(1.7) *	1.38	(1.7) *	−0.02	(1.4)
Age-squared/100	−1.20	(2.1) **			−0.71	(1.1)		
Divorced	−2.30	(1.0)	0.57	(1.9) *	−2.88	(1.0)	0.36	(0.9)
Widow(er)	−11.50	(2.6) ***	−0.04	(0.6')	−3.19	(1.0)	1.27	(2.9) ***
Unemployed	0.37	(0.3)	0.27	(1.5)	−3.21	(1.9) *	−0.22	(1.0)
Retired	2.05	(2.3) **	−0.16	(1.3)	−1.17	(1.2)	−0.29	(2.4) **
Observations	4971		4591		4248		3951	
Individuals	1089		1127		1041		1071	
Correlation error terms	−0.105 ***				−0.100 ***			
c. High education								
Age	3.13	(3.5) ***	−0.01	(0.6)	−0.17	(0.1)	−0.03	(1.8) *
Age-squared/100	−2.15	(3.1) ***			0.17	(0.2)		
Divorced	−6.93	(2.0) *	0.30	(1.1)	2.95	(1.1)	−0.21	(0.9)
Widow(er)	−4.72	(1.6)	0.30	(1.3)	−9.28	(2.9) ***	0.59	(1.2)
Unemployed	−3.05	(1.6)	0.51	(1.8) *	−5.05	(2.5) **	0.47	(1.5)
Retired	1.77	(1.8) *	−0.10	(0.7)	2.53	(2.3) **	0.04	(0.3)
Observations	3364		3196		2660		2542	
Individuals	986		999		897		902	
Correlation error terms	−0.127 ***				−0.138 ***			

Note: All estimates contain individual fixed effects. Absolute *t*-statistics based on individual-level clustered standard errors are reported in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

a partner has negative effects on mental health but only significantly so for males with a low and intermediate education and females with a high education. The death of a partner has a significant positive effect on the loneliness of low and intermediate educated females. Becoming unemployed only has a significant positive effect on loneliness for intermediate and high educated males. Finally, retirement only has negative and significant effects on loneliness of females with intermediate education. Table 5 also shows that the error terms of the mental health and loneliness equations are significantly negatively correlated. Unobserved life events affect both mental health and loneliness at all levels of educational attainment.

V. Conclusions

This paper studies mental health and loneliness among people beyond age 50. It studies the effects of life events focusing on changes in family status and changes in labour market status. The analysis is based on panel data which allows for the introduction of individuals fixed effects which take time-invariant observed and unobserved individual characteristics into account. Life events have significant effects on both mental health and loneliness. Losing a partner through divorce or death or becoming unemployed reduces mental health and increases loneliness. Males retiring experience an increase in mental health. Also, high educated females experience an improvement in mental health when retiring.

The main question the paper aims to address is whether after taking the effects of life events into account there are direct effects of ageing on mental health and loneliness. Establishing pure age effects without additional assumptions is impossible due to an identification problem. With panel data, the trend effects of age and time being are indistinguishable, i.e. if time passes by with one day, the individual is also one day older. The paper uses a line of reasoning attributing the trend effect predominantly to age. The line of reasoning goes as follows. After detrending, it is possible to estimate very flexible age effects and calendar time effects. The variation in the detrended age effects appears to be quite large while the variation in the detrended calendar time effects is rather limited.

Therefore, it is likely that age is more important than calendar time in affecting mental health and loneliness. In other words, ignoring calendar time effects does not seem to bias the age effects too much. This finding would imply that in previous studies in which the identification problem is often ignored the estimated age effect are not biased too much either.

The main finding of the paper is that ageing affects both mental health and loneliness. Up to the high 70s, mental health improves and loneliness goes down. It is not clear whether there is an actual or a perceived improvement in mental health and an actual or perceived reduction in loneliness. It could be that people's mental health improves as they get a better understanding about what life and living is asking for and giving back in return. It could be that loneliness goes down with age as older people have a different perspective on life. Young people thrive on excitement and a high frequency of social interaction while older people appreciate peace and quiet in which not the frequency of social interaction matters but the quality. Whatever the reasons may be for the established age effect, ageing does not seem to have negative effects on mental health until people reach a really high age. The same holds for loneliness. Even very old people do not seem to become lonelier. All in all, getting old does not seem to be a drag.

Acknowledgments

"What a drag it is getting old" is the first line of the 1966 Rolling Stones song "Mothers little helper". A very preliminary version of the paper was presented at the July 2017 Australia National University workshop to honor Alison Booth's economics career and transition to emeritus status. The author thanks participants of this workshop, participants of the 2019 ESPE-conference in Bath and an anonymous reviewer for their comments, Sanne Lin for her excellent research assistance and CentERdata (Tilburg University, The Netherlands) for making the LISS-data available for analysis.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

ORCID

Jan C. van Ours http://orcid.org/0000-0002-0144-9956

References

Baetschmann, G. 2013. "Heterogeneity in the Relationship between Happiness and Age: Evidence from the German Socio-Economic Panel." *German Economic Review* 15 (3): 393–410.

Baetschmann, G., K. E. Staub, and R. Winkelmann. 2015. "Consistent Estimation of the Fixed Effects Ordered Logit Model." *Journal of the Royal Statistical Society A* 178 (3): 685–703.

Bell, A. 2014. "Life-course and Cohort Trajectories of Mental Health in the UK, 1991-2008 – A Multilevel Age–period-cohort Analysis." *Social Science & Medicine* 120: 21–30.

Bharadwaj, P., M. M. Pai, and A. Suziedelyte. 2017. "Mental Health Stigma." *Economics Letters* 159: 57–60.

Blanchflower, D. G., and A. J. Oswald. 2008. "Is Well-being U-shaped over the Life Cycle?" *Social Science & Medicine* 66: 1733–1749.

Blanchflower, D. G., and A. J. Oswald. 2009. "The U-shape without Controls: A Response to Glenn." *Social Science & Medicine* 69: 486–488.

Bond, T. N., and K. Lang. 2019. "The Sad Truth about Happiness Scales." *Journal of Political Economy* 127 (4): 1629–1640.

Chapman, B., and C. Guven. 2016. "Revisiting the Relationship between Marriage and Wellbeing: Does Marriage Quality Matter?" *Journal of Happiness Studies* 17: 533–551.

Chen, S., and J. C. van Ours. 2018. "Subjective Well-being and Partnership Dynamics: Are Same-sex Relationships Different?" *Demography* 55 (6): 2299–2320.

Cheng, T. C., N. Powdthavee, and A. J. Oswald. 2017. "Longitudinal Evidence for a Midlife Nadir in Human Well-being: Results from Four Data Sets." *Economic Journal* 127: 126–142.

Clark, A. E. 2003. "Unemployment and Social Norms: Psychological Evidence from Panel Data." *Journal of Labor Economics* 21: 323–351.

Clark, A. E. 2007. "Born to Be Mild? Cohort Effects Don't (Fully) Explain Why Well-being Is U-shaped in Age". IZA Discussion Paper No. 3170.

Clark, A. E., and A. J. Oswald. 1994. "Unhappiness and Unemployment." *Economic Journal* 104: 648–659.

Das, A. 2019. "Loneliness Does (Not) Have Cardiometabolic Effects: A Longitudinal Study of Older Adults in Two Countries." *Social Science & Medicine* 223: 104–112.

De Jong Gierveld, J., and T. Van Tilburg. 2006. "A 6-item Scale for Overall, Emotional, and Social Loneliness Confirmatory Tests on Survey Data." *Research on Aging* 28 (5): 582–598.

De Ree, J., and R. Alessie. 2011. "Life Satisfaction and Age. Dealing with Underidentification in Age-period-cohort Models." *Social Science & Medicine* 73: 177–182.
Frijters, P., and T. Beatton. 2012. "The Mystery of the U-shaped Relationship between Happiness and Age." *Journal of Economic Behavior & Organization* 82: 525–542.
Glenn, N. 2009. "Is the Apparent U-shape of Well-being over the Life Course a Result of Inappropriate Use of Control Variables?" *Social Science and Medicine* 69 (4): 481–485.
Gwozdz, W., and A. Sousa-Poza. 2010. "Ageing, Health and Life Satisfaction of the Oldest Old: An Analysis for Germany." *Social Indicators Research* 97: 397–417.
Kassenboehmer, S. C., and J. P. Haisken-Denew. 2009. "You're Fired! the Causal Negative Effect of Entry Unemployment on Life Satisfaction." *Economic Journal* 119: 867–889.
Kassenboehmer, S. C., and J. P. Haisken-DeNew. 2012. "Heresy or Enlightenment? the Well- Being Age U-shape Effect Is Flat." *Economics Letters* 117: 235–238.
Kolodziej, I. W. K., and P. García-Gómez. 2019. "Saved by Retirement: Beyond the Mean Effect on Mental Health." *Social Science & Medicine* 225: 85–97.
Luo, Y., L. C. Hawkley, L. J. Waite, and J. T. Cacioppo. 2012. "Loneliness, Health, and Mortality in Old Age: A National Longitudinal Study." *Social Science & Medicine* 74: 907–914.
Picchio, M., and J. C. van Ours. 2020. "Mental Health Effects of Retirement." *De Economist* 168 (3): 319–352.
Richard, A., S. Rohrmann, C. L. Vandeleur, M. Schmid, J. Barth, and M. Eichholzer. 2017. "Loneliness Is Adversely Associated with Physical and Mental Health and Lifestyle Factors: Results from a Swiss National Survey." *PLOS One* 12 (7): e0181442.
Santini, Z. I., K. L. Fiori, J. Feeney, S. Tyrovolas, J. M. Haro, and A. Koyanagi. 2016. "Social Relationships, Loneliness, and Mental Health among Older Men and Women in Ireland: A Prospective Community-based Study." *Journal of Affective Disorders* 204: 59–69.
Schwandt, H. 2016. "Unmet Aspirations as an Explanation for the Age U-shape in Wellbeing." *Journal of Economic Behavior & Organization* 122: 75–87.
Thomson, R. M., and S. V. Katikireddia. 2018. "Mental Health and the Jilted Generation: Using Age-period-cohort Analysis to Assess Differential Trends in Young People's Mental Health following the Great Recession and Austerity in England." *Social Science & Medicine* 214: 133–143.
Van Landeghem, B. 2012. "A Test for the Convexity of Human Well-being over the Life Cycle: Longitudinal Evidence from A 20-year Panel." *Journal of Economic Behavior & Organization* 81: 571–582.
Winkelmann, L., and R. Winkelmann. 1998. "Why are the Unemployed so Unhappy? Evidence from Panel Data." *Economica* 65: 1–15.
Wooden, M., and N. Li. 2016. "Ageing, Death and Life Satisfaction: Evidence from the Household, Income and Labour Dynamics in Australia Survey." *Australian Economic Review* 49 (4): 1–9.
Wunder, C., A. Wiencierz, J. Schwarze, and H. Küchenhoff. 2013. "Well-being over the Life Span: Semiparametric Evidence from British and German Longitudinal Data." *Review of Economics and Statistics* 95 (1): 154–167.
Yang, K., and C. Victor. 2011. "Age and Loneliness in 25 European Nations." *Ageing & Society* 31 (8): 1368–1388.

Appendix: Parameter estimates prime age individuals

Table 6 shows the relevant parameter estimates for prime age individuals, i.e. individuals from age 25 to 54. The results are very much the same as for the main sample in the analysis of individuals from age 51 to 80. Divorce and becoming a widow(er) have negative effects on mental health and positive effect on loneliness whereby the effects of becoming a widow(er) are substantially bigger than the effects of divorcing. Retirement has a positive effect on mental health and a negative effect on the loneliness of males. The main difference between the estimates in Table 6 and those in Tables 2 and 3 are related to the effects of becoming unemployed for males. For older males, there is no significant negative effect, but for prime age males, there is a significant negative effect. For prime age females, it is even stronger than for prime age males but otherwise, the results are similar to those in Tables 2 and 3. Clearly, the negative mental health effects of becoming unemployed for males are age-related.

Table 6. Parameter estimates mental health and loneliness prime age individuals (age 25–54).

	Males				Females			
	Mental health		Loneliness		Mental health		Loneliness	
Divorced	−1.98	(2.3) **	0.30	(2.3) **	−2.53	(3.2) ***	0.08	(0.6)
Widow(er)	−5.94	(2.4) **	0.87	(1.8) *	−6.43	(2.4) **	1.01	(2.6) ***
Unemployed	−1.87	(2.2) **	0.17	(1.6)	−3.61	(4.3) ***	0.20	(1.7) *
Retired	1.75	(1.7) *	−0.34	(2.3) **	1.97	(2.1) **	0.03	(0.2)
Observations	14,786		14,114		17,972		17,154	
Individuals	3,353		3,439		4,092		4,177	

Note: All estimates contain fixed effects for individuals and fixed effects for age. Absolute *t*-statistics based on individual-level clustered standard errors are reported in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.