

## Happiness and age in European adults: The moderating role of GDP per-capita

### Abstract

Studies of happiness levels across the lifespan have found support for two rival hypotheses. The positivity effect states that as people get older they increasingly attend to positive information, which implies that happiness remains stable or increases with age, whereas the u-shaped hypothesis posits a curvilinear shape resulting from a dip during midlife. Both have been presented as potentially universal hypotheses that relate to cognitive and/or biological causes. The current study examined the happiness-age relationship across 29 European nations (N= 46,301), to explore whether it is moderated by national wealth, as indexed by GDP-per-capita (GDPPC). It was found that eudaimonic and hedonic happiness remained relatively stable across the lifespan only in the most affluent nations; in poorer nations there was either a fluctuating or steady age-associated decline. These findings challenge the cultural universality of the happiness-age relationship and suggest that models of how age relates to happiness should include the socio-economic level of analysis.

*Keywords:* Happiness, eudaimonic, hedonic, positivity effect, lifespan

### **Happiness and age in European adults: The moderating role of GDP per-capita**

Across the social sciences, research on happiness tends to focus on *either* the hedonic *or* eudaimonic form (Delle Fave, Brdar, Freire, Vella-Brodrick, & Wissing, 2005). Hedonic happiness is defined as the subjective experience of pleasure and satisfaction, and the absence of pain or negative feelings (Deci & Ryan, 2006). In contrast, eudaimonic happiness is concerned with optimal experience, positive relationships, a sense of purpose, meaning, and a feeling of growth, and has been operationalized by psychologists as ‘flourishing’ (Diener et al., 2010). Comparing the two types and their respective relationship to age has been rarely attempted in the literature.

### **The Positivity Effect Hypothesis**

Studies of happiness across the lifespan support two competing hypotheses. Socio-emotional selectivity theory (SST) proposes that as people get older, they attend more to positive information and positive memories, and as a result positive affect remains stable or increases across the lifespan, despite the physical and cognitive declines associated with age (Carstensen & Mikels, 2005; Charles, Mather & Carstensen, 2003; Mroczek & Kolarz, 1998; Rothermund & Brandstädter, 2003). This positivity effect is supported by experimental, longitudinal and cross-sectional findings that older adults show a positive bias in memory, perceptual attention and cognitive appraisal (Carstensen et al., 2011; Charles, Mather & Carstensen, 2003; Mroczek & Kolarz, 1998). The positivity effect can be understood as the operation of compensatory mental processes that have evolved to manage the losses of the aging self (Rothermund & Brandstädter, 2003; Carstensen & Mikels, 2005). These processes are consistent with neurological changes in older age, such as a decrease in amygdala function combined with greater recruitment of frontal lobes in emotional processing (St Jacques, Bessette-Symons & Cabeza, 2009; Williams et al., 2006).

### **U-Shaped Hypothesis**

The U-shaped hypothesis proposes a curvilinear relationship between happiness and age (Blanchflower & Oswald, 2008; 2009; Morgan & Robinson, 2013; Cheng, Powdthavee & Oswald, 2014). This is supported by cross-sectional and longitudinal studies that have found that happiness dips at midlife and then rises again after the late fifties (Blanchflower & Oswald, 2008, 2009; Cheng, Powdthavee, & Oswald, 2014). U-shaped trajectories are mainly obtained when controlling for various factors such as marital status, income and employment that when controlled for disproportionately lower scores in midlife, when these variables naturally peak (Frijters & Beatton, 2012), however, the U-shape has also been found albeit less frequently in unadjusted data (Blanchflower & Oswald, 2009). A midlife dip in happiness could be explained by the developmental functioning of the frontal lobes, which are linked to cognitive styles such as unrealistic optimism and self-serving bias (Chowdhury, Sharot, Wolfe, Düzcel, & Dolan, 2014; Sharot, 2011).

In contrast to the diverse research on hedonic happiness and ageing, previous research on the relationship of eudaimonic happiness to adult age is relatively scarce. Some variables related to eudaimonia such as a sense of autonomy and environmental mastery have been found to increase with age, while others such as a sense of self-acceptance and personal meaning have shown a U-shaped trajectory (Morgan & Robinson, 2013; Ryff, 1989; Steger, Oishi, & Kashdan, 2009). In sum, whether the relationship between eudaimonic happiness and age fits with the predictions of the positivity effect or the u-shaped hypothesis is unclear.

### **National economic affluence and happiness**

Research on happiness and age has given minimal consideration to whether countries that differ in economic wealth have different happiness-age profiles. Wealth indicators are associated with mean happiness levels across 98% of the world's nations (Diener & Biswas-Diener, 2002), and it may be that this effect is larger in certain age groups than others.

Positive within-and between-person correlations between earnings and life satisfaction are stronger for midlife individuals compared to younger or older adults, suggesting that age trajectories of the association between income and happiness are influenced by life stage developmental changes (Cheung & Lucas, 2015). It has also been hypothesised that the negative impact of older adults' reduced income and poorer health on their SWB may be magnified in nations with less affluent economies and more limited access to medical care (Lucas & Gohm, 2000). Research using meta-analytic techniques to examine the distribution of effect sizes of happiness/age trajectories has found significant heterogeneity in effect sizes across nations (Lucas & Gohm, 2000). These findings suggest that whilst emotionality in general declines with age, perhaps due to decreased affective intensity (Diener & Suh, 1998), unpleasant affect may start to increase again in later life, perhaps due to problems associated with loss of resources, social support & income (Lucas & Gohm, 2000). Such problems are expected to be amplified in less affluent nations. Furthermore, if the effects of difficult socio-economic conditions are cumulative across the lifespan, the difference between older adults in more and less affluent countries would be greater than the difference between young adults.

In the current study, we examined GDP-per capita (GDPPC) as a potential moderator of hedonic and eudaimonic happiness-age trajectories in 29 European countries within a structural equation modelling framework. Given the evidence for a U-shaped relationship of hedonic happiness to age in large cross-sectional samples (Blanchflower & Oswald, 2009) and some evidence for the same pattern in eudaimonic variables (Morgan & Robinson, 2013), we predicted U-shaped relationships for both forms of happiness, but one which would be more curvilinear in wealthy countries due to higher levels of happiness in older adults in these countries. In the other countries we expected a less pronounced post-midlife increase.

## **Method**

### **Participants**

Data were gathered as part of the European Social Survey (ESS). This is a biennial cross-sectional survey of approximately 30 nations, first conducted in 2002 and most recently in 2014. It is funded through the European Commission's Framework Programmes, the European Science Foundation and national funding bodies in each country. Most participating countries use random sampling within geographical clusters, while some used non-clustered random sampling strategies (Jowell & Eva, 2009). ESS sampling is done using strict random probability methods in all countries. Larger countries employ geographical sampling frames to ensure representation of diverse regions. The ESS expert sample panel ensure that the sampling strategies used by different countries are equivalent in (a) their coverage of the population, (b) non-response reduction measures and (c) consideration of minimum bias estimates (European Social Survey, 2012). Data for the current study were taken from the 2012 ESS data round, the processing of which was completed and made publicly available in 2013 (ESS Round 6, 2012).

GDPPC provides an index of national wealth relative to population size. The twenty-nine participating countries were ranked in terms of their GDPPC for that year based on World Bank data (World Bank, 2014). Countries were then grouped into clusters of five from the most wealthy-per-capita to the least. These groupings are shown in Table 1. Within each column, GDPPC is ranked top-to-bottom. Participants for the current analysis (N=46,301) were those between the ages of 20 and 79 who provided full responses. Data for over 80s were relatively sparse so were excluded. Total cell sizes for age-band crossed with GDPPC-band are shown in Table 2.

### **Measures**

Questions for the ESS are comprised of a core module and rotating additional modules. They refer to affective states, values, attitudes and political behaviours. The questionnaires are completed using face-to-face interviews in participating countries. In the 2012 ESS data round the rotating modules were dedicated to the assessment of personal and social wellbeing.

**Hedonic happiness.** Three items included in the 2012 ESS data round assessed this. Two items measured happiness (*‘Taking all things together, how happy would you say you are?’* and *‘How much of the time during the past week were you happy?’*) and one measured life satisfaction (*‘All things considered, how satisfied are you with your life as a whole nowadays?’*). Items are respectively from the 4-item Subjective Happiness Scale, the 20-item Centre for Epidemiologic Studies Depression Scale and the 5-item Satisfaction With Life Scale, all of which have shown internal consistency, reliability and construct validity across cultures (Cheung & Bagley, 1998; Lyubomirsky & Lepper, 1999; Pavot, Diener & Suh, 1998). Items were scored using 11-point or 4-point Likert response scales with additional options for ‘don’t know’ or ‘refuse to answer’.

**Eudaimonic happiness.** Items included in the 2012 ESS data round measured ten aspects of flourishing: emotional stability, vitality, resilience, optimism, positive emotions, self-esteem, engagement, meaning, positive relationships and competence. Example items are *‘I generally feel that what I do in my life is valuable and worthwhile’* (meaning), *‘I am always optimistic about my future’* (optimism), and *‘Most days I feel a sense of accomplishment from what I do’* (competence). Items were scored using 5-point, 7-point or 11-point Likert response scales with additional options for ‘don’t know’ or ‘refuse to answer’. Reliability and construct validity of these ten flourishing items across European nations has been demonstrated with the data from the 2006 ESS (Huppert & So, 2013). In the

2012 cohort, two items (engagement and positive relationships) were excluded as they were missing in this data round

## Results

### Statistical Analysis Plan

**Factorial Structure and Measurement Invariance of Happiness Scale.** After random division of the data into testing and validation sets, exploratory factor analysis was used to identify an initial factor structure in the testing subsample, with confirmatory factor analysis (CFA) performed on the validation subsample. Multi-groups CFA was used to assess measurement invariance across groups. For all CFAs, the Chi-square test of model fit was not performed given its extreme sensitivity to minor deviations from perfect fit with large sample sizes (Cheung & Rensvold, 2002). Instead, acceptable model fit was defined as follows:  $RMSEA < 0.06$ ,  $CFI > 0.95$ ,  $SRMR < 0.08$  (Hu & Bentler, 1999). For assessing invariance, simulation studies suggest that measurement equivalence is demonstrated by a change in McDonald's NCI ( $\Delta Mc$ )  $< 0.0069$  (Meade, Johnson, & Braddy, 2008), and either  $\Delta CFI < 0.01$  (Cheung & Rensvold, 2002) or  $\Delta CFI < 0.002$  (Meade et al., 2008). Given the current lack of consensus on the optimal  $CFI$  change, the current study utilised Cheung et al's less stringent threshold, but with measurement equivalence only supported if both  $\Delta Mc < .0069$  and  $\Delta CFI < 0.01$  criterion were met.

**Age and Happiness.** Structural equation modeling was used to explore the relationship between age and happiness, by examining including age as a predictor of any emergent happiness dimensions. Various models were specified to compare linear vs. quadratic models and examine any moderating influence of GDP. All analyses were conducted with the *lavaan* and *ggplot2* packages in R (2014).

### Factorial Structure



**Exploratory factor analysis.** Maximum likelihood EFA with promax oblique rotation was performed on the testing sample ( $N = 23,150$ ), with two factors extracted based on the results of Horn's parallel analysis (Glorfeld, 1995). An inter-factor correlation of  $r = .64$  was observed, with loadings  $>.45$  used to define a factor. Based on item content, factors were labeled as Eudaimonic Happiness (items D2, D3, D13, D15, D18, D23 and CDES8) and Hedonic Happiness (items SWL and C1).

Item D19 loaded poorly onto both factors, consistent with increasing evidence of generally poor performance of reverse coded items (van Sonderen, Sanderman, & Coyne, 2013), and was dropped from further analysis. Notably, CDES8 exhibited cross-loadings onto both factors (.51 and .18 respectively), but as the second cross-loading was relatively small this item was retained pending further examination.

**Confirmatory factor analysis.** The fit of the factor model identified in the testing sample was further examined in the validation sample ( $N = 23,151$ ) using CFA. Input data was the sample variance-covariance matrix, with loadings of the first item in each factor fixed to 1 to set factor variances. Results suggested acceptable model fit according to one index ( $SRMR = .056$ ), but not others ( $RMSEA = .105$ ,  $CFI = .893$ ). Modification indices suggested two primary areas of misfit. First, CDES8 was indicated in a number of areas of model strain, possibly reflecting the fact that while its content was closely aligned to hedonic happiness, the state assessment ('over the past week') was present only in certain eudaimonic items. This item was therefore dropped. Second, MIs suggested correlated errors for D13/D15 and D18/D23, which appears to reflect a meaningful specificity of theme within each pair that should be accounted for in the model<sup>1</sup>.

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<sup>1</sup> D13 (How often in the past week have you had a lot of energy?) and D15 (How often in the past week have you felt calm and peaceful?). D18 (I feel a sense of accomplishment from what I do) and D23 (I feel what I do in life is valuable and worthwhile).

A further CFA on the re-specified model suggested a better fit to the data with  $CFI = .976$ ,  $RMSEA = .057$ ,  $SRMR = .032$ . Correlation between EH and HH was  $r = .62$ , with unstandardized and standardized factor loadings shown in Table 3. Finally, coefficient omega, which provides a superior assessment of reliability compared to Cronbach's alpha (Raykov, 2001), was computed and suggested good reliability of both hedonic ( $\omega = .83$ ) and eudaimonic ( $\omega = .71$ ) factors. Determinacy values were also good for both hedonic (.93) and eudaimonic (.88) factors, indicating that factor scores can be computed and reliably used as accurate estimates of latent ability (Brown, 2006).

### **Measurement Invariance**

Multiple-groups CFA was used to examine measurement invariance across GDP groups. Measurement invariance is vital to establishing that the ability to measure a construct of interest is equivalent across different subpopulations. Although there are several approaches to invariance testing (Brown, 2006), the current analysis sought to determine the minimum basis for equivalence - equal forms or configural variance (existence of the same basic factor structure across groups) and metric invariance (equivalent factor loadings across groups).

Configural invariance was assessed by fitting the specified two-factor model to each group separately and examining fit. Fit measures indicated acceptable fit,  $CFI = .973$ ,  $RMSEA = .059$ ,  $SRMR = .030$ , suggesting an equivalent basic factorial structure across groups. Analysis of individual GDP groups also confirmed acceptable fit indices for each group. Metric invariance was assessed by further constraining factor loadings to equality across groups. Results revealed little degradation in model fit compared to the equal forms model,  $\Delta CFI = 0.005$ ,  $\Delta Mc = 0.0060$  suggesting item loadings did not differ appreciably across GDP groups<sup>2</sup>.

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<sup>2</sup> Because Meade and Cheung simulations were based on two-group comparisons and the current study employed five groups, change in fit was computed for every possible pair of groups. Model fit indices continued to exhibit below threshold values (mean  $\Delta CFI = .0017$ ,  $\Delta Mc = 0.0009$ ).

Measurement variance was also assessed for age by repeating the above analysis substituting GDP groups for decade age groups (see Table 2). A similar pattern of results was observed, suggesting measurement equivalence holds across range of age spans.

### Structural Regression Models

**Age and Happiness: Linear vs. Quadratic.** To provide an initial assessment of the form of the relationship between age and happiness prior to further testing, age and standardized happiness factor scores were plotted as loess smoothed curves across GDP group (Figures 1 & 2). Possible non-linearity suggested by Figures 1 and 2 was explored by comparing the fit of linear and quadratic structural models. Both models added age as a predictor of both factors in the model, while the quadratic model also included the squared age variable (Schumacker & Lomax, 2010). In the absence of any established guidelines for assessing meaningful change in a structural model, the chi-square difference test was used along with  $R^2$  change to indicate the size of any quadratic effect. While chi-square indicated a significantly better fit for the quadratic model<sup>3</sup>,  $\chi^2(6) = 399.32, p < 0.001$ , the magnitude of this effect was minimal ( $R^2 < 0.1\%$ ) and thus only linear relationships were considered in subsequent analysis as the most parsimonious account of the data.

**Moderation across GDP groups.** To examine whether the association of age with happiness was moderated by GDP, the fit of two models was compared: (a) where regression paths of age were free to vary across GDP groups, and (b) where regression paths were constrained to equality across GDP groups for each factor (Schumacker & Lomax, 2010). Results indicated a significant deterioration in model fit for the constrained model,  $\chi^2(8) = 752.85, p < 0.001$ , suggesting that the association between age and happiness is moderated by GDP group.

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<sup>3</sup> To be confident that a meaningful quadratic effect did not exist within a specific GDP group, separate analyses were rerun on each group as well as for each factor. The same pattern of results emerged (all  $R^2 < 1\%$ ) suggesting little evidence of a substantive quadratic effect for any specific group.

Table 4 shows the standardized regression coefficients of age across GDP groups for each factor along with  $R^2$  estimates. In line with Figures 1 and 2, Table 4 suggests minimal change in happiness across the lifespan for higher GDP groups, but that more substantive decreases in happiness appear to occur for lower GDP groups.

Finally, although the gender ratio within each GDP group was fairly even (the maximum imbalance observed was 42/58%), any potential influence of gender was examined by rerunning all analysis after removal of sufficient cases to ensure an even ratio within each GDP group. A near-identical pattern of results was observed, suggesting little influence of gender.

### **Discussion**

In summary, our hypothesis that the age-happiness relationship would be moderated by GDP was supported for both measures of happiness. While our hypothesis that happiness-age trajectories would be u-shaped due to a dip in midlife was supported, the magnitude of this effect was found to be extremely small. With respect to moderation by GDPPC, figures 1 and 2 illustrate the happiness-age trajectory to be relatively stable for the most affluent nation-clusters (countries with a GDPPC of \$27,900+) for both eudaimonic and hedonic wellbeing, possibly reflecting recent findings that people in the more economically wealthy European countries experience the challenges of midlife as no less meaningful than in young adulthood (Hansen, 2012; Nelson, Kushlev, English, Dunn & Lyubomirsky, 2013).

For less affluent countries in the sample there was clear evidence of a pronounced ‘negativity effect’, suggesting that the aforementioned age-happiness gradients are at least in part mediated by national per-capita affluence, or through indirect effects of this affluence. In more affluent countries, happiness levels in older adults that are as high as those in early adulthood and midlife, may be facilitated by socio-economic variables such as pension

provision and subsidised care and home-support facilities, which help provide for maintained wellbeing in later life.

It is important to explicitly acknowledge the limitations of cross-sectional age difference findings such as those presented here, which can reflect both developmental change and historically influenced cohort differences. Many of the less affluent nations share a recent history of socio-economic turbulence having been within the Soviet Union prior to its break-up in the 1990s. Historical factors stemming from these past conditions may affect the older generation in ways that manifest as cohort effects within data, rather than age effects. This may partially contribute to the negativity effect – a possibility which can be tested by further research using ESS data to explore whether the nature of the negativity effect changes over the subsequent ten years. However, whilst age-related declines in SWB were found predominantly in Eastern Europe, eudaimonic well-being declines in very old age were found across a more geographically, historically and politically diverse range of European nations suggesting that the causes are not specific to ex-Soviet states.

There are many variables associated with GDPPC that may help to explain its differentiating role in the age-happiness relationship, which could be explored in further research. Employment opportunities, leisure facilities, public services, pension provision and more may contribute to the maintenance of happiness in older adults in affluent countries. Future research can explore which of these contributes to the GDPPC happiness differential. There is also a need for future studies into age-happiness trajectories beyond Europe. Of particular interest is whether or not the negativity effect will manifest in non-European nations where there is a markedly different cultural and socio-economic backdrop to the aging process.

In conclusion, our analysis presents evidence that in Europe, GDPPC is a key moderator of the happiness-age relationship for both hedonic and eudaimonic measures.

Eudaimonic and hedonic happiness remain relatively stable across the lifespan only in the most affluent nations; in poorer nations there is either a fluctuating or steady age-associated decline. For those living in the least affluent nations, there is a linear decrease in both types of happiness through every decade of adulthood between ages 20 and 79 – a fact that has been omitted from previous models based on data from the US and Western Europe, and one that demands further research and explanation.

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**Table and figure legends**

Table 1. Countries grouped by GDPPC

Table 2. Sample size across data sub-sections

Table 3. Unstandardized and standardised factor loadings from CFA

Table 4. Standardized regression coefficients ( $\beta$ ) of age across GDP groups and proportion of variance explained ( $R^2$ )

Figure 1. The relationship between hedonic happiness and age within countries grouped into five GDP-per-capita bands

Figure 2. The relationship between eudaimonic happiness and age within countries grouped into five GDP-per-capita bands

Table 1

*Countries grouped by GDPPC*

<b>GDP-per-capita range (US dollars)</b>					
	<b>Group 1:</b>	<b>Group 2:</b>	<b>Group 3:</b>	<b>Group 4:</b>	<b>Group 5:</b>
	43,300 –	36,900 –	27,900 –	23,800 –	8, 740 -
	65,460	43,304	36,209	27,400	23,300
<b>Countries in</b>	Norway	Ireland	UK	Czech	Poland
<b>group</b>	Switzerland	Denmark	Italy	Republic	Hungary
	Sweden	Belgium	Israel	Portugal	Bulgaria
	Netherlands	Iceland	Spain	Slovakia	Albania
	Germany	Finland	Cyprus	Estonia	Ukraine
		France	Slovenia	Russia	Kosovo
				Lithuania	

Table 2

*Sample size across data sub-sections*

<b>Age groups (years)</b>							
<b>GDP-PC</b>							
<b>range (\$)</b>	<b>20-29</b>	<b>30-39</b>	<b>40-49</b>	<b>50-59</b>	<b>60-69</b>	<b>70-79</b>	<b>Totals</b>
<b>43,300 – 65,460</b>	1288	1347	1751	1684	1506	1040	8616
<b>36,900 – 43,304</b>	1392	1736	1855	1889	1763	1041	9676
<b>27,900 – 36,209</b>	1394	1601	1613	1511	1429	919	8467
<b>23,800 – 27,400</b>	1616	1867	1951	2074	1876	1324	10708
<b>8, 740 - 23,300</b>	1501	1581	1602	1690	1508	952	8834
<b>Totals</b>	7191	8132	8772	8848	8082	5276	46301

Table 3

*Unstandardized and standardised factor loadings from CFA ( $p < .001$  observed for all parameter tests)*

	<b>Unstandardized loading</b>	<b>Z</b>	<b>Standardized loading</b>
<b>Latent variables</b>			
<b>EH</b>			
D2	1.00		0.72
D3	0.78	80.65	0.67
D13	0.59	59.76	0.47
D15	0.54	56.84	0.44
D18	0.67	67.13	0.54
D23	0.55	61.90	0.49
<b>HH</b>			
SWL	1.00		0.80
C1	0.96	88.83	0.88
<b>Covariances</b>			
D13 * D15	0.17	38.69	0.29
D18*D23	0.11	30.07	0.24
EH*HH	0.81	55.98	0.62

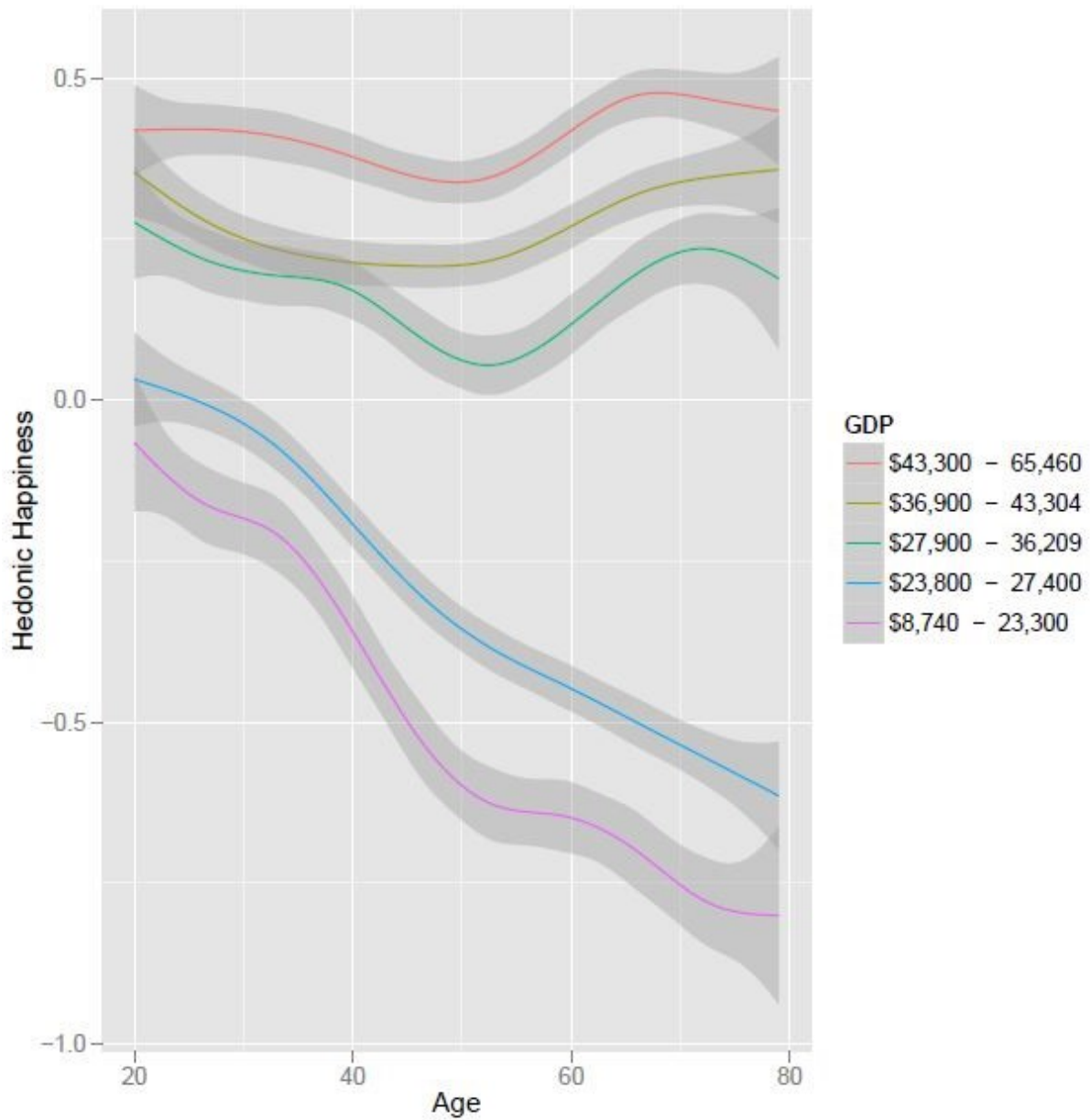
Note. EH = Eudaimonic Happiness, HH = Hedonic Happiness

Table 4

*Standardized regression coefficients ( $\beta$ ) of age across GDP groups and proportion of variance explained ( $R^2$ )*

	<b>HH</b>				<b>EH</b>			
	$\beta$	$R^2$	$z$	$p$	$\beta$	$R^2$	$z$	$p$
\$8,740- 23,300	-.20	.04	17.48	<.001	-.22	.05	18.32	<.001
\$23,800- 27,400	-.21	.05	19.83	<.001	-.28	.08	25.55	<.001
\$27,900- 36,209	-.01	<.01	0.81	.416	-.08	<.01	6.37	<.001
\$36,900- 43,304	.03	<.01	2.31	.021	.01	<.01	0.23	.819
\$43,300- 65,460	.03	<.01	2.20	.028	.01	<.01	0.47	.723

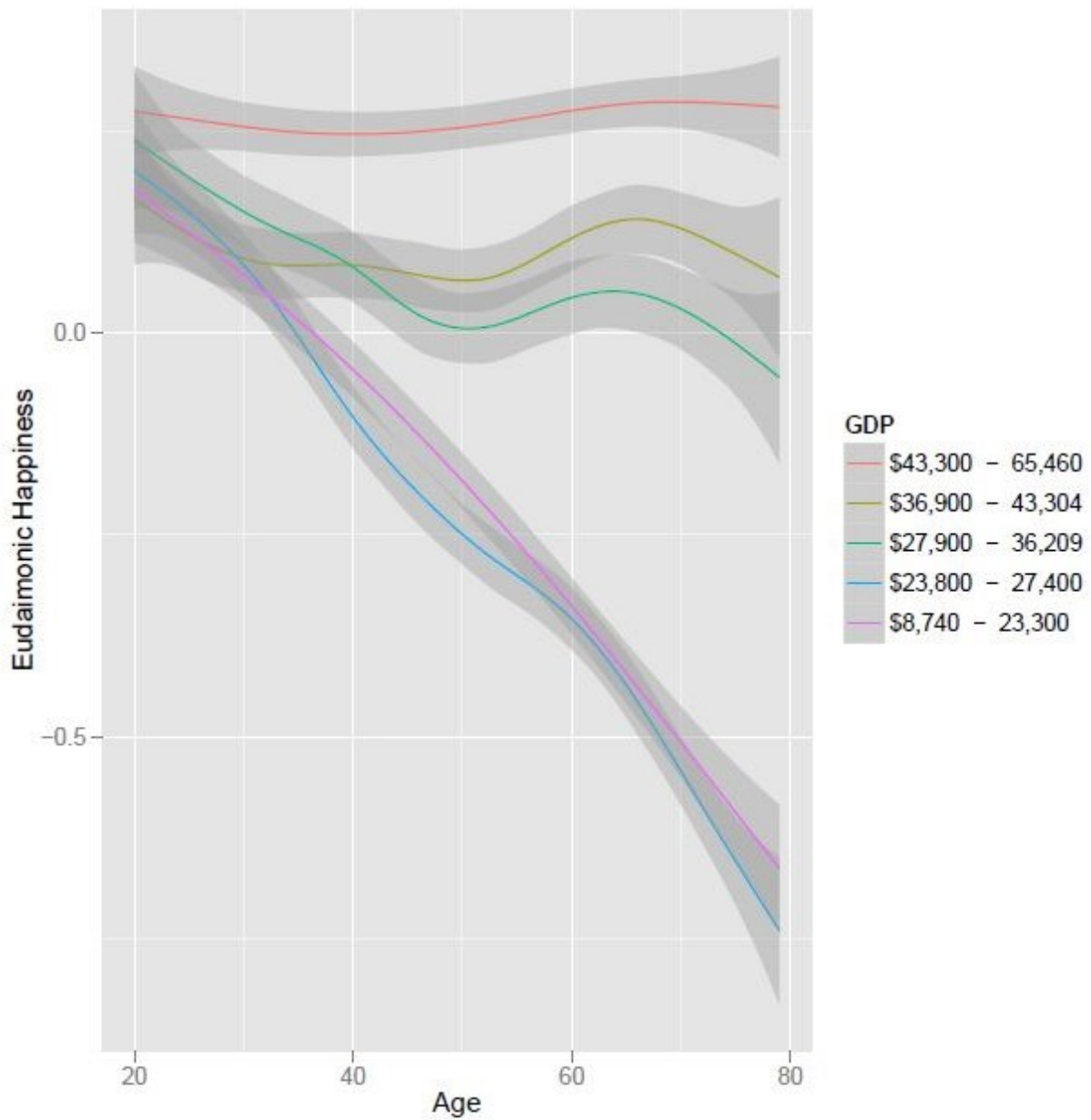
Note. EH = Eudaimonic Happiness, HH = Hedonic Happiness



Note. Grey shaded areas around lines represent confidence intervals set at 95%

Figure 1. The relationship between hedonic happiness and age within countries grouped into five GDP-per-capita bands





Note. Grey shaded areas around lines represent confidence intervals set at 95%

Figure 2. The relationship between eudaimonic happiness and age within countries grouped into five GDP-per-capita bands