



# Economic Development and Adolescent Wellbeing in 139 Countries

Jose Marquez<sup>1,3</sup> · Ferran Casas<sup>2</sup> · Laura Taylor<sup>3</sup> ·  
Jan-Emmanuel De Neve<sup>3</sup>

Accepted: 13 April 2024 / Published online: 5 June 2024  
© The Author(s) 2024

## Abstract

There is a positive association between the level of economic development and national levels of overall life satisfaction (OLS) in the adult population, with decreasing marginal returns. However, research shows no association in early adolescence and a negative association in middle adolescence. We hypothesize that this is due to the exclusion of low-income countries, where adolescent wellbeing is rarely collected. 2015–2019 Gallup World Poll data from 139 countries in middle adolescence (age 15–17;  $n = 36,907$ ) were analysed using linear regression to study the association between country levels of economic development and OLS, positive emotions (PE), and negative emotions (NE), and how this varies across economic development levels, and gender. Variations across economic development levels were compared with those observed in the adult population. Log per-capita GDP is positively associated with OLS and PE, although in high-income countries no association is observed for PE, and among females for OLS. For NE, a negative association is observed in lower-income countries and a positive association in higher-income countries. In this age group (age 15–17), the log per-capita GDP – OLS association is stronger in lower-income countries than in higher-income countries, but this pattern reverses with age in adulthood. A nuanced relationship exists between economic development and adolescent wellbeing, which varies across measures, levels of economic development, gender, and age -including notable differences compared to adults. Our study highlights the need for improving child and adolescent wellbeing data worldwide, especially in lower-income countries, to better understand how best to support wellbeing globally.

**Keywords** Wellbeing · Life satisfaction · Adolescence · Economic development

---

✉ Jose Marquez  
jose.marquez@manchester.ac.uk

<sup>1</sup> Manchester Institute of Education, University of Manchester, Manchester M13 9PL, UK

<sup>2</sup> Faculty of Education and Social Sciences, Andres Bello University, Santiago, Chile

<sup>3</sup> Wellbeing Research Centre, University of Oxford, Oxford, UK

## 1 Introduction

Historically, there has been a substantial gap between adult and child and adolescent subjective well-being data availability. Although this gap has been slowly narrowing in the past two decades, remaining limitations in data availability for children and adolescents may explain some counterintuitive research findings such as the negative association between national levels of economic development and subjective well-being in middle adolescence.

When indicators of child and adolescent subjective well-being at the population level started to be available in different countries in the twenty-first century, they immediately created debates in the international arena when the data were compared to adult data. This included two main questions. First, children's subjective well-being scores appeared to be higher than among the adult population in the same region or country. Second, these indicators did not show a correlation with macrosocial economic indicators like indicators of adults' subjective well-being did (Casas et al., 2020; Lee & Yoo, 2015). These results were confusing, and the consequent question was: Are children happier than adults, and independently of the socioeconomic context in the countries and regions they live in? To be able to rigorously answer this question, improving data availability was essential.

Thanks to a notable improvement in the availability of longitudinal data over the last decade, child and adolescent subjective well-being researchers have been able to rigorously study the first question noted above: differences in subjective well-being levels between adults and children. Research on adults shows a U-shape trajectory over the life cycle which has been observed globally and is characterised by a wellbeing decrease in late adolescence (18–24) and in the 20 s and 30 s, a nadir in the 40 s, and an increase that starts at some point in mid-life (40 s–50 s) with some variation across countries (Blanchflower, 2021) –although recent meta-analytic evidence suggests another decline may exist after age 70 (Buecker et al., 2023). Regarding earlier stages in life, as more longitudinal data on adolescence has become available, we have learned that, indeed, children tend to report higher levels of subjective well-being than adults, which then decreases with age throughout adolescence (Casas & González-Carrasco, 2020; Daly, 2022; Goldbeck et al., 2007), indicating that the decline defining the left side of the U-shape starts earlier in life (i.e., in early adolescence) and from a higher point. In early-to-mid adolescence (age 10–16), the decline involves a decrease of the positive affect and the cognitive components of subjective well-being (overall life satisfaction (OLS) and satisfaction with life domains) and an increase in negative affect, and different gender patterns of said decrease have been identified in different countries (Casas & González-Carrasco, 2020; Daly, 2022; Goldbeck et al., 2007).

The last decade has also witnessed a substantial increase in the number of countries participating in international studies that collect child and adolescent subjective well-being data, which has allowed researchers to investigate the second question noted above: the association between macro-economic indicators

and adolescents' subjective well-being. However, research thus far has shown that, while international variation in the subjective well-being of adults can mainly be explained by country-level characteristics (Helliwell et al., 2019), in the case of children and adolescents, this is mostly explained by factors in the child's home, school, and community context (Lee & Yoo, 2015). In relation to economic development, as described in more detail below, research shows mixed evidence in early adolescence depending on the measure considered (e.g. Casas et al., 2020, 2022; Lee & Yoo, 2015; Main et al., 2019), and a negative association in middle adolescence (Campbell et al., 2021; Rudolf & Bethmann, 2023), which contradicts findings from research conducting the same analyses using adult data (e.g., Deaton, 2008; Stevenson & Wolfers, 2013).

A the theoretical framework that is relevant to these associations is Bronfenbrenner's (1979) ecological theory, which focuses on the influence of multiple environments and the interconnections between them on the development of children and adolescents. It distinguishes between the most inner circle, the microsystem (family, school, after school clubs, etc.); the mesosystem, which refers to the collection of distinct microsystems and the interactions between them; the exosystem, where the developing person is not an active participant but is affected by events that occur in this setting (e.g. education policies and practices); and the macrosystems, which refers to the organisation of the social institutions in a society. The latter would be expected to be affected by such a relevant macro-level variable like the level of economic development in that society. Bronfenbrenner (1979) argued that what matters is how children experience their environment, and we would assume that this experience should be more negative in societies with lower level of economic development, which is what is observed in adult populations. However, as explained in detail below, this is not observed at age 10–15.

The main hypothesis of the present study is that discrepancies in the adult and child and adolescent literature on the links between economic development and subjective well-being are due to child and adolescent data availability limitations that are yet to be overcome. So far, researchers have explored this question in high-income countries mainly, as child and adolescent wellbeing data collected in international studies rarely includes participants from lower-income countries. The present study addresses this question by analysing 2015–19 data on 15–17-year-olds from 139 countries collected in the Gallup World Poll, which has so far remained mostly untapped in international research on adolescents' wellbeing. We follow World Bank Analytical Classifications (GNI per capita in US\$; Atlas methodology (World Bank, n.d.)), to categorise these 139 countries as high-income, upper middle-income, lower middle-income and low-income. We will refer to "lower-income countries" when including lower middle- and low-income countries altogether, and "higher-income countries" when including upper middle- and high-income countries. Furthermore, in our discussion of the existing literature, we define adolescence within the age range of 10 to 24, distinguishing between early adolescence (age 10–13), middle adolescence (age 14–17) and late adolescence (age 18–24). This approach reflects critical brain development stages as well as changes in other aspects of individual development and cultural norms (Arain et al., 2013; Blakemore, 2018; Sawyer et al., 2018)). In addition, we also examine this question for males and females

separately given research findings on gender differences in levels, trends, trajectories, and drivers of adolescent subjective well-being and how these vary across age, countries, and subjective well-being measures (Aymerich et al., 2021; Campbell et al., 2021; Chen et al., 2020; González-Carrasco et al., 2017; Marquez, 2023; Marquez et al., 2024).

### 1.1 What do we Mean by Wellbeing?

Wellbeing has traditionally been conceptualized through three main theoretical lenses. First, hedonic/subjective well-being comprises an affective component (positive and negative affect), and a cognitive component (satisfaction with life), and emphasizes ‘feeling good’ (Diener et al., 2002). Second, eudaimonic/psychological well-being is defined in terms of autonomy, purpose in life, environmental mastery, optimism, personal growth, self-acceptance, and/or positive relations with others, and emphasizes ‘flourishing’ (Ryff et al., 2021). Third, in some of the health sciences traditions, conceptualisations of mental well-being (Stewart-Brown et al., 2009) include mental health symptoms and use the terms wellbeing and mental health interchangeably (Campbell et al., 2021; Fuhrmann et al., 2022; Orben & Przybylski, 2019).

To aid the reader, the present study uses the term ‘wellbeing’ to refer to subjective (hedonic) well-being, and psychological (eudaimonic) well-being in broad conceptual terms. This will facilitate the discussion of findings from previous research that has examined this question using a range of wellbeing measures and less conventional terminology. For example, as described in more detail below, using PISA 2018 data, Campbell et al. (2021) use the term ‘mental health’ to refer to subjective (hedonic) and psychological (eudaimonic) well-being – and, within the affective component of the subjective (hedonic) well-being dimension, use the term ‘psychological distress’ to refer to negative affect and ‘hedonia’ to refer to positive affect. Another important reason for the use of the term ‘wellbeing’ in broad conceptual terms is that, although our main interest is in subjective well-being (OLS), as explicitly indicated in the hypothesis motivating this study, we take advantage of a rather unexplored data set (Gallup World Poll) in adolescent wellbeing research to examine this question also for positive emotions and negative emotions. These are often considered to fall within the affective subjective well-being dimension (Helliwell et al., 2023; Joshanloo & Jovanović, 2021), and negative emotions have also been operationalised as mental health symptoms in previous research (e.g. Elgar et al., 2021).

### 1.2 What Data is Available to Study the Links Between Economic Development and Child and Adolescent Wellbeing?

Most indicators of child and adolescent wellbeing available for international research used only instruments to capture subjective well-being, and mainly the cognitive component (mostly OLS). Only a few researchers have also tested correlations using instruments measuring the affective component (Casas et al., 2013). However, because said instruments have not been tested with children for very long, the few

international datasets including such indicators do not show a consensus about the characteristics of the instrument to be used. The result is a disparity of instruments, and it is unclear whether they capture equal or equivalent constructs. A detailed analysis of different international datasets that include potential children's wellbeing indicators shows the disparity of the measures used to obtain the available data, and the diverse range of age groups of participants:

- **The International Survey of Children's Well-Being (ISCWeB)** (see [www.isciweb.org](http://www.isciweb.org)), promoted by the *International Society for Child Indicators* (ISCI), also known as the **Children's Worlds project**. At present, data from nationally representative samples from three waves are available (Wave 1: 2011–2012; Wave 2: 2013–2014; and Wave 3: 2017–2019), plus another wave during the COVID-19 period, collected in 2021, using non-representative samples from 20 countries. This international dataset includes younger age groups from late childhood and early adolescence: 8, 10, and 12 years old. The Wave 3 dataset includes 35 countries from diverse socio-economic backgrounds in four continents, using four multi-item and one single-item scale to measure different wellbeing facets. The main limitation of these datasets is that the affective psychometric scales only include three items on positive affect and three on negative affect, which could be addressed in future waves of the study. The third wave of the Children's Worlds project collected data from 35 countries for the 10-year-old age group (25 high-, 5 upper middle-, 5 lower middle-, 0 low-income) and from 30 (21 high-, 4 upper middle-, 5 lower middle-, 0 low-income) for the 12-years-old-group.
- **The Programme for International Student Assessment (PISA)** (see [www.oecd.org/pisa](http://www.oecd.org/pisa)) developed by the Organisation for Economic Co-operation and Development (OECD), which focuses on 15-year-old students. The PISA questionnaire included a single-item 0–10 scale on the cognitive component of subjective well-being (OLS) in 2015 and 2018. The 2018 survey also included nine items on affect (five on positive affect and four on negative affect) and three items on eudaimonic well-being (meaning and purpose in life). In 2018, data on LS in 10 life domains were collected using 4-point scales in 9 countries, and data on mental health symptoms (nine items using 5-point scales) was consistently collected only in the United Arab Emirates (Marquez, 2022). The 2018 dataset includes 70 countries and economies that collected wellbeing data, making it the dataset with the most countries (65 high-, 5 upper middle-, 0 lower middle-, and 0 low-income). In the 2018 report, OLS is defined as “a useful summary indicator of well-being widely used by national statistical offices” (OECD, 2019, p. 41). In addition, in PISA for Development, data was collected in seven additional countries (0 high-, 3 upper middle-, 4 lower middle-, 0 low-income) between 2014 and 2016 on OLS (0–10 scale), anxiety (one binary item: yes/no) and depression (one binary item: yes/no). The main limitation of the PISA survey is that –with the exception of a few countries in PISA 2018– the cognitive component of subjective well-being (LS) is measured with a single-item scale, and positive affect, negative affect and eudaimonic well-being are measured using a 4-point scale. This calls into question the robustness of the measures.

- **The *Health Behaviour in School-aged Children (HBSC)*** (see [www.hbsc.org](http://www.hbsc.org)), supported by the WHO, was one of the earlier studies administered to children 11-, 13- and 15-years of age. The latest data collection (2021/22) included 50 countries from Europe and North America, as well as 4 Central Asian countries that participated for the first time (32 high-, 12 upper middle-, 5 lower middle-, and 1 low-income). Since 2001, it incorporated an adapted version of the single-item cognitive subjective well-being (0 to 10) scale (i.e. OLS) named Cantril's ladder (Cantril, 1965). This means five waves that use Cantril's ladder are available, although its main limitation is that it only uses a single-item scale to assess subjective well-being. It also includes eight 5-point items on different mental health symptoms.
- **The *Gallup World Poll*** (see [www.gallup.com/analytics/349487/gallup-global-happiness-center.aspx](http://www.gallup.com/analytics/349487/gallup-global-happiness-center.aspx)) collects nationally representative samples of the population aged 15 years old or more in over 160 countries every year, with a sample size of at least 1,000 participants per country each year. Although these are not representative samples of adolescent populations, some recent studies have used these data to assess the wellbeing of older adolescents (age 15–24) worldwide by pulling together data from two or more waves to minimise the limitations of the small size for this age groups (e.g. Elgar et al., 2021; Handa et al., 2023). Despite these limitations, the Gallup World Poll data provides an opportunity to study the wellbeing of adolescents in lower-income countries. For example, as described in detail in the method section, the analysis presented in this paper includes Gallup World Poll data from 139 countries (37 high-, 39 upper middle-, 42 lower middle-, 21 low-income). The Gallup World Poll data set includes scores for Cantril's ladder on OLS from 0 to 10 (Cantril, 1965), 10 items on yesterday's mood (5 positive and 5 negative, which are conceptualised as positive emotions and negative emotions in Gallup), and a set of 10 items on satisfaction with different life aspects or domains. Some of the limitations of these instruments include the use of binary items to ask about emotions and domain LS, and the fact that most domain LS items ask participants to report their satisfaction in 10 life domains 'in the city/region where they live', which is unconventional in international child and adolescent wellbeing studies. An evident implication is that, with the exception of the OLS scale, these instruments have rarely been used and validated in adolescent populations across many countries.

In summary, as described above, at present, the availability of international databases including potential indicators of children's or adolescents' subjective well-being is very limited. Additionally, while there are some preliminary studies using Children's Worlds, PISA and HBSC datasets to study the links between economic development and national levels of wellbeing in early and middle adolescence (age 10–15), evidence from analyses using the Gallup World Poll data including more lower-income countries is limited to late adolescence (age 15–24) samples. This evidence is discussed next.

### 1.3 What do we Know About the Links Between the Level of Economic Development and National Levels of Adolescent Wellbeing?

The relationship between economic development and wellbeing is arguably the most studied and contested area in the field of wellbeing economics. This question, which has mostly been studied in adult populations, has its origins in the Easterlin Paradox (Easterlin, 1974), which states that at a point in time happiness varies directly with income, both among and within nations, but over time the long-term growth rates of happiness and income are not significantly associated. This theory has been challenged by evidence from various studies showing a positive association, however, this is evidence from analyses of cross-section data (e.g. Deaton, 2008; Stevenson & Wolfers, 2008) or analyses that consider short-term time fluctuations. Easterlin and O'Connor (2022), argue that to test the paradox we need to look over the long run and consider a wide enough basket of countries. The evidence that Easterlin and O'Connor (2022) find with the best –but still limited- data sets available (the Gallup World Poll and the World Values Survey) is that growth rates per se do not show any remarkable and detectable association with average wellbeing over recent decades.

Researchers who have examined this association for decades have mainly used Gross Domestic Product (GDP) per capita as the measure of economic development. This measure has been accused of being a weak indicator of economic development and well-being (Costanza et al., 2009; Dynan & Sheiner, 2018), and there are other macro-economic indicators that can be used to assess economic development. Despite its limitations, its main advantage is that its use allows the examination of the contrasting evidence emerging from the adult and child and adolescent literature, described below, as most of the existing literature assessing the association between economic development and wellbeing uses GDP to measure economic development. Moreover, log GDP per capita (as opposed to GDP per capita) is widely used in the field to account for the existence of diminishing marginal utility affecting this association (Deaton, 2008), which implies that each additional unit of gain leads to an ever-smaller increase in subjective value (Easterlin, 2005).

Compared to adults, the data that is available to study this question in adolescents is more limited. Thus far, due to the lack of trend data over a large enough number of years and countries, it has only been possible to study this with cross-section data. Interestingly, in the adult population, as noted above, the analysis of cross-section data reveals a positive association between country levels of economic development and wellbeing (e.g. Deaton, 2008; Stevenson & Wolfers, 2008), which is stronger in higher-income countries than in lower-income countries (Deaton, 2008). However, in early adolescent populations, evidence of the existence of this association is mixed, and in middle adolescence the association is negative. This evidence is discussed next.

#### 1.3.1 Early Adolescence (Data from High-Income Countries Mostly): Mixed Evidence Depending on the Wellbeing Measure

Several studies have used the Children's Worlds data to study this question in early adolescence (ages 10, 12) in up to 35 countries, finding no associations between



GDP per capita and the cognitive component of subjective well-being (OLS) (Casas et al., 2020, 2022; Lee & Yoo, 2015; Main et al., 2019). Casas et al. (2022), however, found associations between economic indicators such as GDP per capita and affective subjective well-being and some life satisfaction domains. Interestingly, this study found that the higher the per-capita GDP the lower the positive affect, but also the lower the correlation between negative affect and the OLS for both the 10 and the 12-year-old age groups, suggesting the poorer a country is in economic terms, the more consistency there is between children's answer to items on negative affect and items on their cognitive subjective well-being. Children in wealthy countries tend to report high cognitive subjective well-being despite their negative affect also being high and increasing with age (Casas & González-Carrasco, 2020; Casas et al., 2022).

Evidence from HBSC data is limited to Levin et al.'s (2011) study. Using HBSC 2006 data from 13-year-olds in 35 countries, this study found that per-capita GDP (Purchasing Power Parity (PPP) US\$) did not explain between-country variance in socioeconomic inequalities in OLS.

#### **1.4 Middle Adolescence (Data from High-Income Countries Mostly): a Negative Association**

A few recent studies have examined this question in middle adolescence using PISA 2018 data from 15-year-old adolescents in over 70 countries and economies, finding some counter-intuitive results. Rudolf and Bethmann (2023) is the only study that has used the log GDP per capita (instead of GDP per capita) to account for decreasing marginal utility (Deaton, 2008) among all those that focus on early or middle adolescence (age 10–15). This study found a negative association between log per-capita GDP and adolescents' OLS (i.e., the richer the country the lower the OLS), which the authors define as the paradox of wealthy nations' low adolescent life satisfaction. Importantly, in a robustness check, the authors note that the addition of 7 upper middle- and lower middle-income countries that participated in PISA for Development 'hints towards an inverted-U relationships', with OLS increasing as GDP increases in lower-income countries and decreasing as GDP increases in higher-income countries. This would suggest that the consideration of lower-income countries may change what we know about the relationship between GDP per capita and wellbeing in adolescence. Further evidence of this paradox involving a wider range of measures was observed by Campbell et al. (2021) in another study using PISA 2018 data, who found that higher GDP per capita was associated with worse national levels of wellbeing for all the outcomes studied -including OLS, positive affect (defined as 'hedonia' in their study), negative affect ('psychological distress' in their study), and eudaimonic well-being (meaning and purpose in life)- as well as a larger gender gap in these outcomes. Analyses using post-COVID-19 data from PISA 2022 (Marquez et al., 2024) also find a negative association between OLS and log GDP per capita at age 15.



### 1.5 Late Adolescence (Global Data Including a Large Representation of Higher- and Lower-Income Countries): a Positive Association

In a recent study using Gallup World Poll data, Handa et al. (2023) compared levels and determinants of OLS (Cantril's ladder 0 to 10 scale; Cantril, 1965) among individuals aged 15–24 years and 25–59 years across 145 countries pulling together data from the 2014 and 2015 waves. This study found a positive association between OLS and log per-capita GDP (PPP US\$) for both age groups, which was stronger for the 25–59 group than for the 15–24 group. Recent analyses using post-COVID-19 data on 15–24 year olds collected in 138 countries in 2022 in Gallup World Poll also show lower OLS in lower-income countries, compared to higher-income countries (Marquez et al., 2024).

### 1.6 The Present Study

Overall, the literature studying the association between national levels of economic development and wellbeing in adolescence shows mixed evidence in early adolescence (age 10–13; considering data from high-income countries mostly); a negative association in middle adolescence (age 15; data from high-income countries), with some preliminary evidence of an inverted U-shape association when lower-income countries are considered; and a positive association in late adolescence (age 15–24; global data from a great variety of higher- and lower-income countries). An evaluation of these studies suggests that contrasting findings may be the result of differences in the wellbeing measures used, the age of participants, and the number and nature of countries considered. Notably, no low-income countries (and very few lower-middle income countries) have been included in previous studies focusing on early and middle adolescence. In addition, research on adults shows that the association between economic development and wellbeing (OLS) is stronger in higher-income countries than in lower-income countries, which is unlikely to be observed in middle-adolescent populations given the findings discussed above. In view of this, in the present study, we aim to shed light on the reasons for these contrasting associations in different age groups, particularly with regards to the counterintuitive findings observed in early-to-middle adolescence. We pursue this by examining the following three hypotheses:

- H1: The positive association between national levels of wellbeing in middle adolescence and economic development (log per-capita GDP) will be evident once lower-income countries are considered. To assess this hypothesis, the present research will include some data analyses focused on the younger population included in Gallup World Poll datasets, taking advantage that it includes more lower-income countries than any other of the aforementioned datasets.
- H2: This association will differ across wellbeing measures, gender and levels of economic development. We will examine the association between log per-capita GDP and national levels of adolescents' wellbeing with consideration of various

measures (OLS, positive emotions, and negative emotions), and with a focus on differences by gender and level of economic development.

- H3: The association between economic development and national levels of well-being will be stronger in higher-income countries than in lower-income countries in the adult population, but this will not be observed in middle adolescence. We will examine the association between log per-capita GDP and national levels of wellbeing in the adult population (age 18–24; 25–54; 55–80) across different levels of economic development and compare with results in middle adolescence (age 15–17).

## 2 Method

### 2.1 Study Sample

The data was obtained from 15–17-year-old adolescents who participated in the Gallup World Wide Research Data collection 2015–2019. The Gallup World Poll uses randomly selected, nationally representative samples of the population aged 15–65 in around 150 countries, typically surveying 1,000 individuals in each country every year, face-to-face or via telephone (Gallup, [n.d.](#); Tortora et al., [2010](#)). Although data was available up to 2022 at the time of the data analysis, we preferred to avoid the years affected by the COVID-19 pandemic as this phenomenon may have altered the wellbeing-GDP association in ways that would not allow us to contrast our results with those observed in the adolescent and adult literature, all of which use pre-pandemic data. We excluded from the sample countries with less than 30 valid (non-missing) responses to our variables of interest for either females or males (Plane & Gordon, [1982](#)). This exclusion mainly affects high-income countries, where the sample size for this age group tends to be smaller compared to lower-income countries (see details about the sample size in each country in Table A1 in Appendix 1). After these exclusions, the final sample includes data from 36,907 15–17-year-old adolescents from 139 countries. To study H3, we also analysed adult data from the same countries and waves of data collection (n 108,229 age 18–24; 397,909 age 25–54; n 154,153 age 55–80). The characteristics of the sample are further described in Table 1, which includes additional information on the gender composition of the sample across age groups and levels of economic development.

### 2.2 Variables

The study variables are described in Table 1. The only independent variable examined is the level of economic development in each country, which was assessed using the log per-capita GDP PPP (estimations made by the International Monetary Fund (IMF, [n.d.](#))) for 2015–2019. For classifications by GDP levels, we used the 2017 World Bank Analytical Classifications (GNI per capita in US\$; Atlas methodology (World Bank, [n.d.](#))). As to the dependent variables, we used a measure of OLS (Cantril Ladder (Cantril, [1965](#))), positive emotions, and negative emotions.

**Table 1** Descriptive information of study variables and characteristics of the sample (36,907 15–17-year-old adolescents, from 139 countries)

| Variable                      | Description   | Value  |                                      |
|-------------------------------|---|--|--------------------------------------|
|                               |   | Mean   | S.D                                  |
| Overall life satisfaction     | Cantril's ladder (Cantril, 1965) 0 to 10 overall life satisfaction scale across the 139 countries studied   | Age 15–17<br>5.96<br>Age 18–24<br>5.65<br>Age 25–54<br>5.27<br>Age 55–80<br>5.05 | (1.16)<br>(1.07)<br>(1.11)<br>(1.07) |
| Positive Emotions             | 0–5 scale derived from 5 binary items: “Did you experience the following feelings during a lot of the day yesterday (yes = 1 / no = 0): Laugh/Smile; Learned; Enjoyment; Well-rested; Treated with respect. Cronbach's alpha 0.57   | Age 15–17<br>3.96<br>Age 18–24<br>3.76<br>Age 25–54<br>3.46<br>Age 55–80<br>3.31 | (0.37)<br>(0.38)<br>(0.40)<br>(0.50) |
| Negative Emotions             | 0–5 scale derived from 5 binary items: “Did you experience the following feelings during a lot of the day yesterday (yes = 1 / no = 0): Sadness; Worry; Stress; Anger; Physical pain. Cronbach's alpha 0.68   | Age 15–17<br>1.08<br>Age 18–24<br>1.33<br>Age 25–54<br>1.64<br>Age 55–80<br>1.8  | (0.41)<br>(0.42)<br>(0.44)<br>(0.51) |
| Level of economic development | Log of the average Gross Domestic Product (GDP) Purchasing Power Parity per capita (GDP PPP estimations made by the International Monetary Fund (IMF)) for 2015–2019. <a href="https://www.imf.org/external/datamapper/NGDPDPC@WEO/OEMDC/ADVEC/WEOWORLD">https://www.imf.org/external/datamapper/NGDPDPC@WEO/OEMDC/ADVEC/WEOWORLD</a> | 12,513.7   | (18,653.6)                           |

**Table 1** (continued)

| Variable | Description          | Value                  |                        |
|----------|----------------------|------------------------|------------------------|
|          |                      | Mean                   | S.D                    |
| Gender   | Female (1), Male (0) | F (53.59%), M (46.41%) |                        |
|          |                      | Age 15–17 (H)          | F (49.64%), M (50.36%) |
|          |                      | Age 18–24 (H)          | F (51.33%), M (48.67%) |
|          |                      | Age 25–54 (H)          | F (50.13%), M (49.87%) |
|          |                      | Age 55–80 (H)          | F (54.63%), M (45.37%) |
|          |                      | Age 15–17 (UM)         | F (50.60%), M (49.40%) |
|          |                      | Age 18–24 (UM)         | F (53.31%), M (48.67%) |
|          |                      | Age 25–54 (UM)         | F (56.04%), M (43.96%) |
|          |                      | Age 55–80 (UM)         | F (56.14%), M (43.86%) |
|          |                      | Age 15–17 (LM)         | F (51.37%), M (48.63%) |
|          |                      | Age 18–24 (LM)         | F (53.39%), M (46.61%) |
|          |                      | Age 25–54 (LM)         | F (54.62%), M (45.38%) |
|          |                      | Age 55–80 (LM)         | F (54.33%), M (45.67%) |
|          |                      | Age 15–17 (L)          | F (53.11%), M (46.89%) |
|          |                      | Age 18–24 (L)          | F (55.32%), M (44.68%) |
|          |                      | Age 25–54 (L)          | F (51.14%), M (48.86%) |
|          |                      | Age 55–80 (L)          | F (44.81%), M (55.19%) |

**Table 1** (continued)

| Variable   | Description | Value |     |
|--|-------------|-------|-----|
|  |             | Mean  | S.D |
| Country  |             |       |     |
| Countries ordered by average GDP per capita in 2015–2019 and classified (high, upper middle, lower middle, low income) using the 2017 World Bank Analytical Classifications (GNI per capita in US\$ (Atlas methodology) (ADD REF):   |             |       |     |
| <i>37 High income (&gt; 12,235)</i>  |             |       |     |
| Luxembourg, Switzerland, Ireland, Iceland, Singapore, Denmark, Australia, Sweden, Netherlands, Austria, Hong Kong SAR, Germany, Belgium, United Arab Emirates, New Zealand, Israel, Italy, Republic of Korea, Malta, Kuwait, Cyprus, Taiwan  |             |       |     |
| Province of China, Bahrain, Saudi Arabia, Portugal, Czech Republic, Estonia, Greece, Slovak Republic, Uruguay, Lithuania, Latvia, Panama, Chile, Poland, Croatia, Argentina  |             |       |     |
| <i>39 Upper middle income (3,956–12,235)</i>   |             |       |     |
| Costa Rica, Romania, Mauritius, Russian Federation, Malaysia, Republic of Türkiye, Libya, Mexico, Kazakhstan, Brazil, China, Bulgaria, Turkmenistan, Dominican Republic, Montenegro, Lebanon, Gabon, Botswana, Thailand, Peru, Colombia, Serbia, South Africa, Iran, Ecuador, Belarus, North Macedonia, Paraguay, Iraq, Bosnia and Herzegovina, Namibia, Albania, Azerbaijan, Georgia, Jordan, Sri Lanka, Guatemala, Algeria, Kosovo         |             |       |     |
| <i>42 Lower middle income (1,006–3,955)</i>  |             |       |     |
| Armenia, El Salvador, Eswatini, Mongolia, Indonesia, Tunisia, Venezuela, Republic of Moldova, Morocco, Bolivia, State of Palestine, Egypt, Philippines, Vietnam, Ukraine, Congo, Honduras, Lao P.D.R., Nigeria, Uzbekistan, Côte d'Ivoire, Ghana, Nicaragua, India, Kenya, Bangladesh, Mauritania, Zimbabwe, Pakistan, Cameroon, Cambodia, Zambia, Senegal, Haiti, Comoros, Kyrgyz Republic, Myanmar, Benin, Lesotho, Nepal, Yemen, Tanzania |             |       |     |
| <i>21 Low income (&lt; 1,006)</i>  |             |       |     |
| Tajikistan, Uganda, Togo, Ethiopia, Mali, Guinea, Rwanda, Burkina Faso, Chad, Gambia, Liberia, Afghanistan, Sierra Leone, Niger, Madagascar, South Sudan, Democratic Republic of the Congo, Mozambique, Malawi, Central African Republic, Somalia  |             |       |     |

mean and S.D. values indicate the mean and standard deviation of the country means across all the countries studied. *H* high-income countries, *UM* upper middle-income countries, *LM* lower middle-income countries; *L* low-income countries, *F* female, *M* males

The latter two were derived from the items available in the Gallup World Poll (see Table 1). These scales have been used in previous studies of positive and negative affect and related constructs (e.g. Joshanloo & Jovanović, 2021). These variables are described in detail in Table 1. A dichotomous gender variable (male = 0; female = 1) was used.

## 2.3 Analytic Strategy

Systematic linear regressions were calculated for economic development on each wellbeing indicator (i.e., OLS, PE, and NE). For economic development, the natural log was applied to per-capita GDP to account for the diminishing marginal utility of income (e.g., Deaton, 2008), although additional analyses are also presented for GDP per capita. Regressions were conducted for the pooled sample, and separately for males and females, and for the groups of countries classified according to the level of economic development in 2017 (high-, upper middle-, lower middle-, and low-income countries). Given the small number of high- and low-income countries, which limits our capacity to identify potentially meaningful relationships, separate analyses are presented combining these with their immediate higher/lower group (i.e. high or upper middle-income, and low or lower middle-income). Additional separate analyses were conducted using adult data (age 18–24; 25–54; 55–80) to examine H3. We used listwise deletion as levels of missing data were very low and similarly distributed across countries at different GDP levels (see Table A2 in Appendix 1): OLS (1.80% age 15–17; 1.30% age 18–24; 1.42% age 25–54; 2.39% age 55–80), PE (4.51%, 4.33%, 5.62%, and 7.80%, respectively), and NE (3.08%, 2.84%, 2.89%, and 3.26%, respectively).

## 3 Results

Table 1 shows the descriptive information of the study variables and sample, and Table 2 shows the correlations between LS, PE, and NE at the country-level (i.e. country means correlations) and the individual-level (i.e. correlations between respondents' scores). Table 3 shows the average country mean in OLS, PE, and NE, by gender and level of economic development. Table 4 presents the relationship between country means in wellbeing (OLS, PE, and NE) and economic development (per-capita GDP and log per-capita GDP). Figure 1 presents a visual description of these relationships showing the linear and quadratic fit lines.

### 3.1 The Relationship Between Life Satisfaction and Economic Development Levels

As shown in Fig. 1.A1, there is a positive relationship between per-capita GDP and OLS. The quadratic fit line in Fig. 1.A2 has a noticeable inverted-U shape, indicating evidence of decreasing marginal returns. Figure 1.A3 uses the log per-capita GDP to account for decreasing marginal returns and shows a positive relationship

**Table 2** Correlations between the different outcome variables

| Country-level correlations (age 15–17) |       |       |     | Individual-level correlations (age 15–17) |       |       |     |
|--|-------|-------|-----|---|-------|-------|-----|
| Variables                              | (1)   | (2)   | (3) | Variables                                 | (1)   | (2)   | (3) |
| (1) Overall life satisfaction          | 1     |       |     | (1) Overall life satisfaction             | 1     |       |     |
| (2) Positive Emotions                  | 0.68  | 1     |     | (2) Positive Emotions                     | 0.20  | 1     |     |
| (3) Negative Emotions                  | −0.39 | −0.60 | 1   | (3) Negative Emotions                     | −0.15 | −0.35 | 1   |
| Country-level correlations (age 18–24) |       |       |     | Individual-level correlations (age 18–24) |       |       |     |
| Variables                              | (1)   | (2)   | (3) | Variables                                 | (1)   | (2)   | (3) |
| (1) Overall life satisfaction          | 1     |       |     | (1) Overall life satisfaction             | 1     |       |     |
| (2) Positive Emotions                  | 0.70  | 1     |     | (2) Positive Emotions                     | 0.22  | 1     |     |
| (3) Negative Emotions                  | −0.44 | −0.53 | 1   | (3) Negative Emotions                     | −0.16 | −0.36 | 1   |
| Country-level correlations (age 25–54) |       |       |     | Individual-level correlations (age 25–24) |       |       |     |
| Variables                              | (1)   | (2)   | (3) | Variables                                 | (1)   | (2)   | (3) |
| (1) Overall life satisfaction          | 1     |       |     | (1) Overall life satisfaction             | 1     |       |     |
| (2) Positive Emotions                  | 0.54  | 1     |     | (2) Positive Emotions                     | 0.24  | 1     |     |
| (3) Negative Emotions                  | −0.50 | −0.33 | 1   | (3) Negative Emotions                     | −0.22 | −0.37 | 1   |
| Country-level correlations (age 55–80) |       |       |     | Individual-level correlations (age 55–80) |       |       |     |
| Variables                              | (1)   | (2)   | (3) | Variables                                 | (1)   | (2)   | (3) |
| (1) Overall life satisfaction          | 1     |       |     | (1) Overall life satisfaction             | 1     |       |     |
| (2) Positive Emotions                  | 0.55  | 1     |     | (2) Positive Emotions                     | 0.30  | 1     |     |
| (3) Negative Emotions                  | −0.67 | −0.36 | 1   | (3) Negative Emotions                     | −0.30 | −0.38 | 1   |

between log per-capita GDP and OLS. The quadratic fit line in Fig. 1.A4 (log GDP per capita) also has an inverted-U shape indicating that this association is stronger in lower-income countries than in higher-income countries, but this curvature is much more moderate than that in Fig. 1.A2 (per-capita GDP). This pattern is observed in more detail in Table 4, which shows that for both per-capita GDP and the log per-capita GDP, there is a clear association with OLS (respectively, Standardized  $\beta = 0.58^{***}$ ;  $r$ -squared = 0.34, and Standardized  $\beta = 0.81^{***}$ ;  $r$ -squared = 0.66) when considering all the 139 countries. This association is somewhat stronger in lower-income countries (LM+L in Table 4, although non-statistically significant effects are found for L, probably due to small  $n$ ) than in higher-income countries, particularly for per-capita GDP. Gender differences look trivial at all levels of economic development except in high-income countries, where a positive association with log per-capita GDP is observed for males but not for females.

### 3.2 The Relationship Between Positive Emotions and Economic Development Levels

Economic development and PE are also positively associated, although Fig. 1. B1-B4 show that the curvature of the inverted U-shape quadratic fit line is more accentuated than for OLS. The latter is observed before (Fig. 1.B2, per-capita GDP) and after (Fig. 1.B4, log per-capita GDP) accounting for the existence of decreasing



**Table 3** Average country mean in overall life satisfaction, positive emotions and negative emotions, by the level of economic development and gender

|         |    | Age 15–17                        |      |                               |      | Age 18–24                        |      |                               |      | Age 25–54                        |      |                               |      | Age 55–80                        |      |                               |      |
|---------|----|----------------------------------|------|-------------------------------|------|----------------------------------|------|-------------------------------|------|----------------------------------|------|-------------------------------|------|----------------------------------|------|-------------------------------|------|
|         |    | Life sat-<br>isfaction<br>(0–10) |      | Positive<br>emotions<br>(0–5) |      | Life sat-<br>isfaction<br>(0–10) |      | Positive<br>emotions<br>(0–5) |      | Life sat-<br>isfaction<br>(0–10) |      | Positive<br>emotions<br>(0–5) |      | Life sat-<br>isfaction<br>(0–10) |      | Positive<br>emotions<br>(0–5) |      |
|         |    | Mean                             | Mean | Mean                          | Mean | Mean                             | Mean | Mean                          | Mean | Mean                             | Mean | Mean                          | Mean | Mean                             | Mean | Mean                          | Mean |
| All     |    |                                  |      |                               |      |                                  |      |                               |      |                                  |      |                               |      |                                  |      |                               |      |
|         | H  | 37                               | 7.12 | 4.18                          | 1.00 | 6.79                             | 4.00 | 1.18                          | 6.57 | 3.68                             | 1.40 | 6.37                          | 3.57 | 1.37                             |      |                               |      |
|         | UM | 39                               | 6.29 | 4.06                          | 0.90 | 5.86                             | 3.83 | 1.21                          | 5.35 | 3.45                             | 1.57 | 5.04                          | 3.23 | 1.80                             |      |                               |      |
|         | LM | 42                               | 5.39 | 3.88                          | 1.10 | 5.09                             | 3.66 | 1.37                          | 4.67 | 3.38                             | 1.71 | 4.48                          | 3.24 | 1.96                             |      |                               |      |
|         | L  | 21                               | 4.45 | 3.56                          | 1.49 | 4.39                             | 3.43 | 1.74                          | 4.06 | 3.29                             | 2.02 | 3.91                          | 3.16 | 2.28                             |      |                               |      |
| Males   |    |                                  |      |                               |      |                                  |      |                               |      |                                  |      |                               |      |                                  |      |                               |      |
|         | H  | 37                               | 7.08 | 4.30                          | 0.92 | 6.74                             | 4.00 | 1.11                          | 6.50 | 3.69                             | 1.32 | 6.36                          | 3.58 | 1.23                             |      |                               |      |
|         | UM | 39                               | 6.26 | 4.06                          | 0.82 | 5.75                             | 3.84 | 1.14                          | 5.25 | 3.48                             | 1.45 | 4.95                          | 3.28 | 1.62                             |      |                               |      |
|         | LM | 42                               | 5.28 | 3.86                          | 1.05 | 4.97                             | 3.63 | 1.33                          | 4.57 | 3.39                             | 1.61 | 4.47                          | 3.29 | 1.76                             |      |                               |      |
|         | L  | 21                               | 4.44 | 3.55                          | 1.47 | 4.35                             | 3.43 | 1.74                          | 4.07 | 3.32                             | 1.95 | 3.97                          | 3.24 | 2.18                             |      |                               |      |
| Females |    |                                  |      |                               |      |                                  |      |                               |      |                                  |      |                               |      |                                  |      |                               |      |
|         | H  | 37                               | 7.15 | 4.14                          | 1.09 | 6.83                             | 4.01 | 1.27                          | 6.63 | 3.67                             | 1.49 | 6.38                          | 3.55 | 1.50                             |      |                               |      |
|         | UM | 39                               | 6.32 | 4.06                          | 1.01 | 5.99                             | 3.62 | 1.30                          | 5.44 | 3.42                             | 1.67 | 5.13                          | 3.18 | 1.98                             |      |                               |      |
|         | LM | 42                               | 5.52 | 3.90                          | 1.15 | 5.22                             | 3.68 | 1.42                          | 4.75 | 3.37                             | 1.80 | 4.49                          | 3.18 | 2.16                             |      |                               |      |
|         | L  | 21                               | 4.47 | 3.57                          | 1.51 | 4.43                             | 3.42 | 1.74                          | 4.05 | 3.26                             | 2.08 | 3.85                          | 3.04 | 2.40                             |      |                               |      |

**Table 3** (continued)

The sample includes 139 countries with at least 30 non-missing responses from males and at least 30 non-missing responses from females in the Gallup study across 2015–2019. Countries ordered by average GDP per capita in 2015–2019 using the 2017 World Bank Analytical Classifications (GNI per capita in US\$ (Atlas methodology): <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>): The sample includes 139 countries with at least 30 non-missing responses from males and at least 30 non-missing responses from females in the Gallup study across 2015–2019. Countries ordered by average GDP per capita in 2015–2019 using the 2017 World Bank Analytical Classifications (GNI per capita in US\$ (Atlas methodology): <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>):

UM: Upper middle income (3,956–12,235): Costa Rica, Romania, Mauritius, Russian Federation, Malaysia, Republic of Türkiye, Libya, Mexico, Kazakhstan, Brazil, China, Bulgaria, Turkmenistan, Dominican Republic, Montenegro, Lebanon, Gabon, Botswana, Thailand, Peru, Colombia, Serbia, South Africa, Iran, Ecuador, Belarus, North Macedonia, Paraguay, Iraq, Bosnia and Herzegovina, Namibia, Albania, Azerbaijan, Georgia, Jordan, Sri Lanka, Guatemala, Algeria, Kosovo

UM: Upper middle income (3,956–12,235): Costa Rica, Romania, Mauritius, Russian Federation, Malaysia, Republic of Türkiye, Libya, Mexico, Kazakhstan, Brazil, China, Bulgaria, Turkmenistan, Dominican Republic, Montenegro, Lebanon, Gabon, Botswana, Thailand, Peru, Colombia, Serbia, South Africa, Iran, Ecuador, Belarus, North Macedonia, Paraguay, Iraq, Bosnia and Herzegovina, Namibia, Albania, Azerbaijan, Georgia, Jordan, Sri Lanka, Guatemala, Algeria, Kosovo

UM: Upper middle income (3,956–12,235): Costa Rica, Romania, Mauritius, Russian Federation, Malaysia, Republic of Türkiye, Libya, Mexico, Kazakhstan, Brazil, China, Bulgaria, Turkmenistan, Dominican Republic, Montenegro, Lebanon, Gabon, Botswana, Thailand, Peru, Colombia, Serbia, South Africa, Iran, Ecuador, Belarus, North Macedonia, Paraguay, Iraq, Bosnia and Herzegovina, Namibia, Albania, Azerbaijan, Georgia, Jordan, Sri Lanka, Guatemala, Algeria, Kosovo

LM: Lower middle income (1,006–3,955): Armenia, El Salvador, Eswatini, Mongolia, Indonesia, Tunisia, Venezuela, Republic of Moldova, Morocco, Bolivia, State of Palestine, Egypt, Philippines, Vietnam, Ukraine, Congo, Honduras, Lao P.D.R., Nigeria, Uzbekistan, Côte d'Ivoire, Ghana, Nicaragua, India, Kenya, Bangladesh, Mauritania, Zimbabwe, Pakistan, Cameroon, Cambodia, Zambia, Senegal, Haiti, Comoros, Kyrgyz Republic, Myanmar, Benin, Lesotho, Nepal, Yemen, Tanzania

L: Low income (<1,006): Tajikistan, Uganda, Togo, Ethiopia, Mali, Guinea, Rwanda, Burkina Faso, Chad, Gambia, Liberia, Afghanistan, Sierra Leone, Niger, Madagascar, South Sudan, Democratic Republic of the Congo, Mozambique, Malawi, Central African Republic, Somalia

**Table 4** Regressions to explain how GDP predicts adolescent wellbeing across 139 countries (standardized  $\beta$ ), by gender

| Independent variable | Overall life satisfaction (0–10) |                |           |                    | Positive emotions (0–5) |                |           |                    | Negative emotions (0–5) |                |           |                    |
|----------------------|----------------------------------|----------------|-----------|--------------------|-------------------------|----------------|-----------|--------------------|-------------------------|----------------|-----------|--------------------|
|                      | $n$                              | GDP per capita | R-squared | Log GDP per capita | R-squared               | GDP per capita | R-squared | Log GDP per capita | R-squared               | GDP per capita | R-squared | Log GDP per capita |
| <b>All</b>           |                                  |                |           |                    |                         |                |           |                    |                         |                |           |                    |
| All                  |                                  |                |           |                    |                         |                |           |                    |                         |                |           |                    |
| All countries        | 139                              | 0.58***        | 0.34      | 0.81***            | 0.66                    | 0.32***        | 0.10      | 0.54***            | 0.29                    | −0.08          | 0.01      | −0.31***           |
| H                    | 37                               | 0.32           | 0.10      | 0.35*              | 0.12                    | −0.06          | 0.00      | −0.21              | 0.04                    | 0.21           | 0.04      | 0.36*              |
| H & UM               | 76                               | 0.49***        | 0.24      | 0.58***            | 0.34                    | 0.12           | 0.01      | 0.14               | 0.02                    | 0.20           | 0.04      | 0.24*              |
| UM                   | 39                               | 0.29           | 0.08      | 0.26               | 0.07                    | 0.09           | 0.01      | 0.08               | 0.01                    | 0.09           | 0.01      | 0.08               |
| LM                   | 42                               | 0.53***        | 0.28      | 0.53***            | 0.28                    | 0.43**         | 0.19      | 0.45***            | 0.20                    | −0.10          | 0.01      | −0.09              |
| LM & L               | 63                               | 0.64***        | 0.41      | 0.65***            | 0.42                    | 0.53***        | 0.28      | 0.53***            | 0.28                    | −0.37**        | 0.14      | −0.43***           |
| L                    | 21                               | 0.36           | 0.13      | 0.34               | 0.12                    | 0.09           | 0.08      | 0.06               | 0.01                    | −0.18          | 0.04      | −0.16              |
| <b>Males</b>         |                                  |                |           |                    |                         |                |           |                    |                         |                |           |                    |
| All countries        | 139                              | 0.58***        | 0.34      | 0.80***            | 0.65                    | 0.33***        | 0.11      | 0.56***            | 0.31                    | −0.12          | 0.01      | −0.35***           |
| H                    | 37                               | 0.34*          | 0.12      | 0.36*              | 0.13                    | −0.14          | 0.02      | −0.23              | 0.05                    | 0.17           | 0.03      | 0.31               |
| H & UM               | 76                               | 0.48***        | 0.23      | 0.56***            | 0.31                    | 0.11           | 0.01      | 0.16               | 0.03                    | 0.20           | 0.04      | 0.25*              |
| UM                   | 39                               | 0.28           | 0.08      | 0.25               | 0.06                    | 0.11           | 0.01      | 0.09               | 0.01                    | 0.13           | 0.02      | 0.14               |
| LM                   | 42                               | 0.54***        | 0.29      | 0.54***            | 0.29                    | 0.44**         | 0.20      | 0.47**             | 0.22                    | −0.17          | 0.03      | −0.16              |
| LM & L               | 63                               | 0.62***        | 0.39      | 0.62***            | 0.38                    | 0.54***        | 0.30      | 0.54***            | 0.29                    | −0.40**        | 0.16      | −0.44***           |
| L                    | 21                               | 0.40           | 0.16      | 0.38               | 0.15                    | 0.07           | 0.01      | 0.05               | 0.00                    | −0.21          | 0.04      | −0.18              |

**Table 4** (continued)

| Independent variable | Overall life satisfaction (0–10) |                |           |                    | Positive emotions (0–5) |                |           |                    | Negative emotions (0–5) |                |           |                    |      |
|----------------------|----------------------------------|----------------|-----------|--------------------|-------------------------|----------------|-----------|--------------------|-------------------------|----------------|-----------|--------------------|------|
|                      | <i>n</i>                         | GDP per capita | R-squared | Log GDP per capita | R-squared               | GDP per capita | R-squared | Log GDP per capita | R-squared               | GDP per capita | R-squared | Log GDP per capita |      |
| Females              |                                  |                |           |                    |                         |                |           |                    |                         |                |           |                    |      |
| All countries        | 139                              | 0.57***        | 0.32      | 0.80***            | 0.64                    | 0.28**         | 0.08      | 0.47***            | 0.22                    | −0.04          | 0.00      | −0.23**            | 0.05 |
| H                    | 37                               | 0.26           | 0.07      | 0.30               | 0.09                    | 0.01           | 0.00      | −0.14              | 0.02                    | 0.20           | 0.04      | 0.36*              | 0.13 |
| H & UM               | 76                               | 0.47***        | 0.22      | 0.57***            | 0.32                    | 0.10           | 0.01      | 0.09               | 0.01                    | 0.17           | 0.03      | 0.19               | 0.04 |
| UM                   | 39                               | 0.28           | 0.08      | 0.25               | 0.06                    | 0.07           | 0.00      | 0.07               | 0.01                    | 0.02           | 0.00      | 0.00               | 0.00 |
| LM                   | 42                               | 0.50**         | 0.24      | 0.50***            | 0.25                    | 0.40**         | 0.16      | 0.41**             | 0.17                    | −0.01          | 0.00      | 0.02               | 0.00 |
| LM & L               | 63                               | 0.63***        | 0.40      | 0.65***            | 0.42                    | 0.48***        | 0.24      | 0.49***            | 0.24                    | −0.30*         | 0.09      | −0.36***           | 0.13 |
| L                    | 21                               | 0.28           | 0.08      | 0.26               | 0.07                    | 0.09           | 0.01      | 0.06               | 0.00                    | −0.16          | 0.03      | −0.13              | 0.02 |

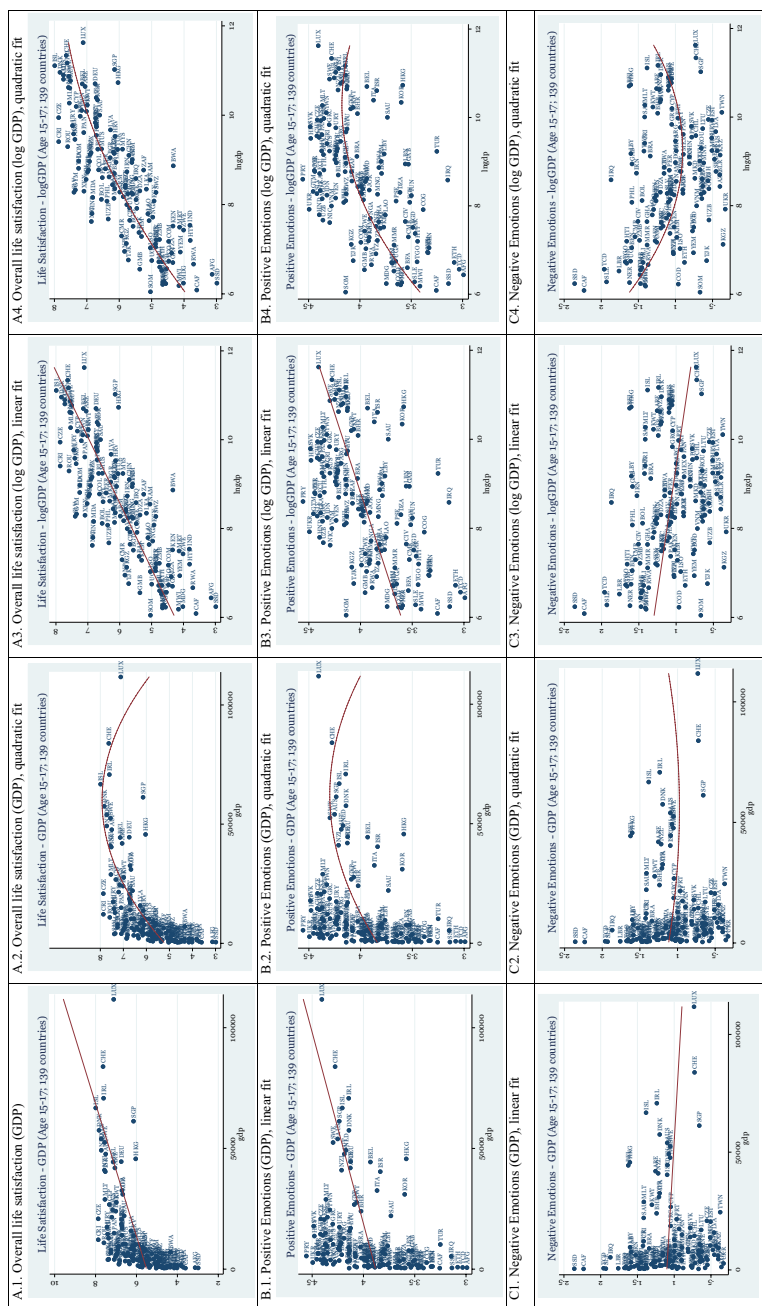


Fig. 1 Scatter plots of the association between GDP, and negative emotions, positive emotions and overall life satisfaction

marginal returns. This is more clearly observed in Table 4. The association is statistically significant when considering all the 139 countries (Standardized  $\beta = 0.54^{***}$ ;  $r\text{-squared} = 0.29$ ), but separate analyses by the level of economic development reveal the existence of a positive association in lower-income countries (only in LM and LM+L in Table 3), and no association in higher-income countries. Table 4 also shows that this association is stronger for males than for females (considering all the 139 countries, for log GDP per capita: Standardized  $\beta = 0.56^{***}$ ;  $r\text{-squared} = 0.31$ ; and Standardized  $\beta = 0.47^{***}$ ;  $r\text{-squared} = 0.22$ , respectively).

### 3.3 The Relationship Between Negative Emotions and Economic Development Levels

Table 4 shows a negative association between NE and log per-capita GDP (Standardized  $\beta = -0.31^{***}$ ;  $r\text{-squared} = 0.09$ ; see also Fig. 1.C3), but no association is observed for per-capita GDP (see Fig. 1.C1). The quadratic fit line in Fig. 1.C2 (per-capita GDP) barely shows a U-shaped curvature, but this curvature is rather accentuated in Fig. 4.C4, where log per-capita GDP is used to account for decreasing marginal returns. As shown in Table 3, this shape is explained by the existence of a negative association in lower-income countries (for log per-capita GDP in middle lower- and low-income countries: Standardized  $\beta = -0.43^{***}$ ;  $r\text{-squared} = 0.18$ ), and a positive association in higher-income countries (for log per-capita GDP in upper middle- and high-income countries: Standardized  $\beta = 0.24^*$ ;  $r\text{-squared} = 0.06$ ). Moreover, these associations are stronger among females than males.

### 3.4 The Relationship Between Wellbeing and Economic Development Levels Across Age

Tables 5 and 6, and Figs. 2, 3, and 4 show the association between log per-capita GDP and wellbeing (OLS, PE, and NE) across age groups (age 15–17, 18–24, 25–54, and 55–80). Table 5 shows that, for OLS, there is a positive association for all age groups, and the strength of this association does not seem to vary substantially across age groups, ranging between a Standardized  $\beta$  of 0.85\*\*\* and  $r\text{-squared}$  of 0.72 (age 25–54) and a Standardized  $\beta$  of 0.80\*\*\* and  $r\text{-squared}$  of 0.65 (age 55–80). However, in older age groups, the association is stronger in higher-income countries than in lower-income countries, whereas the opposite is observed in younger age groups –and, for this pattern, no gender differences are observed.

Table 5 also shows that, for PE, there is also a positive association for all age groups, but this association is stronger for younger age groups than for older age groups, going from a Standardized  $\beta$  of 0.54\*\*\* and a  $r\text{-squared}$  of 0.29 (age 15–17) to a Standardized  $\beta$  of 0.34\*\*\* and a  $r\text{-squared}$  of 0.11 (age 55–80). Moreover, in the youngest age groups (age 15–17, and 18–24), the association is statistically significant in lower-income countries only, whereas, in the oldest age groups (age 25–54, and 55–80), the association is statistically significant only in higher-income countries. Some gender differences are observed in Table 6. In late adolescence (age 18–24), a positive association is observed in higher-income countries for males but





**Table 5** (continued)

| Independent variable | Negative Emotions (0–5) |                    |           |                    | Age 18–24          |           |                    |           | Age 25–54          |           |                    |           | Age 55–80          |           |                    |           |
|----------------------|-------------------------|--------------------|-----------|--------------------|--------------------|-----------|--------------------|-----------|--------------------|-----------|--------------------|-----------|--------------------|-----------|--------------------|-----------|
|                      | <i>n</i>                | Log GDP per capita | R-squared | Log GDP per capita | Log GDP per capita | R-squared | Log GDP per capita | R-squared | Log GDP per capita | R-squared | Log GDP per capita | R-squared | Log GDP per capita | R-squared | Log GDP per capita | R-squared |
| All                  |                         |                    |           |                    |                    |           |                    |           |                    |           |                    |           |                    |           |                    |           |
| All countries        | 139                     | −0.31***           | 0.09      | −0.37***           | 0.14               | −0.46***  | 0.21               | −0.64***  | 0.40               |           |                    |           |                    |           |                    |           |
| H                    | 37                      | 0.36*              | 0.13      | 0.11               | 0.01               | −0.27     | 0.08               | −0.59***  | 0.34               |           |                    |           |                    |           |                    |           |
| H & UM               | 76                      | 0.24*              | 0.06      | −0.00              | 0.00               | −0.28*    | 0.08               | −0.62***  | 0.38               |           |                    |           |                    |           |                    |           |
| UM                   | 39                      | 0.08               | 0.00      | 0.02               | 0.00               | −0.15     | 0.02               | −0.34*    | 0.12               |           |                    |           |                    |           |                    |           |
| LM                   | 42                      | −0.09              | 0.01      | −0.12              | 0.01               | −0.09     | 0.01               | −0.07     | 0.01               |           |                    |           |                    |           |                    |           |
| LM & L               | 63                      | −0.43***           | 0.18      | −0.40**            | 0.16               | −0.31*    | 0.10               | −0.31*    | 0.09               |           |                    |           |                    |           |                    |           |
| L                    | 21                      | −0.16              | 0.03      | −0.15              | 0.02               | −0.04     | 0.00               | −0.08     | 0.01               |           |                    |           |                    |           |                    |           |

Significance Levels: \* 0.05 \*\* 0.01 \*\*\* 0.001. The sample includes 139 countries with at least 30 non-missing responses from males and at least 30 non-missing responses from females in the Gallup study across 2015–2019. Countries ordered by average GDP per capita in 2015–2019 using the 2017 World Bank Analytical Classifications (GNI per capita in US\$ (Atlas methodology): <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>):

H: High income (> 12,235): Luxembourg, Switzerland, Ireland, Iceland, Singapore, Denmark, Australia, Sweden, Netherlands, Austria, Hong Kong SAR, Germany, Belgium, United Arab Emirates, New Zealand, Israel, Italy, Republic of Korea, Malta, Kuwait, Cyprus, Taiwan Province of China, Bahrain, Saudi Arabia, Portugal, Czech Republic, Estonia, Greece, Slovak Republic, Uruguay, Lithuania, Latvia, Panama, Chile, Poland, Croatia, Argentina

UM: Upper middle income (3,956–12,235): Costa Rica, Romania, Mauritius, Russian Federation, Malaysia, Republic of Türkiye, Libya, Mexico, Kazakhstan, Brazil, China, Bulgaria, Turkmenistan, Dominican Republic, Montenegro, Lebanon, Gabon, Botswana, Thailand, Peru, Colombia, Serbia, South Africa, Iran, Ecuador, Belarus, North Macedonia, Paraguay, Iraq, Bosnia and Herzegovina, Namibia, Albania, Azerbaijan, Georgia, Jordan, Sri Lanka, Guatemala, Algeria, Kosovo

LM: Lower middle income (1,006–3,955): Armenia, El Salvador, Eswatini, Mongolia, Indonesia, Tunisia, Venezuela, Republic of Moldova, Morocco, Bolivia, State of Palestine, Egypt, Philippines, Vietnam, Ukraine, Congo, Honduras, Lao P.D.R., Nigeria, Uzbekistan, Côte d'Ivoire, Ghana, Nicaragua, India, Kenya, Bangladesh, Mauritania, Zimbabwe, Pakistan, Cameroon, Cambodia, Zambia, Senegal, Haiti, Comoros, Kyrgyz Republic, Myanmar, Benin, Lesotho, Nepal, Yemen, Tanzania

L: Low income (< 1,006): Tajikistan, Uganda, Togo, Ethiopia, Mali, Guinea, Rwanda, Burkina Faso, Chad, Gambia, Liberia, Afghanistan, Sierra Leone, Niger, Madagascar, South Sudan, Democratic Republic of the Congo, Mozambique, Malawi, Central African Republic, Somalia

**Table 6** Regressions to explain how log GDP predicts wellbeing across 139 countries (Standardized  $\beta$ ), by age group and gender

|                      | <i>n</i> | Age 15–17               |           |                    | Age 18–24          |           |                    | Age 25–54          |           |                    | Age 55–80          |           |  |
|----------------------|----------|-------------------------|-----------|--------------------|--------------------|-----------|--------------------|--------------------|-----------|--------------------|--------------------|-----------|--|
|                      |          | Log GDP per capita      | R-squared | Log GDP per capita | Log GDP per capita | R-squared | Log GDP per capita | Log GDP per capita | R-squared | Log GDP per capita | Log GDP per capita | R-squared |  |
| All                  |          |                         |           |                    |                    |           |                    |                    |           |                    |                    |           |  |
| All countries        | 139      | 0.80***                 | 0.65      | 0.82***            | 0.67               | 0.84***   | 0.70               | 0.80***            | 0.64      |                    |                    |           |  |
| H                    | 37       | 0.36*                   | 0.13      | 0.51**             | 0.26               | 0.67***   | 0.45               | 0.75***            | 0.57      |                    |                    |           |  |
| H & UM               | 76       | 0.56***                 | 0.31      | 0.69***            | 0.48               | 0.78***   | 0.61               | 0.81***            | 0.66      |                    |                    |           |  |
| UM                   | 39       | 0.25                    | 0.06      | 0.34*              | 0.12               | 0.48**    | 0.23               | 0.42**             | 0.18      |                    |                    |           |  |
| LM                   | 42       | 0.54***                 | 0.29      | 0.52***            | 0.27               | 0.51**    | 0.26               | 0.34*              | 0.11      |                    |                    |           |  |
| LM & L               | 63       | 0.62***                 | 0.38      | 0.55***            | 0.30               | 0.51***   | 0.26               | 0.44***            | 0.19      |                    |                    |           |  |
| L                    | 21       | 0.38                    | 0.15      | 0.27               | 0.08               | 0.25      | 0.06               | 0.36               | 0.13      |                    |                    |           |  |
| Independent variable |          |                         |           |                    |                    |           |                    |                    |           |                    |                    |           |  |
|                      |          | Positive emotions (0–5) |           |                    |                    |           |                    |                    |           |                    |                    |           |  |
|                      |          |                         |           |                    |                    |           |                    |                    |           |                    |                    |           |  |
| All                  |          |                         |           |                    |                    |           |                    |                    |           |                    |                    |           |  |
| All countries        | 139      | 0.56***                 | 0.31      | 0.51***            | 0.26               | 0.35***   | 0.12               | 0.29***            | 0.09      |                    |                    |           |  |
| H                    | 37       | −0.23                   | 0.05      | −0.08              | 0.01               | 0.24      | 0.06               | 0.45***            | 0.20      |                    |                    |           |  |
| H & UM               | 76       | 0.16                    | 0.03      | 0.23*              | 0.05               | 0.31**    | 0.10               | 0.40***            | 0.16      |                    |                    |           |  |
| UM                   | 39       | 0.09                    | 0.01      | 0.16               | 0.02               | 0.22      | 0.05               | 0.19               | 0.03      |                    |                    |           |  |
| LM                   | 42       | 0.47**                  | 0.22      | 0.33*              | 0.11               | 0.23      | 0.05               | 0.11               | 0.01      |                    |                    |           |  |
| LM & L               | 63       | 0.54***                 | 0.29      | 0.36**             | 0.13               | 0.18      | 0.03               | 0.14               | 0.02      |                    |                    |           |  |
| L                    | 21       | 0.05                    | 0.02      | 0.06               | 0.00               | −0.02     | 0                  | 0.11               | 0.01      |                    |                    |           |  |

**Table 6** (continued)

| Independent variable | Negative Emotions (0–5) |                    |           |  | Age 18–24          |           |  |  | Age 25–54          |           |  |  | Age 55–80          |           |  |  |
|----------------------|-------------------------|--------------------|-----------|--|--------------------|-----------|--|--|--------------------|-----------|--|--|--------------------|-----------|--|--|
|                      | <i>n</i>                | Log GDP per capita | R-squared |  | Log GDP per capita | R-squared |  |  | Log GDP per capita | R-squared |  |  | Log GDP per capita | R-squared |  |  |
| All                  |                         |                    |           |  |                    |           |  |  |                    |           |  |  |                    |           |  |  |
| All countries        | 139                     | −0.35***           | 0.12      |  | −0.43***           | 0.19      |  |  | −0.47***           | 0.22      |  |  | −0.64***           | 0.41      |  |  |
| H                    | 37                      | 0.31               | 0.09      |  | 0.13               | 0.02      |  |  | −0.20              | 0.04      |  |  | −0.54***           | 0.28      |  |  |
| H & UM               | 76                      | 0.25*              | 0.06      |  | −0.01              | 0.00      |  |  | −0.24*             | 0.06      |  |  | −0.60***           | 0.36      |  |  |
| UM                   | 39                      | 0.14               | 0.02      |  | 0.02               | 0.00      |  |  | −0.17              | 0.03      |  |  | −0.38*             | 0.14      |  |  |
| LM                   | 42                      | −0.16              | 0.03      |  | −0.17              | 0.03      |  |  | −0.11              | 0.01      |  |  | −0.08              | 0.01      |  |  |
| LM & L               | 63                      | −0.44***           | 0.20      |  | −0.45***           | 0.20      |  |  | −0.35**            | 0.12      |  |  | −0.38**            | 0.14      |  |  |
| L                    | 21                      | −0.18              | 0.03      |  | −0.17              | 0.04      |  |  | −0.08              | 0.01      |  |  | −0.07              | 0.00      |  |  |

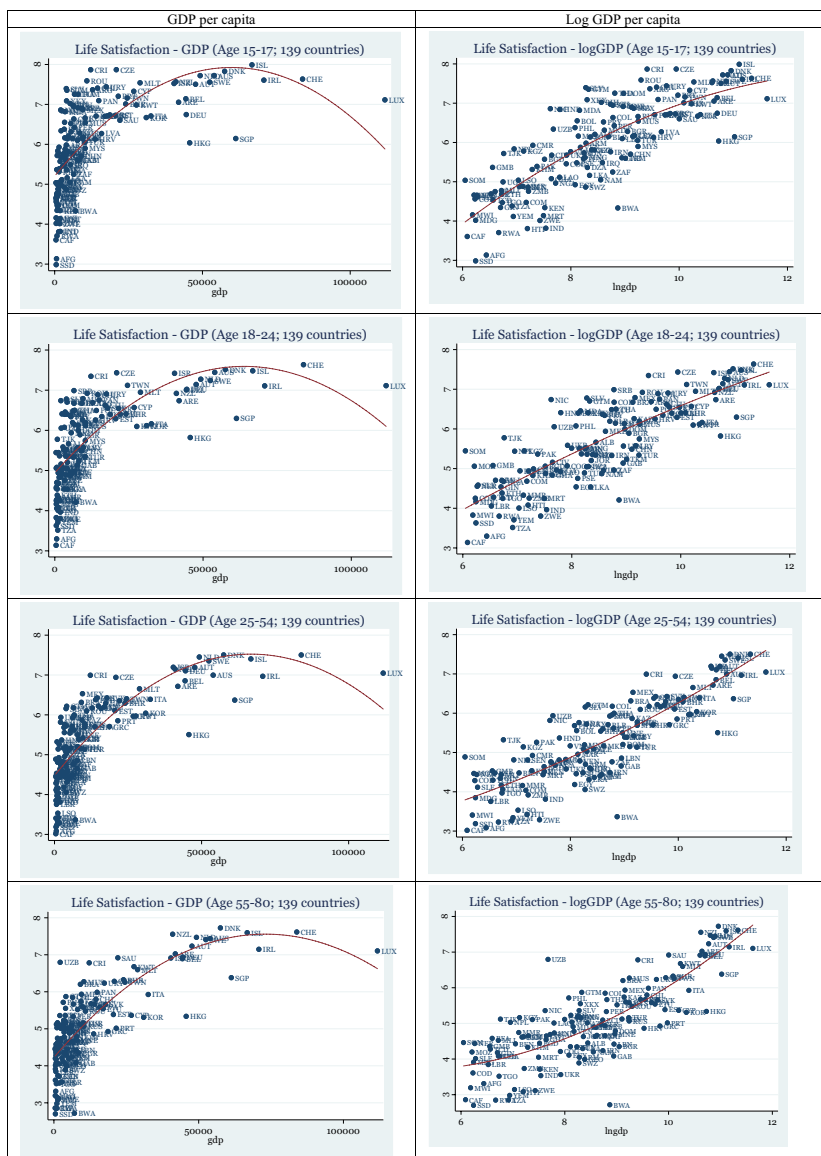
Significance Levels: \* 0.05 \*\* 0.01 \*\*\* 0.001. The sample includes 139 countries with at least 30 non-missing responses from males and at least 30 non-missing responses from females in the Gallup study across 2015–2019. Countries ordered by average GDP per capita in 2015–2019 using the 2017 World Bank Analytical Classifications (GNI per capita in US\$ (Atlas methodology): <https://datahelppdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>):

H: High income (> 12,235): Luxembourg, Switzerland, Ireland, Iceland, Singapore, Denmark, Australia, Sweden, Netherlands, Austria, Hong Kong SAR, Germany, Belgium, United Arab Emirates, New Zealand, Israel, Italy, Republic of Korea, Malta, Kuwait, Cyprus, Taiwan Province of China, Bahrain, Saudi Arabia, Portugal, Czech Republic, Estonia, Greece, Slovak Republic, Uruguay, Lithuania, Latvia, Panama, Chile, Poland, Croatia, Argentina

UM: Upper middle income (3,956–12,235): Costa Rica, Romania, Mauritius, Russian Federation, Malaysia, Republic of Türkiye, Libya, Mexico, Kazakhstan, Brazil, China, Bulgaria, Turkmenistan, Dominican Republic, Montenegro, Lebanon, Gabon, Botswana, Thailand, Peru, Colombia, Serbia, South Africa, Iran, Ecuador, Belarus, North Macedonia, Paraguay, Iraq, Bosnia and Herzegovina, Namibia, Albania, Azerbaijan, Georgia, Jordan, Sri Lanka, Guatemala, Algeria, Kosovo

LM: Lower middle income (1,006–3,955): Armenia, El Salvador, Eswatini, Mongolia, Indonesia, Republic of Moldova, Morocco, Bolivia, State of Palestine, Egypt, Philippines, Vietnam, Ukraine, Congo, Honduras, Lao P.D.R., Nigeria, Uzbekistan, Côte d'Ivoire, Ghana, Nicaragua, India, Kenya, Bangladesh, Mauritania, Zimbabwe, Pakistan, Cameroon, Cambodia, Zambia, Senegal, Haiti, Comoros, Kyrgyz Republic, Myanmar, Benin, Lesotho, Nepal, Yemen, Tanzania

L: Low income (< 1,006): Tajikistan, Uganda, Togo, Ethiopia, Mali, Guinea, Rwanda, Burkina Faso, Chad, Gambia, Liberia, Afghanistan, Sierra Leone, Niger, Madagascar, South Sudan, Democratic Republic of the Congo, Mozambique, Malawi, Central African Republic, Somalia



**Fig. 2** Relationship between country levels of economic development and overall life satisfaction across age groups

not females. Also, the positive association observed in higher-income countries for the 55–80 age group is stronger for males than for females.

Finally, for NE, Table 5 shows a negative association is for all the age groups, but this association is stronger in older age groups than in younger age groups, going from a Standardized  $\beta$  of  $-0.31^{***}$  and a  $r$ -squared of 0.09 (age 15–17) to



**Fig. 3** Relationship between country levels of economic development and positive emotions across age groups

a Standardized  $\beta$  of  $-0.64^{***}$  and a r-squared of 0.40 (age 55–80). Table 5 shows that, in middle and late adolescence (age 15–17, and 18–24, respectively), the association is stronger for males than for females. Moreover, as noted before, in middle adolescence (age 15–17), the quadratic fit line in Fig. 4 has a clear U-shape association because (as shown in Table 5) this association is negative in lower-income



**Fig. 4** Relationship between country levels of economic development and negative emotions across age groups

countries (for lower middle- and low-income countries: Standardized  $\beta = -0.43^{***}$ ;  $r$ -squared = 0.18) and positive in higher-income countries (for upper middle- and high-income countries: Standardized  $\beta = 0.24^{***}$ ;  $r$ -squared = 0.06). However, as we move from younger to older age groups, the U-shape reverses and turns into an inverted U-shape in the older group for two reasons. First, compared to the age

15–17 group, the strength of the negative association in lower-income countries remains similar in size in late adolescence (for age 18–24 in lower middle- and low-income countries: Standardized  $\beta = -0.40^{**}$ ;  $r\text{-squared} = 0.16$ ), but decreases after adolescence (in the 25–54 age group, Standardized  $\beta = -0.31^*$ ;  $r\text{-squared} = 0.10$ ; and in the 55–80 age group, Standardized  $\beta = -0.31^*$ ;  $r\text{-squared} = 0.09$ ). For the 55–80 age group, the negative association in lower-income countries is observed for males, but no association is found for females (see Table 5). And second, Table 5 also shows that, compared to the 15–17 age group, the positive association in higher-income countries disappears in late adolescence (age 18–24), then becomes negative (for 25–54 in upper middle- and high-income countries: Standardized  $\beta = -0.29^*$ ;  $r\text{-squared} = 0.08$ ), and remains negative and increases substantially in the 55–80 age group (Standardized  $\beta = -0.62^{***}$ ;  $r\text{-squared} = 0.38$ ).

## 4 Discussion

### 4.1 Main Findings

This is the first study to investigate the associations between national levels of economic development and wellbeing in middle adolescence (age 15–17) with the inclusion of a large number of lower middle- and low-income countries, a range of wellbeing measures (OLS, PE, and NE), and a focus on differences by gender and across levels of economic development. Our analysis provides evidence to assess the three hypotheses presented in this study.

H1: The positive association between national levels of wellbeing in middle adolescence and economic development (log per-capita GDP) will be evident once lower-income countries are considered.

Evidence of this association was first observed in the descriptive part of the analysis in Table 3, which shows that levels of wellbeing are clearly lower in lower-income countries when compared to higher income countries on average. Moreover, results in Table 1 suggest that the fact of including a greater diversity of countries in terms of income than in previous studies may also be the reason why in the present research OLS displays lower scores compared to other studies in middle adolescence (Campbell et al., 2021; Rudolf & Bethmann, 2023).

We found further evidence in the regression analysis. Specifically, we found a clear positive association between log per-capita GDP and adolescent OLS and PE, and a negative association with NE. This is in line with findings consistently observed in studies using cross-section data from adult populations (e.g., Deaton, 2008; Stevenson & Wolfers, 2013). Indeed, using the same analytical method, the 2012 edition of the World Happiness Report (Clark et al., 2012) (Table 3.1) showed that, for OLS, among those aged 15–54 years old, the strength of this association was exactly the same (Standardized  $\beta = 0.81^{***}$ ;  $r\text{-squared} = 0.65$ ) as in our study (Standardized  $\beta = 0.81^{***}$ ;  $r\text{-squared} = 0.66$ ). This has been further supported by our analyses of older age groups, which are discussed in more detail below.



Up to now, there was no clear explanation to diverse inconclusive and counterintuitive results from the literature investigating this question. Apparently, the relationships between economic indicators and indicators of subjective well-being at macrosocial level should be identified for all age groups due to the fact that a minimum level of material well-being is needed to feel subjective well-being as pointed out by different researchers of adults subjective well-being (e.g. Deaton, 2008; Stevenson & Wolfers, 2008). Our results provide support to the hypothesis that inconclusive and counter-intuitive results from the literature investigating this question in early and –especially– middle adolescents (Campbell et al., 2021; Casas et al., 2022; Lee & Yoo, 2015; Main et al., 2019; Rudolf & Bethmann, 2023) may be a consequence of adolescents from lower-income countries not being included. This highlights the need for improving adolescent wellbeing data collection globally as our understanding of adolescents' wellbeing and how to promote it may be highly influenced by the type of countries that we have data to analyse – so far, mostly data from high-income countries has been used.

H2: This association will differ across wellbeing measures, gender and levels of economic development.

In support of our second hypothesis, we systematically found differences across wellbeing measures, gender, and levels of economic development.

## 4.2 Differences by Wellbeing Measure

Differences by wellbeing measures were consistently observed. Perhaps, the most evident one refers to the shape of this relationship across the 139 countries studied. For NE, the direction of the association was different when comparing higher-income countries (a positive association) and lower-income countries (a negative association). This was not observed for OLS and PE, meaning that this association is different depending on the wellbeing measure used. These findings are in line with findings by Casas et al. (2022) focusing on early adolescence, who identified associations involving affective indicators of subjective well-being, but not cognitive indicators (life satisfaction). These authors observed that the different components of children's subjective well-being display idiosyncratic associations with both wealth (including levels of economic development) and inequality indicators at the national level, which highlights the importance of analysing each component separately. In particular, they pointed out that children in wealthy countries tend to report high cognitive subjective well-being more frequently, despite their negative affect also being high – suggesting they tend to show more inconsistency between their answers to cognitive and affective components of their subjective well-being than children in less developed countries. Negative affect items are related to negative experiences and therefore, apparently, the answers from lower-income countries display a more expected or consistent association with macroeconomic indicators than the responses from the high-income countries.

### 4.3 Differences by Gender

Gender differences were also evident in many parts of the analysis, consistent with previous evidence on gender differences in levels, trends, trajectories, and drivers of adolescent subjective well-being and how these vary across age, countries, and measures of subjective well-being (Aymerich et al., 2021; Campbell et al., 2021; Chen et al., 2020; González-Carrasco et al., 2017; Marquez, 2023; Marquez et al., 2024). The positive association between log per-capita GDP and OLS was similar among males and females, but the positive associations with PE and the negative association with NE were stronger among males than among females. Important gender differences were observed in high-income countries, where we found a positive association between log pergirlsta GDP and OLS among boys, but not among girls, as well as a positive association with NE among females, but not among males. These findings are in line with findings by Campbell et al. (2021) indicating that, in high-income countries, higher per-capita GDP is associated with a larger gender gap in adolescent wellbeing – in their study, OLS, positive affect, negative affect, and eudaimonic well-being (meaning and purpose in life).

### 4.4 Differences by the Level of Economic Development

We found differences across different levels of economic development. Complementing the findings discussed above involving gender differences in this association in high-income, other important findings of our analysis involve the association between log per-capita GDP and OLS (weaker in high-income countries than in non-high-income countries), the association between log per-capita GDP and PE (only observed in lower-income countries) and the inverted U-shape association involving NE (i.e. a negative association in lower-income countries and a positive association in higher-income countries).

As noted before, non-existing –or even negative- associations between national levels of economic development and wellbeing in early and middle adolescence in high-income countries have been found in previous studies for various measures of subjective well-being, including OLS (Campbell et al., 2021; Rudolf & Bethmann, 2023), domain life satisfaction (Casas et al., 2022), positive and negative affect (Campbell et al., 2021; Casas & González-Carrasco, 2020; Casas et al., 2022), and eudaimonic wellbeing (Campbell et al., 2021). Overall, this would suggest that some aspects of economic development may negatively influence adolescents' wellbeing in high-income countries –and in view of findings on gender differences- particularly so among females. Rudolf and Bethmann (2023) argue that this may explained by 'intensity of education', and other studies provide further support that school-related factors play an important role in explaining wellbeing levels (Marquez & Main, 2021; Taylor et al., 2022) and negative trends (Marquez et al., 2022) across high-income countries. Casas et al. (2022) results suggested that the wealthier a country is, the lower their children's satisfaction with their life as students—wealthier countries appear to have more demanding, competitive and stressful school

systems, which has negative consequences for children's subjective well-being at the ages of both 10 and 12. This is a question that deserves more attention in future research.

H3: The association between economic development and national levels of well-being will be stronger in higher-income countries than in lower-income countries in the adult population, but this will not be observed in middle adolescence.

Finally, we also found evidence supporting our third hypothesis. For all age groups, there is a positive association between log per-capita GDP and wellbeing -this is a positive association with OLS (stable across age groups) and PE (stronger for younger age groups than older age groups), and a negative association with NE (stronger for older age groups than younger age groups). Furthermore, while higher wellbeing (i.e. higher OLS and PE, and lower NE) was observed in countries with higher levels of economic development, its association with log per-capita GDP was stronger in lower-income countries than in higher-income countries for younger age groups -i.e. middle adolescence (age 15–17) and to a lesser extent also for late adolescence (age 18–24). However, this pattern reverses with age as this association turns stronger in higher-income countries than in lower-income countries in the age 25–54 group and even more so in the age 55–80 group. All of this suggests that different socio-economic contexts at the macro-level may have diverse effects on the subjective well-being of the population depending on the stage throughout the life course.

## 5 Implications and Future Research

The most evident implication of this study is the need for collecting adolescents' wellbeing data on a global scale as what we know about their subjective well-being and how to promote it may differ across levels of economic development, and most research until now has predominantly involved adolescents from high-income countries.

There is also a need for collecting data on a broader range of relevant subjective well-being indicators, based on cross-culturally validated instruments. The quadripartite theory on children's subjective well-being states that four kinds of measures are needed to appropriately capture subjective well-being (Savahl et al., 2021): cognitive context-free measures, cognitive domain-based measures, positive affect measures and negative affect measures. However, there are still many ongoing discussions on how to appropriately measure the affective components cross-culturally. While the traditional position only divides between positive and negative affect (Bradburn, 1969; Bradburn & Caplovitz, 1965), the most modern Core Affects Theory (Russell, 2003) defends that each kind of affect is divided into three forms: active, passive, and neutral. Other authors state that there is a big difference between more stable and long-term affect and more transitory moods (Cummins, 2014). Some authors state that a few positive affects are more important and stable than others, which have been named as HDM (Homeostatically Protected Mood)

(Cummins, 2010). We are conscious, however, that the Gallup Poll includes positive and negative emotions, but not affects in strict conceptual terms. As to the eudaimonic well-being of children and adolescence, despite the instruments to measure this are scarcely developed, there is an increasing number of publications on the topic (e.g.: Nahkur & Casas, 2021), and new models integrating eudaimonic well-being to the said components of subjective well-being have recently appeared in the literature (e.g.: Moreta-Herrera et al., 2023; Strelhow et al., 2020).

Future research should be based on these new theoretical and conceptual advances, that offer common criteria to select indicators that could be cross-culturally comparable. Given the suspicion of interaction effects that arises from the analysis the variables examined, future research should also examine interaction effects in the regression analysis. The availability of more longitudinal data on children's and adolescents' subjective well-being would also be very helpful to advance the understanding of its evolution with age, to discriminate between what can be a natural development of decreasing-with-age phenomenon (Goldbeck et al., 2007) and other phenomena that may negatively impact children's and adolescents' subjective well-being at the population level.

## 6 Strengths and Limitations

Our study has some limitations worth noting, which call for caution when interpreting our results. To examine our main hypothesis, the present study takes advantage of a data set (Gallup World Poll) that is representative of the 15–64-year-old population (but not of our 15–17-year-old sample), therefore, no nationally representative data of the age group of interest was used in this study. Relatedly, the number of respondents per country is unequal and relatively small in some countries. Furthermore, we use linear regression in our analysis, in line with the main studies investigating the same research question in the adult (Clark et al., 2012; Deaton, 2008) and child and adolescent (Casas et al., 2022; Rudolf & Bethmann, 2023) literature. The main reason was to facilitate the comparison of our results with those in these studies. However, given the hierarchical structure of the data, using linear regression rather than multi-level modelling -despite facilitating these comparisons- may produce less robust estimates (Hox et al., 2017). In addition, due to our interest on the intriguing lack of association between GDP and wellbeing in early-to-middle adolescence, which contrasts with adult findings, our focus exclusively centres around this specific macro-level measure of economic development (GDP), ignoring other relevant measures of economic well-being, as well as other potential predictors that are not included in the model. Moreover, we acknowledge that we use a measure to assess levels of economic development (GDP) that has been accused of being a weak indicator of economic development and well-being (Costanza et al., 2009; Dynan & SheIner, 2018). Finally, the wellbeing measures available do not cover key wellbeing aspects such as positive affect, negative affect, and eudaimonic wellbeing, and the instruments used by the Gallup World Poll are not always equivalent to those used in previous research assessing this question in children and adolescents. Relatedly, although previous studies have used these items to derived similar

scales and define these as affects (Joshani & Jovanović, 2021), we acknowledge that the items used in the positive and negative emotion scales are a combination of affects, emotions, and some other things that cannot be considered affects or emotions in strict conceptual terms. Thus, our emotions scales do not perfectly fit previous academic definitions of emotions (Mauss & Robinson, 2010) or affects (Diener et al., 2002). Moreover, different authors have recommended using broader scales when measuring subjective well-being phenomena in order to capture more variance, due to the non-normal distribution of scores (the so called “optimistic bias”, Casas, 2011). While the Cantril Ladder uses a 0–10 scale, the emotions have been measured using binary scales, which are very limited from the metric point of view. Future research should consider a broader set of scores.

These limitations speak to the broader data availability limitations affecting the field of child and adolescent wellbeing research. The current lack of availability of more adolescents’ datasets, and of data collected using a broader range of wellbeing instruments that may capture the different components and facets of wellbeing is a major limitation, as well as the lack of more lower-middle and low-income countries in all available datasets. Additionally, the four available international surveys here mentioned do not include the same measurement instruments and therefore, comparison cannot be precise.

## 7 Conclusion

The analyses presented in this study suggest that including low- and lower middle-income countries in the existing international datasets on children’s and adolescents’ subjective well-being may dramatically change the results and, consequently, the scope of evidence-based results on children’s subjective well-being at macrosocial level that enhances our knowledge on how subjective well-being functions. Our results also show that not only country income level, but also gender (controlled by age) and the instruments used to assess children’s or adolescents’ wellbeing may raise important differences in the results obtained – such results suggesting that even our present view and understanding of subjective well-being throughout life course evolution in different populations should be modified. Data collection in more countries is needed to increase data availability, but also from a broader range of age-groups. The fact that most data collection is school-based raises the problem that after age 14–16 or younger depending on the country, many adolescents no longer attend school, particularly in lower-income countries, and therefore they are not included in the available international datasets.

Finally, we need to make a call to action for international organizations and international surveys to agree upon the instruments to be used. At least some of the multi-item subjective well-being instruments should be the same in all multi-country data collection in order to be able to develop appropriate cross-cultural comparisons. Although more progress is needed (e.g., the quadripartite theory, with the pending decision of broader models including the eudemonic dimension) – appropriate theoretical background is available, and researchers should take advantage of this

existing solid foundation. However, most international studies are not collecting data on the established components of subjective well-being, and this is frequently limited to one dimension, or even to only single-item instruments. A cohesive approach is urgently needed at the international level.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s12187-024-10131-8>.

**Acknowledgements** The authors gratefully acknowledge the efforts of Gallup in collecting these data and the participants responding to the Gallup World Poll survey.

**Author's Contribution** All authors have made substantial contribution to conception and design, execution, or analysis and interpretation of data. Additionally, all authors were involved in drafting the article and revising it critically for intellectual content. All authors have read the enclosed manuscript and agree to the authorship and content of the manuscript.

**Funding** Not applicable.

**Data Availability** Access to Gallup World Poll data can be requested [here](#).

## Declarations

**Informed Consent, Ethical Approval, and Research Involving Human Participants** In this research, we exclusively used secondary data collected by Gallup in the Gallup World Poll. More information regarding participants' consent, ethical approval, research involving human participants, and other details can be found [here](#).

**Competing Interests** We confirm that there are no conflict of interests affecting the submission of this manuscript.

**Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

## References

- Arain, M., Haque, M., Johal, L., Mathur, P., Nel, W., Rais, A., Sandhu, R., & Sharma, S. (2013). Maturation of the adolescent brain. *Neuropsychiatric Disease and Treatment*, 9, 449–461. <https://doi.org/10.2147/NDT.S39776>
- Aymerich, M., Cladellas, R., Castelló, A., Casas, F., & Cunill, M. (2021). The evolution of life satisfaction throughout childhood and adolescence: Differences in young people's evaluations according to age and gender. *Child Indicators Research*, 14(6), 2347–2369.
- Blakemore, S. J. (2018). Avoiding social risk in adolescence. *Current Directions in Psychological Science*, 27(2), 116–122.
- Blanchflower, D. G. (2021). Is happiness U-shaped everywhere? Age and subjective well-being in 145 countries. *Journal of Population Economics*, 34(2), 575–624.

- Bradburn, N. M. (1969). *The structure of psychological well-being*. Aldine.
- Bradburn, N. M., & Caplovitz, D. (1965). *Reports on happiness: A pilot study of behavior related to mental health*. Aldine.
- Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Harvard University Press.
- Buecker, S., Luhmann, M., Haehner, P., Bühler, J. L., Dapp, L. C., Luciano, E. C., & Orth, U. (2023). The development of subjective well-being across the life span: A meta-analytic review of longitudinal studies. *Psychological Bulletin*, 149(7–8), 418–446. <https://doi.org/10.1037/bul0000401>
- Campbell, O. L., Bann, D., & Patalay, P. (2021). The gender gap in adolescent mental health: A cross-national investigation of 566,829 adolescents across 73 countries. *SSM-Population Health*, 13, 100742.
- Cantril, H. (1965). *The pattern of human concerns*. Rutgers University Press.
- Casas, F. (2011). Subjective social indicators and child and adolescent well-being. *Child Indicators Research*, 4(4), 555–575. <https://doi.org/10.1007/s12187-010-9093-z>
- Casas, F., & González-Carrasco, M. (2020). The evolution of positive and negative affect in a longitudinal sample of children and adolescents. *Child Indicators Research*, 13, 1503–1521. <https://doi.org/10.1007/s12187-019-09703-w>
- Casas, F., Bălătescu, S., Bertrán, I., González, M., & Hatos, A. (2013). School satisfaction among adolescents: Testing different indicators for its measurement and its relationship with overall life satisfaction and subjective well-being in Romania and Spain. *Social Indicators Research*, 111, 665–681. <https://doi.org/10.1007/s11205-012-0025-9>
- Casas, F., Oriol, X., & González-Carrasco, M. (2020). Positive affect and its relationship with general life satisfaction among 10 and 12-year-old children in 18 countries. *Child Indicators Research*, 13, 2261–2290. <https://doi.org/10.1007/s12187-020-09733-9>
- Casas, F., González-Carrasco, M., Oriol, X., & Malo, S. (2022). Economic and children's subjective well-being indicators at the national level in 35 countries. *Child Indicators Research*. <https://doi.org/10.1007/s12187-022-09918-4>
- Chen, X., Cai, Z., He, J., & Fan, X. (2020). Gender differences in life satisfaction among children and adolescents: A meta-analysis. *Journal of Happiness Studies: An Interdisciplinary Forum on Subjective Well-Being*, 21(6), 2279–2307. <https://doi.org/10.1007/s10902-019-00169-9>
- Clark, A. E., Layard, R., & Senik, C. (2012). The causes of happiness and misery. In J. Helliwell, R. Layard, & J. Sachs (Eds.), *UN world happiness report, United Nations* (pp. 59–89). [halshs-00846583](https://doi.org/10.1007/978-1-4020-0846-5_83).
- Costanza, R., Hart, M., Posner, S., Talberth, J. (2009). *Beyond GDP: The need for new measures of progress*. Pardee Paper No. 4, Boston: Pardee Center for the Study of the Longer-Range Future.
- Cummins, R. A. (2010). Subjective well-being, homeostatically protected mood and depression: a synthesis. *Journal of Happiness Studies*, 11, 1–17. <https://doi.org/10.1007/s10902-009-9167-0>
- Cummins, R. A. (2014). Understanding the well-being of children and adolescents through homeostatic theory. In A. Ben-Arieh, F. Casas, I. Frønes, & J. E. Korbin (Eds.), *Handbook of child well-being* (pp. 635–662). Springer.
- Daly, M. (2022). Cross-national and longitudinal evidence for a rapid decline in life satisfaction in adolescence. *Journal of Adolescence*, 94(3), 422–434.
- Deaton, A. (2008). Income, health, and well-being around the world: Evidence from the Gallup World Poll. *Journal of Economic Perspectives*, 22(2), 53–72.
- Diener, E., Lucas, R. E., & Oishi, S. (2002). Subjective well-being: The science of happiness and life satisfaction. In C. R. Snyder & S. J. Lopez (Eds.), *Handbook of positive psychology* (pp. 463–473). Oxford University Press.
- Dynan, K., & Sheiner, L. (2018). *GDP as a measure of economic well-being* (vol. 43, p. 53). Hutchins Center Working Paper
- Easterlin, R. (1974). Does economic growth improve the human lot? In P. A. David & M. W. Reder (Eds.), *Nations and households in economic growth: Essays in honour of Moses Abramovitz*. Academic.
- Easterlin, R. A. (2005). Diminishing marginal utility of income? *Caveat Emptor. Social Indicators Research*, 70(3), 243–255.
- Easterlin, R. A., & O'Connor, K. J. (2022). The easterlin paradox. *Handbook of labor, human resources and population economics* (pp. 1–25). Springer International Publishing.



- Elgar, F. J., Pickett, W., Pförtner, T. K., Gariépy, G., Gordon, D., Georgiades, K., ... & Melgar-Quinonez, H. R. (2021). Relative food insecurity, mental health and wellbeing in 160 countries. *Social Science & Medicine*, 268, 113556.
- Fuhrmann, D., Van Harmelen, A. L., & Kievit, R. A. (2022). Well-being and cognition are coupled during development: A preregistered longitudinal study of 1,136 children and adolescents. *Clinical Psychological Science*, 10(3), 450–466.
- Gallup (n.d.). *World poll methodology*. *Worldwide research methodology and codebook*. Gallup. Accessible at: <https://news.gallup.com/poll/165404/world-poll-methodology.aspx>. Accessed 15 Mar 2024.
- Goldbeck, L., Schmitz, T. G., Nesier, T., Herschbach, P., & Henrich, G. (2007). Life satisfaction decreases during adolescence. *Quality of Life Research*, 16, 969–979. <https://doi.org/10.1007/s11136-007-9205-5>
- González-Carrasco, M., Casas, F., Malo, S., Viñas, F., & Dinisman, T. (2017). Changes in subjective well-being through the adolescent years: Differences by gender. *Journal of Happiness Studies*, 18(1), 63–88. <https://doi.org/10.1007/s10902-016-9717-1>. ISSN1389-4978
- Handa, S., Pereira, A., & Holmqvist, G. (2023). The rapid decline of happiness: Exploring life satisfaction among young people across the world. *Applied Research in Quality of Life*, 18(3), 1549–1579.
- Helliwell, J., Layard, R., & Sachs, J. (2019). *World happiness report 2019*. New York: Sustainable Development Solutions Network. Available at <http://worldhappiness.report/ed/2019/>. Accessed 15 Mar 2024.
- Helliwell, J. F., Huang, H., Norton, M., Goff, L., & Wang, S. (2023). World happiness, trust and social connections in times of crisis. In *World happiness report 2023* (11th ed., Chapter 2). Sustainable Development Solutions Network.
- Hox, J., Moerbeek, M., & Van de Schoot, R. (2017). *Multilevel analysis: Techniques and applications*. Routledge.
- IMF (n.d.). *GDP per capita, current prices U.S. dollars per capita*. The international monetary fund. Accessible at: <https://www.imf.org/external/datamapper/NGDPDPC@WEO/OEMDC/ADVEC/WEOWORLD>. Accessed 15 Mar 2024.
- Joshanloo, M., & Jovanović, V. (2021). Subjective health in relation to hedonic and eudaimonic wellbeing: Evidence from the Gallup World Poll. *Journal of Health Psychology*, 26(3), 438–448.
- Lee, B. J., & Yoo, M. S. (2015). Family, school, and community correlates of children's subjective well-being: An international comparative study. *Child Indicators Research*, 8, 151–175. <https://doi.org/10.1007/s12187-016-9373-3>
- Levin, K. A., Torsheim, T., Vollebergh, W., Richter, M., Davies, C. A., Schnohr, C. W., ... & Currie, C. (2011). National income and income inequality, family affluence and life satisfaction among 13 year old boys and girls: A multilevel study in 35 countries. *Social Indicators Research*, 104, 179–194.
- Main, G., Montserrat, C., Andresen, S., Bradshaw, J., & Lee, B. J. (2019). Inequality, material well-being, and subjective well-being: Exploring associations for children across 15 diverse countries. *Children and Youth Services Review*, 97, 3–13.
- Marquez, J. (2022). *Happy Schools and Communities: Supporting Adolescents' Wellbeing in the United Arab Emirates* (Policy Paper No. 59). Sheikh Saud bin Saqr Al Qasimi Foundation for Policy Research. <https://doi.org/10.18502/aqf.0195>
- Marquez, J. (2023) 'School and gender differences in adolescent life satisfaction: a cross-national study', *Child & Youth Care Forum*, <https://link.springer.com/article/10.1007/s10566-023-09756-7>
- Marquez, J., & Main, G. (2021). Can schools and education policy make children happier? A comparative study in 33 countries. *Child Indicators Research*, 14, 283–339.
- Marquez, J., Inchley, J., & Long, E. (2022). Cross-country and gender differences in factors associated with the decline in adolescents' life satisfaction. *Child Indicators Research*. <https://doi.org/10.1007/s12187-022-09930-8>
- Marquez, J., Taylor, L., Boyle, L., Zhou, W., & De Neve, J.E. (2024). Child and adolescent well-being: Global trends, challenges and opportunities. *World Happiness Report*. <https://doi.org/10.18724/whr-91b0-ek06>
- Mauss, I. B., & Robinson, M. D. (2010). Measures of emotion: A reviews. *Cognition and Emotion*, 109–137. Psychology Press. <https://doi.org/10.1080/02699930802204677>
- Moreta-Herrera, R., Oriol-Granado, X., Gozale-Carrasco, M., & Vaca-Quintana, D. (2023). Examining the relationship between subjective wellbeing and psychological wellbeing among 12year-oldchildren from 30 countries. *Child Indicators Research, Online First*. <https://doi.org/10.1007/s12187-023-10042-0>

- Nahkur, O., & Casas, F. (2021). Fit and cross-country comparability of Children's Worlds Psychological Well-Being Scale using 12-year-olds samples. *Child Indicators Research*, 14, 2211–2247. <https://doi.org/10.1007/s12187-021-09833-0>
- OECD. (2019). PISA 2018 results (volume III): What school life means for students' lives. PISA, OECD Publishing. <https://doi.org/10.1787/acd78851-en>
- Orben, A., & Przybylski, A. K. (2019). The association between adolescent well-being and digital technology use. *Nature Human Behaviour*, 3(2), 173–182.
- Plane, D. R., & Gordon, K. R. (1982). A simple proof of the nonapplicability of the central limit theorem to finite populations. *The American Statistician*, 36(3a), 175–176.
- Rudolf, R., & Bethmann, D. (2023). The paradox of wealthy nations' low adolescent life satisfaction. *Journal of Happiness Studies*, 24(1), 79–105.
- Russell, J. A. (2003). Core Affect and the psychological construction of emotion. *Psychological Review*, 110, 145–172. <https://doi.org/10.1037/0033-295X.110.1.145>
- Ryff, C. D., Boylan, J. M., & Kirsch, J. A. (2021). Eudaimonic and hedonic well-being. In M. T. Lee, L. D. Kubzansky, & T. J. VanderWeele (Eds.), *Measuring well-being*. Oxford University Press. <https://doi.org/10.1093/oso/9780197512531.003.0005>
- Savahl, S., Casas, F., & Adams, S. (2021). The structure of children's subjective well-being. *Frontiers in Psychology*, 12, 650691. <https://doi.org/10.3389/fpsyg.2021.650691>
- Sawyer, S. M., Azzopardi, P. S., Wickremaratne, D., & Patton, G. C. (2018). The age of adolescence. *The Lancet. Child & Adolescent Health*, 2(3), 223–228. [https://doi.org/10.1016/S2352-4642\(18\)30022-1](https://doi.org/10.1016/S2352-4642(18)30022-1)
- Stevenson, B., & Wolfers, J. (2008). *Economic growth and subjective well-being: Reassessing the Easterlin paradox* (No. w14282). National Bureau of Economic Research.
- Stevenson, B., & Wolfers, J. (2013). Subjective well-being and income: Is there any evidence of satiation? *American Economic Review*, 103(3), 598–604.
- Stewart-Brown, S., Tennant, A., Tennant, R., Platt, S., Parkinson, J., & Weich, S. (2009). Internal construct validity of the Warwick-Edinburgh mental well-being scale (WEMWBS): A Rasch analysis using data from the Scottish health education population survey. *Health and Quality of Life Outcomes*, 7(1), 1–8.
- Strelhow, M. R. W., Sarriera, J. C., & Casas, F. (2020). Evaluation of well-being in adolescence: proposal of an integrative model with hedonic and eudemonic aspects. *Child Indicators Research*, 13, 1439–1452. <https://doi.org/10.1007/s12187-019-09708-5>
- Taylor, L. J., DeNeve, J.-E., DeBrost, L., & Khanna, D. (2022). *Wellbeing in Education in Childhood and Adolescence (Report No. 1)*. International Baccalaureate Organisation. <https://ibo.org/research/policy-research/well-being-in-education-in-childhood-and-adolescence-2022>. Accessed 15 Mar 2024.
- Tortora, R. D., Srinivasan, R., & Esipova, N. (2010). The Gallup world poll. In A. Harkness, M. Braun, B. Edwards, T. P. Johnson, L. Lyberg, P. P. Mohler, B.-E. Pennell, T. W. Smith (Eds.), *Survey methods in multinational, multiregional, and multicultural contexts* (pp. 535–543). John Wiley & Sons, Inc. <https://doi.org/10.1002/9780470609927.ch31>
- World Bank (n.d.). World Bank Country and Lending Groups. In *Country classification*. The World Bank. Accessible at: <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>. Accessed 15 Mar 2024.

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.