HOW TO COMPLETE THE RANK-LIST OF AVERAGE HAPPINESS IN NATIONS IN THE 2010s

Estimating overall happiness from components of happiness using mixed effect models

Ruut Veenhoven and Alphonso Fraquet

EHERO working paper 2021-03

Erasmus Happiness Economics Research Organization
Erasmus University Rotterdam, Netherlands
https://eur.nl/en/ehero

EHERO
Erasmus Happiness Economics Research Organisation

HOW TO COMPLETE THE RANK-LIST OF HAPPINESS IN NATIONS IN THE 2010s

Estimating *overall* happiness in nations from *components* of happiness using mixed-effect models

Ruut Veenhoven[1] and Alvaro Fraquet[2] EHERO working paper 2021-3

ABSTRACT

Happiness is a new topic in studies on the comparative performance of nations. The first cross-national studies date from the 1950s and covered a dozen of mainly developed nations. Today happiness is assessed periodically in almost all nations in the world, resulting in some 12.000 observations of average happiness in nations in a particular year.

In spite of this data abundance, we still lack a rank-list of average happiness that covers all contemporary nations. The main reason is that the surveys used in the nations applied different questions on happiness, producing scores on which cannot be compared. This limits any listing to the most commonly used measure.

Today, the most commonly used measure of overall happiness is a single question on life-satisfaction rated on a numerical 0-10 step scale. Until 2007 this measure was available for most nations of the world but since the Gallup World Poll stopped using this question, we now lack direct information on life-satisfaction for a lot of countries. The Gallup World Poll does provide information on two other measures of happiness in nations, 1) affect level as measured with questions about yesterday's positive and negative affects and 2) life-evaluation as measured with the Cantril ladder question.

These measures tap *components* of happiness rather than *overall* happiness. Yet, when taken together, these component measures may still provide us with an estimate of overall happiness. In this paper we present an exploration of this option. Using data for nations on which data about all three happiness variants are available in the same year, we inspected which combination of the two components of happiness best fit with observed overall happiness in these nations. We calculated various statistical models, both fixed-effects and mixed-effects, and assessed a point estimate of satisfaction with the average measure from one of these models. This estimate was then used to complete a rank list of overall happiness in 160 nations for the years 2010-2019.

1 Emeritus professor of social conditions for human happiness at Erasmus University Rotterdam in the Netherlands, Erasmus Happiness Economics Research Organization EHERO. E-mail: veenhoven@ese.eur.nl

2 PhD student at University of Girona, Spain, Research Group on Statistics, Econometrics and Health (GRECS); Fundació Salut Empordà, Figueres, Girona, Spain; CIBER of Epidemiology and Public Health (CIBERESP), Madrid, Spain. E-mail: afranquet@salutemporda.cat

Keywords: cross-national, overall happiness, components of happiness, life-satisfaction, imputation of missing cases

1 INTRODUCTION

The development of centralized nation states created a (political) need for quantitative information on what is going in a country, which led in the 19th century to the development of 'social statistics'. Topics covered were physical health in the population, such as measured using height and longevity and demographics like marriage and fecundity. Suicides were also counted and in France these counts served as the basis of the sociological classic 'Le suicide' by Emile Durkheim (1897).

In the 20th century, such data became available for several countries and this opened the possibility to compare how well countries were doing relatively. Most of these cross-national comparisons dealt with economic and demographic variables, and had data taken from registries. In the second half of the century, developments in survey research allowed for inclusion of subjective indicators, such as support for government policies and self-rated health. 'Happiness' is now also a topic in many survey studies in nations.

1.1 Reasons for interest in happiness in nations

Most citizens want to be happy and expect their governments to create conditions for them to lead a satisfying life. Governments have responded to this expectation, among other things because unhappy citizens are less likely to abide to law, tend to cheat more on taxes and to vote more against ruling parties at election times. Hence, governments want to know how happy their citizens are and to identify pockets of unhappiness in their population. Governments are also interested in how happy their population is in comparison to other countries. Cross-national comparison helps interested parties to see how far their country is from the best possible level of happiness. Additionally, happiness has become an issue in the competition between political ideologies.

1.2 Development of cross-national research on happiness

The first assessments of happiness in the general population of a nation took place in the USA in 1946 when a Gallup opinion poll included the question "*In general, how happy would you say you are?"*. Since, similar questions have been included in several survey studies in other developed nations, in the beginning such questions were included incidentally but since the 1970s questions on happiness have become standard in periodical quality of life surveys in nations.

The first cross-national survey study that involved a question on happiness was held in 1948 and covered 11 nations (Buchanan & Cantril 1953). The first cross-national study in which happiness was a main issue was done in the early 1960s and covered 18 countries (Cantril 1965). Since this time, questions on happiness have been included in several international survey programs, such as the Eurobarometer survey since 1972, the European

Value Survey since 1984, the Latino Barometer since 1995 and the Gallup World Poll since 2006.

1.3 Questions on happiness used

Happiness is mostly measured using a single question. Different formulations have been used in these survey questions, most of which appeared already in the above-mentioned first studies.

'Happiness' was the keyword in the first general population study in the USA in 1946. The question used in the cross-national survey in 1950 reads" *How satisfied are you with the way your life is going on now?".*

In his 1960 cross-national study Cantril (1965) used a different format; respondents were presented with a picture of a ladder and asked to imagine that the top of the ladder represented the *best possible life* and the bottom the *worst possible life*. Respondents were next asked to indicate on which step of the ladder they would rate their own life at present. This question invites the respondent to make to a cognitive evaluation of their life, since the respondent is asked to compare the quality of his/her life as it is with how good life could be. As such the question taps the cognitive component of happiness, discussed further in section 2.2.

Another kind of questions that appeared later asks respondents *how happy they feels most of the time.* Next to single questions on average affect, e.g., *how is your mood these days*, series of questions on the experience of specific positive and negative affects have been used, e.g. *how often have you been cheerful last week* and *how often did you feel down?* An *Affect Balance* Score can be computed from the responses to such questions, subtracting average negative affect from average positive affect. These questions tap the affective component of happiness.

1.4 Problems of comparison

The variety of survey questions on happiness has proliferated over the years and that has brought problems of comparison; to compare happiness across nations, we need comparable measures and the same holds for comparison over time within nations.

1.5 Aim of this paper

In this paper we focused on comparison across nations and tried to distill the longest possible rank-list of average happiness in contemporary nations.

2 SOLUTIONS FOR THE COMPARABILITY PROBLEM IN THE WORLD DATABASE OF HAPPINESS

The World Database of Happiness deals with the comparability problem using the following seven steps.

1) Restriction to happiness in the sense of life-satisfaction
2) Sorting of variants within that concept
3) Classifying the following technical aspects of survey questions on happiness
   - time frame
   - kind of question
   - rating scale
   - scale length
   - minor variation on phrasing of questions that are identical for the above aspects
4) Types of *equivalent* question types are identified from this sorting for *identical* questions,
5) Scores on these questions are transformed to a common 0-10 range as far as possible
6) On this basis it was decided which kind of happiness measure covered most nations: until the 1980s this was questions that used 'happiness' as a key word. Since then, questions on 'satisfaction with life' have been the most used, and today this kind of question is still used for the nation rank-reports in the World Database of Happiness.
7) When data about life-satisfaction are missing for a country, but data about other happiness variants is available, estimates of life-satisfaction are made based on this data.

In this paper we reports on a new technique that fits the available data on happiness in nations in the 2010s.

This procedure is described in full detail here. Below we expand the steps mentioned above. steps points.

2.1 Selection of questions on concept

The first step is to limit to studies that used questions on happiness in the sense of the *overall appreciation of one's life as a whole*, in other words how much people like the life they live. This concept is delineated in more detail here Fit with this concept was assessed on the basis of close reading of the questions and response options presented in questionnaires this is called 'face validity' testing. Several commonly used 'happiness scales' fail at this point because they contain questions on subtly different matters than happiness as defined above.

2.2 Sorting by conceptual variant

When assessing how much we like the life we live, we use two sources of information: 1) how well we feel most of the time, and 2) to what extent we think that live brings us what we want from it. These sub-appraisals are referred to as the two 'components' of happiness, respectively the affective component named 'hedonic level of affect' and the cognitive component called 'contentment'. To delineate the difference of these components with the total evaluation of life, we speak of 'Overall' happiness' (Veenhoven 2009). This conceptual distinction is explained in more detail here and summarized in scheme 1 below.

Scheme 1
Concept of overall happiness and components

Total evaluation of life	**Overall Happiness** (life-satisfaction)	
Components	Affective **Hedonic level of affect**	Cognitive **Contentment**
Information basis	Affective experience	Cognitive comparison

All these happiness variants can be measured using questions, all of which have been used in general population surveys. In the World Database of Happiness, these questions are presented separately and coded as follows for **Conceptual Focus**:
- O for questions on **O**verall happiness
- A for questions on hedonic level of **A**ffect
- C for questions on **C**ontentment
- M for questions in which the above variants are **M**ixed in some way

2.3 Sorting by type of survey question on happiness variants

The questions used for measuring the above-mentioned conceptual variants differ in the following ways:

Keyword used
Differences in keywords used in survey questions appeared as early as the first survey questions Cf. section 1.2. The very first survey question in 1948 used the term 'happiness', the second survey question in 1950 used the term 'life-satisfaction'. We deal with these differences using the following subclassifications
- O-HL for questions that use 'happiness' as a keyword
- O-SL for questions that use 'satisfaction' as a keyword

Time frames of lead question
The focus is on 'present' happiness, which can be 'currently', 'these days', 'during the last year' or 'hitherto'

Kind of questioning
Single one-time questions are the most commonly used type of questions in national surveys, but some studies ask the same happiness question twice in an interview or use multiple questions.

Response scale
Respondents record their answers on a response scale, where they tick an option that best reflects how they feel about their life. When these options are labeled uding words, such as 'very happy' or 'unhappy', we speak of *verbal scales*. When respondents pick a number, we speak of a *numerical scale*. Numerical scales are less vulnerable to language bias than verbal scales, and are for this reason, most suited for cross-national rankings.

Length of rating scale
Response scales vary also in the number of response options available to the respondent, which can vary from 2 to 100. The range from 0 to 10 is currently seen as the best and this scale length has been adopted for many cross-national studies, such as the European Social Survey.

2.4 Grouping equivalent measure types

Survey questions are selected that are sufficiently similar to allow meaningful comparison across nations. In these questions the same key word is used, the same kind of questioning and the same kind of response scale. The questions may differ in the timeframe addressed and in the precise wording of the question. These questions are then sorted into types of *equivalent* measures of happiness. An overview of the happiness measure types is found here.
.

Transformation of means to the same 0-10 numerical scale

Most data on happiness in nations have been and are still gathered using response scales other than 0-10 numerical. Scores on these scales are transformed to scale 0-10 using the following techniques.

Linear stretch of the mean
The formula currently used in the World Database of happiness is as follows:

*MeanT = (Me.C_Mean - Me.Ind_RRfrom) * 10 / (Me.Ind_RRto - Me.Ind_RRfrom)*
Where
Me.C Mean = observed mean on original scale
Me.Ind RRfrom = lowest possible score on original scale

Me,ind RRto = highest possible score on original scale
Me.ind RRfrom = lowest possible score on original scale
MeanT = transformed mean on range 0-10

This technique is applied only for numerical scales with at least 7 response options. In the World Database of Happiness, it is mostly used for transforming scores from a 1-10 step scale to range 0-10.

Using fixed values to response options, as rated by experts
Experts rated the valence of verbal response options on a 0-10 scale. In the elementary variant they were asked to rate the value of a word, e.g.: 9 for 'very happy'. If a frequency distribution is available, these values are used to compute a weighted mean. This method is currently used in the World Database of Happiness, for questions using verbal response options.

Using contextual values for response options as assessed by native speakers
In a more sophisticated variant of the above technique, the value of a response options is rated in the context of the total response scale and the language. Ratings are made by native speakers, using a 'scale interval recorder'. In this case the value given to the response option 'very happy' can be lower than 9 if part of a long scale and preceded by even more positive options, such as 'extremely happy' or be rated lower in languages where the words 'very' and or 'happy' denote less intensity. This method also requires that a full frequency distribution is available on a basis of which a weighed mean can be computed. This method has been applied for questions with verbal response scales that have been used in general population surveys in some 30 languages, but to date (2021) it has not been implemented in the World Database of Happiness.

Reference distribution method
When in the same year in the same country at least two equivalent question on happiness have been used in different surveys, and responses were rated on a verbal scale in one case and on a 0-10 step numerical scale in the other case, the value of the verbal response options can be estimated using a Beta distribution. This method has also not been implemented in the World Database of Happiness as yet

For more information on the methods discussed above go to DeJonge et al (2017) Diversity in survey questions on the same topic: Techniques for improving comparability

2.5 Presentation of average happiness in nations over 10-year periods

Average happiness in nations may differ across time and hence rank lists are typically presented for periods. Ideally, we would present the data on happiness by year, but at

present the available data do not support such presentation, since surveys that include the focal question on life-satisfaction are typically not held every year in every country. Rank lists In the World Database of Happiness therefore cover 10-year periods, such as from 1945 to 1955 and from 1960 to 1970. The period we considered in this paper was 2010 to 2019 and we refer to these years as the 2010s.

In countries where more than one survey was held during a 10-year period, the mean of the observed averages is used for rank lists in the World Database of Happiness. An advantage of this approach is that these averages will be less affected by random measurement error, since differences in sampling and interview conditions will balance out.

3 FOCUS ON SINGLE QUESTIONS ON LIFE-SATISFACTION USING A NUMERICAL SCALE

Following the last point made in section 2, the reader is reminded that it is *homogenized* data on average happiness in nations that have been entered into the collection of Distributional Findings on Happiness in Nations of the World Database of Happiness. An overview of the number of countries in which the different measures of happiness have been used since start of this research in the 1940s is provided in Table 1. On the right side of the table, the reader can see that questions on life-satisfaction are currently the most used, questions designed to be responded on a numerical scale in particular. For this reason we will restrict the rank-list of average happiness in nations to responses to single questions on life-satisfaction using a numerical response scale.

Some additional advantages of using the life-satisfaction question are: 1) the focus is on the respondent's *overall* enjoyment of life and not on the *components* of happiness discussed above in section 2.2 and 2) the term 'satisfaction with life' more clearly in denotes the concept of liking the life one lives than the word 'happiness', which as a ' stand-alone' is open to different interpretations. The term 'life-satisfaction' will also be less vulnerable for language bias. The advantage of using numerical response scales is that sematic bias is further reduced.

3.1 Dealing with cases where no such data have been gathered

In the lower part of table 1 we can see several combinations of equivalent measures scores which are transformed to a common 0-10 numerical scale. In the 2000-2009 period data on 10+11+101 numeral life-satisfaction were available for 151 nations, while data for 10+11 Best-Worst Possible Life were available for 165 countries. This difference was even greater in the 2010s, where data on life-satisfaction (10+11+101 step) is available for only 96 nations, while Best-Worst is available for 161 nations. This is because the Gallup World Poll stopped using the question on life-satisfaction in 2006. How to deal with this change in the availability of survey data?

World Happiness Report solution: focus on another happiness variant
One option is to forget about life-satisfaction and to rank nations on another happiness variant on which more information is available. This way is followed in the World Happiness Reports (Helliwell et al 2021) where the Best-Worst Possible Life question leads. This implies a change in conceptual focus from overall happiness to the cognitive component of happiness. The World Happiness Reports acknowledges the difference by denoting the Best-Possible Life scores as 'life-*evaluation*' in contrast to 'life-*satisfaction*'.

This shift of conceptual focus is not without consequences for the rank-order obtained using this measure of happiness. People in rich nations are more likely to score high on this cognitive measure of happiness than people in poor nations and the measure does not capture nation differences in mood level, such as in the case of Africa, where

people tend to be dissatisfied cognitively while feeling fairly well (Brule & Veenhoven 2015).

The restriction to the cognitive component of happiness is also of consequence for the analyses performed with these rank-lists. Correlation with country characteristics will be affected, such as obtaining a stronger correlation with income inequality in nations, and these findings will support theories that see happiness as the perceived realization of wants rather than theories that see happiness as the gratification of needs (Veenhoven 2009).

Solution of the World Database of Happiness: substitute missing cases
The approach of the World Database of Happiness is to stay with the concept of overall happiness and to seek to impute missing data. In this paper we describe a technique to substitute missing data for the 2010s and possibly beyond.

3.2 Method of substitution currently used in the World Database of Happiness

At the bottom of table 1 we can see that in the 2000-2009 period slightly more data were available for the cognitive Best-Worst question (164) than for overall life-satisfaction (151), a difference of 13 countries. Average life-satisfaction in these 13 nations was estimated on basis of the correspondence between scores on life-satisfaction and contentment in the many nations where both had been assessed in the same year. Using a regression analysis, the following formula was derived.

Estimated 0-10 life satisfaction = 1.156 x observed score on the Best-Worst item - 0.457.

The 95% confidence interval around these estimated values is about 1.3 points which means that these estimates are not very precise. See note 4 of the WDH Rank Report of Average Happiness in nations 2000-2009.

3.3 Need for another method for the years 2010-2019

This approach became more questionable for the 2010-2019 period, where many more scores on life-satisfaction had to be imputed, 65 cases instead of 13. So, we needed to reconsider how we would estimate missing data on life-satisfaction in nations in the 2010s and that is what we discuss in this paper.

4 AN ALTERNATIVE METHOD FOR SUBSTITUTING MISSING CASES
Estimating unmeasured overall happiness from measured 'components' of happiness

4.1 Available data on 'components' of happiness in nations

We distinguished In section 2.2 between *overall happiness* (life-satisfaction) and two 'components' of happiness, an affective component called *hedonic level of affect* and a cognitive component called *contentment*. Measures of these two components of happiness have been included in the Gallup World Poll since 2006 This survey yields yearly data for a great number of countries all over the world.

Affective component
In the Gallup World poll, hedonic level of affect is measured using the following questions on how well one has felt the day before:
- Did you feel well-rested yesterday?
- Were you treated with respect yesterday?
- Did you smile and laugh a lot yesterday
- Did you learn or do something interesting yesterday?
Did you experience the following feelings during A LOT of the day yesterday?
- How about enjoyment?
- How about physical pain?
- How about worry?
- How about sadness?
- How about stress?
- How about anger?
The response format is 'yes' or 'no'

Half of these items is about positive affect experienced and half about negative affect. Gallup groups the responses in respectively a *positive affect score* and a *negative affect score* and considers these separately.

In the World Database of Happiness, the scores are combined in an *Affect Balance Score*, subtracting average negative affect from average positive affect. Since people typically experience more positive affect than negative affect, this balance is positive for almost all country/years. In the World Database of Happiness, the balance is expressed as the percentage by which positive affect outweighs negative affect. These balance scores are found here.

We defined Hedonic level was defined as how well one feels *most of the time* (cf. section 2.2) while the questions are about *yesterday*'s affective experience. Since people can have had a particular good or bad day, this measure is a poor indicator of how well an individual respondent feels most of the time, however, good or bad days will balance in a country's average. So, the balance score does reflect how well people typically feel in a

country.

Asking questions about yesterday's affect, rather than about how well one feels generally has the advantage that cognitive appraisal is minimized. The experience is still fresh and separated from a respondent's wider evaluations of life.

Cognitive component

In the Gallup World Poll life-evaluation is measured using a picture of a ladder which respondents use to rate their answer to the following question:

4.2 Why the two components of happiness together are likely to predict overall happiness

We argues above in section 2.2 that people, when assessing how much they like the life they live, draw on two sources of information, how well they feel most of the time and to what extent they perceive that they are getting what they want. As such, the two components together will provide a better prediction of overall happiness (life-satisfaction) that just the cognitive component.

An additional reason is that configurations of contentment and affect level differ across parts of the world and in particular in Africa, where contentment is low, and affect falls in the medium range (Brule and Veenhoven 2015). Estimating life-satisfaction on basis of contentment alone, would therefore underestimate life-satisfaction in Africa.

4.3 Analytic approach

4.3.1 Notations

When obtaining longitudinal data, individuals or groups are observed multiple times at varying time intervals. This is the case in our data. We have multiple nations producing

different information at different times. For time *t* and nation *n* we observed a three-dimensional vector X_{ij} of fixed-effects covariates (overall happiness, affect or contentment) and a two-dimensional vector of random effects (nation and year). From Table 2 we can see that not all the years have the same amount of information and from Table 3 that not all the nations have the same amount of information.

Standard statistics methods such as least-square regressions assume that data points are independent and identically distributed. These assumptions are not met with our data; we have information from nations for different years, this information is not independent and, as not all the nations have the same amount of information, the sample is not identically distributed.

4.3.2 Data

The primary source of data used consists of 2059 observations taken from 180 different nations based on measures of overall happiness affect balance and contentment. The dataset used in this study was based on average responses to the following measure types as gathered in the World Database of happiness:

- 10-step numeral Life-satisfaction, 11-step numeral Life-satisfaction (for overall happiness)
- 6 item Yesterday Affect Balance (as affect)
- 11-step numeral Best-Worst possible Life (as contentment).

The dependent variable of this study is overall happiness. To measure overall happiness, we used the yearly mean of 10-step numeral life satisfaction and 11-step numeral life-satisfaction (on range 0-10). Independent variables are nation, year, affect and contentment. From Table 4 it can be seen how many observations were available for each measure. The data we used consisted of information gathered between 2006 and 2019.

4.3.3 Fixed effects model

A fixed effects model is a statistical model in which the model parameters are non-random quantities. A statistical model is made up of three parts: the dependent variable, the independent variable, and the estimation of the parameters (the β). The dependent variable in this analysis is Overall Happiness. The dependent variable was the one we wanted to estimate from the independent variables. The independent variables for this analysis are Affect and Contentment. The model parameters are used to measure the effect that each independent variable has on the dependent variable. Usually, a fixed effects model is estimated using least-square regression. We define a fixed effect model formally as:

$$y_{ij} = \beta_0 + \beta_\delta X_{ij} + \varepsilon_{ij}$$
$$i = Afghanistan, Albania, \dots, Yemen$$
$$j = 2006, \dots, 2019$$
$$\varepsilon \sim N(0, \sigma^2)$$

Where y_{ij} denotes the dependent variable (overall happiness) for the *ith* nation at *jth* year. Parameter β_0 is the intercept and grand mean, β_δ corresponds to the effect of the measure (contentment or affect), X_{ij} Is the measure value which takes a value between 0 and 10 and ε_{ij} is the residual error. The vector of all residual errors was assumed to follow a normal distribution with mean 0 and residual variance equal to σ^2.

Our first approach was to compute four fixed effects models using Overall Happiness as the dependent variable and Affect and Contentment as independent variables. The zero model does not use an independent variable, the first model uses only contentment, the second one uses only affect as independent variable and in the third both measures are used.

The results for the fixed effects models are shown in Table 5. The results show a positive relationship between contentment and overall happiness and a positive relationship between affect and overall happiness. As we mentioned above, the independence assumption is violated due to the nature of the data. Our second approach to determining the correspondence of overall happiness to the two components of happiness was to use a random intercepts model which is a type of mixed-effect model.

4.3.4 Random intercepts model

A natural assumption for the data used would be that data points from within a nation show more similarity when compared to other points from that country than if compared to data points from different countries. One way to interpret this assumption is to assume that each nation has an idiosyncratic overall response latency; some nations are happier than the average, some less. We assumed the same for each year. Some years are happier than the average and some years are less happy than the average.

In order to allow for idiosyncratic average response latencies per nation we needed to introduce effects that capture the displacement of each nation from the grand mean (i.e. the intercept β_0), and the same could be done to introduce effects that capture the displacement of each year. Such a model could be specified as:

$$y_{ij} = \beta_0 + S_{0,i} + S_{0,j} + \beta_\delta X_{ij} + \varepsilon_{i,j}$$
$$i = Afghanistan, Albania, \dots, Yemen$$
$$j = 2006, \dots, 2019$$
$$\varepsilon \sim N(0, \sigma^2)$$
$$S_0 \sim N(0, v)$$

where $S_{0,i}$ corresponds to the idiosyncratic effect associated to nation i and $S_{0,j}$ corresponds to the idiosyncratic effect associated to year j. Furthermore, we assumed that the vector of the idiosyncratic effects S_0, followed a zero-centered normal distribution with variance $\sigma^2_{S_0}$. The $S_{0,i}$ and $S_{0,j}$ values can be either positive or negative, summing up to zero. These values allow each nation to have its own intercept, which are assumed to be normally distributed around β_0.

4.3.5 *Software used*

Data was analysed using a linear mixed-effect model computed using the lme4 (Douglas et al., 2015), lmerTest (Kuznetsova et al., 2017), broom.mixed (Bolker & Robinson, 2020), performance (Lüdecke et al., 2021) and tidyverse (Wickham et al., 2019) packages for the statistical programing language R (R Core Team, 2020).

4.3.6 *Code availability*

The code used is available upon request from the authors.

4.4 Model selection

The results of the fixed effect analysis for the three mixed-effect models are presented in Table 6. The results show a positive relationship between contentment and overall happiness. There was a one-point increase in contentment, which increases overall happiness by 0.815 points on average in model 1 (0.751 in model 3). The results also showed that contentment is a very strong predictor for overall happiness. In both models the p-value of contentment was less than 0.001 which is highly statistically significant.

4.4.1 *Models*

Using the notation explained above we can now formally define the models as:

$$Model\ 0: overall_{i,j} = 6.160 + S_{0,i} + S_{0,j} + \varepsilon_{i,j}$$

$$Model\ 1: overall_{i,j} = 1.720 + S_{0,i} + S_{0,j} + 0.815 \cdot contentment_{i,j} + \varepsilon_{i,j}$$

$$Model\ 2: overall_{i,j} = 1.820 + S_{0,i} + S_{0,j} + 0.607 \cdot affect_{i,j} + \varepsilon_{i,j}$$

$$Model\ 3: overall_{i,j} = 0.893 + S_{0,i} + S_{0,j} + 0.751 \cdot contentment_{i,j} + 0.164 \cdot affect_{i,j} + \varepsilon_{i,j}$$

$$i = Afghanistan, Albania, \dots, Yemen$$

$$j = 2006, \dots, 2019$$

$$\varepsilon \sim N(0, \sigma^2)$$

$$S_0 \sim N(0, v)$$

4.4.2 *Model performance*

We have used three criteria for the evaluation and selection of a model: the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC) and the Interclass-Correlation Coefficient (ICC).

The AIC is an estimator of prediction error and thereby relative quality of statistical model for a given dataset. The AIC is a tool for model selection. It allows usto estimate the quality of a model relative to another model. The formula of AIC can be written as:

$$AIC = 2k - 2\ln(\hat{L})$$

Where *k* is the number of parameters and $\hat{L}$ the maximum value for the likelihood function for the model. A lower AIC value implies a better model-performance compared to the rest of the models with the same random effects.

The BIC is another estimator of prediction error. The BIC can be formally defined as:

$$BIC = k \cdot ln(n) - 2\ln(\hat{L})$$

Where k is the number of parameters estimated by the model, n is the number of observations in the data and $\hat{L}$ the maximum value of the likelihood function for that model. A lower BIC indicates a better performance.

As can be seen from Table 7 lower AIC and BIC values correspond to model 3. Note that model 2 gave similar values.

The other criterion used to evaluate models was the ICC. The ICC is a statistic used to quantify the proportion of variance explained by a grouping (random) factor in multilevel/hierarchical data (Nakagawa, Johnson & Schielzeth, 2017). The values of ICC vary from 0 to 1. A value of 0 means that a grouping does not add information and a value of 1 indicates that all the observations in the grouping are equal. We present the adjusted ICC and the conditional ICC for each of the mixed-effect models in Table 8. The adjusted ICC only relates to the random effects and the conditional ICC also takes the fixed effects variance into account.

We show the residuals for the four new models and the earlier model in Figure 2.

4.4.3 Our choice

We opted to use model 3, on the basis of its statistical performance and because of its fit with the theory of the structure of happiness, discussed in section 2.2

Attending to AIC Criterion selecting the model 3 was the best model. The estimations of the random intercepts are presented in Table 9 *for nations* and in Table 10 *for years.*

5 APPLICATION TO DATA ON AVERAGE HAPPINESS IN NATIONS 2010-2019

We present in Table 11, in column 1 all nations in which at least one survey was held in the 2010s that included one or more questions about happiness, either on overall happiness or both components of happiness. Al together there were 160 nations.

We present In column 2 of Table 11 the average responses to questions about life-satisfaction, which were available for 96 nations in this period. We call this 'observed' life-satisfaction'. These data are taken from the collection Happiness in Nations of the World Database of Happiness, measure types 10-step numeral life-satisfaction and 11-step numeral life-satisfaction.

We present in column 3 of Table 11 the combinations of average affect balance and contentment that best fit average life-satisfaction (model 3). We refer to these scores as 'estimated' life-satisfaction. These estimates were available for 156 nations in the 2010s.

As noted above in section 3.3, we lacked data on overall happiness (life-satisfaction) over the years 2010-2019 for 65 nations for which data on Contentment and Affect Balance were available. We impute these missing cases with the estimates given in column 3 4n column 4 of table 11.

We report the number of survey studies on which these averages draw in column 5.

Resulting rank order

We present in Table 12 a sorting of column 4 of Table 11 from highest to lowest. Denmark ranks on top on this list and Tanzania at the bottom. These countries fit a wider pattern, average happiness tends to be high in developed western nations and low in developing Africa. Happiness is also low in the war-stricken counties of the Middle East, such as Iraq and Syria. Happiness is also high in Latin-American countries. Asian countries are mainly found in the middle of the rank-list

This rank-order is similar to these observed in earlier periods, such as over the years 1990-1999 and the 2000-2009 period which can be found here.. We find the same countries at the top (e.g. Denmark) in the middle (e. g. India) and at the bottom (e.g. Zimbabwe). This consistency suggests that average happiness is a stable nation characteristic.

6 VALIDITY CHECKS

Though quite similar with earlier rankings, our ranking of average happiness in nations in the 2010s is not identical. Some countries rank higher than before (e.g. Pakistan) and some rank lower (e.g. Colombia). This can be due to changes in living conditions in the country, but the difference can also be the result of a method effect. The rank-order of countries over the years 2000-2009 was largely based on observed life-satisfaction, while the rank-order presented here for the 2010-2019 period draws heavily on imputations. This begs the question of how valid these imputations are. Do they really reflect average happiness?

We did two validity tests. We first considered the similarities between observed and estimated life-satisfaction in a nation, which can be seen as a test of concurrent validity of our imputations. Next, we considered the strength of correlation with societal characteristics of observed and estimated life-satisfaction in nations, which can be seen as a test of predictive validity.

6.1 Similarity of observed and estimated life-satisfaction

We had two scores on average happiness for 93 nations during the 2010s, 1) 'observed' overall happiness measured using responses to survey questions on life-satisfaction (column 2 in Table 11) and 2) 'estimated' overall happiness using a combination of responses to questions about yesterday's affect and contentment (column 3 in Table 11). Ideally, the estimates should have fully concurred with the observed values. Did they?

Strong correlation

We present on Figure 3 a scatterplot of observed life-satisfaction (vertical) against estimated life-satisfaction (horizontal). A pattern of strong linear correlation appears. The correlation is +.90. This suggests that our estimates of life-satisfaction in the 65 countries for which we have no observation on life-satisfaction were valid.

No perfect correlation

However, the correlation is not perfect, the cases are not on one line and there are outliers at both sides of the dot cloud.

Differences in scores. How big are these differences between observed and estimated life-satisfaction? We present a histogram of the differences in average happiness on Figure 4. The pointed pattern reflects the strong correlation visible in Figure 3. The deviation varies between minus 0,7 point on the 0-10 scale (estimates greater than observed) to plus 1,2 (observed life-satisfaction higher than estimated).

Differences in rank. On Figure 5 we present a similar histogram for happiness rankings. The pattern is more dispersed in this case and the rankings differ between 7 (lower) and 8 (higher) steps on this list for 93 nations. The difference with Figure 4 is due to the fact that minor differences in scores here count equally as much for differences in ranking as major differences do.

This difference between actual scores and ranking is reflected in the difference between the Pearson correlation, which was +.90 and Spearman's rank-order correlation, which was +.89.

Outliers. On the upper side of the dot cloud are the nations for which observed life-satisfaction is substantially higher than estimated life-satisfaction. Differences of 0,5 point and more appeared for Albania, Bangladesh, Bosnia and Herzegovina, Ecuador, India, Indonesia, Kyrgisthan,North Macedonia, Montenegro, Pakistan, Qatar, Rwanda, Yemen and Zimbabwe. On the lower part of the dot cloud are a few nations for which observed life-satisfaction was lower than estimated life-satisfaction. Differences greater than 0,5 point were observed for Australia, Belarus and Egypt.

We see little substantive system in these outliers, at best there is a concentration of Balkan nations (Albania, Bosnia and Herzegovina, North Macedonia and Montenegro). There is more similarity in a methodological point; in all these outlying cases of observed life-satisfaction the data were based on one or two surveys, while estimated life-satisfaction was typically based on 6 to 10 surveys. More surveys provided a more accurate picture of average happiness in a country in this 10-year period, both because more years were sampled and thus more data used and because random sampling error balances out.

6.2 Strength of correlation with nation characteristics

Assessing the average happiness in nations allowed us to identify the best livable countries and the societal characteristic of these (cf. section 1.2). Earlier analyses have shown that happy nations tend to be economically developed, are well organized and allow citizens considerable freedom. Together such sets of national characteristics explain about 75% of the difference in happiness (Veenhoven, 2018). In this section we report some correlations with the most important of these characteristics. If our estimates of life-satisfaction do not tap observed life-satisfaction correctly, we can expect lower correlations and hence less explained variance.

We present in Table 13 the correlations between five nation characteristics and average happiness as measured with 1) observed life-satisfaction (column 2) and 2) estimated life-satisfaction (column 3). In column 4 we present correlations with the earlier estimate of life-satisfaction based on contentment only. At the bottom of the table is the explained variance in happiness by each of the three measures. To allow for comparison, the analysis was restricted to the 57 nations for which scores on all the variables were

available.

The percentages of explained variance were 52% for observed life-satisfaction, 68% for estimated life-satisfaction using our fitted combination of Affect and Contentment and 55% for the estimate on a basis of Contentment only. This variable was used for ranking average happiness in nations in earlier periods and in this paper, we seek to replace it with an estimate that is also based on Affect.

Our estimate of average life-satisfaction in nations based on a fitted combination of Affect and Contentment performed best with an explained variance of 68%. Instead of less this estimate explains more variance in happiness than observed happiness does, at 52%. A main reason for this difference seems to be the greater precision of our estimates. As mentioned above, our estimates drew on many more surveys per nation, which gave us a better representation of happiness in all years and reduces random measurement bias. If our estimate involved any loss in validity at all, this was clearly counter balanced by a gain in reliability.

The new estimates of average life-satisfaction based on Affect and Contentment also did better than estimate of average life-satisfaction in nations used earlier, based on Contentment only, of which only 55% of the variance can be explained by this set of nation characteristics. This suggests that our new way of estimating overall happiness (life-satisfaction) is an improvement to previous methods.

7 DISCUSSION

7.1 Advantages of this alternative method

Conceptual

A substantive advantage of estimating average life-satisfaction in nations using a fitted combination of Affect and Contentment is that the estimate is no longer based on the cognitive component, it also takes the affective component into account. As such the alternative method proposed here fits the conceptual structure of happiness as described in section 2.2 of this paper. We have argued insection3.1 that the earlier limitation to the cognitive component involved an underestimation of happiness in African countries.

Methodological

In order to increase statistical power, it is customary to use more than one observation per case. The use of repeated observations is a problem for most statistical procedures such as a least squares regression model with two assumptions: that the data are independent, and that the data are identically distributed. If we look at the data collected from the World Database of Happiness, we can see that they do not meet either of the above criteria. The data are not independent data because for many countries we have measurements in different years and not all countries have the same amount of data.

Mixed models can be understood as a generalization of ordinary regression that explicitly captures the dependency between different data points using random effects parameters. This allows estimating in a more precise and generalizable way with greater statistical power, the real effect that he study parameters have on the variable of interest (Singman & Kellen, 2019).

7.2 Limitations of this alternative method

The models were estimated using the means obtained by nation, an estimate obtained from the microdata (each of the questionnaires) would surely allow a better estimate to be made by including individual random effects. Probably due to the inherited data structure is better to nest the years into the nation effect because in a same situation (like economic crisis or global pandemic) each country reacts in a different manner.

7.3 Lines for further research

Additional robustness checks of our estimation method can be made using another measure of overall happiness than the question on life-satisfaction; from Table 1 we can see that there are 96 countries for which the average response to a question on happiness (10 step and 11-step numeral combined) is available for the 2010s.

We can also expand on the analysis reported on Table 13. The differences in

explained variance observed in this analysis are partly due to moderators in the relationship between societal characteristics and happiness, such as personal freedom being less instrumental for happiness in collectivistic cultures. We can avoid these effects by considering similar sets of countries separately and compare the explained variance of a same set of societal characteristics by original and imputed levels of happiness.

Note: any estimation involves bias, which will lower the correlations between these estimates of happiness and societal characteristics, such as economic growth. A task for future research is to estimate the size of this distortion, on the basis of which we can dis-attenuate observed correlations.

7.4 Better work with estimated life-satisfaction?

Above we have discussed how our new estimate of life-satisfaction based on a fitted combination of Affect and Contentment provides a more accurate estimate of average happiness than observed happiness (cf. section 6.1) resulting in a higher percentage of explained variance from a set of nation characteristics (cf. section 6.2). This begs the question of whether we had better forget about observed life-satisfaction and instead use the more accurate estimates.

In this case, data on life-satisfaction would be used only to derive the formula given in model 3 for a particular period and to draw further on the richer data on Affect balance and Contentment provided by the Gallup World Poll.

We opted not do so this because:
1) This gain in reliability will come at the cost of face validity, it is less clear what estimates measure than what answers to a straight single question measure. To be used, the data must be understandable for the users, for non-academic users in particular
2) Using estimated life-satisfaction for the rank-reports would involve a change in the approach followed so far in the World Database of Happiness and complicate comparisons with rankings in earlier periods.
3) Changing to estimated overall happiness would make the rank reports too dependent on the Gallup World Poll, which has its limitations and may not continue forever. A main aim of the World Database of Happiness is to include all the available data on happiness in nations.

Researchers can also opt to use our estimated life-satisfaction as presented in column 3 of table 11 instead of the combination of Observed + Estimated life-satisfaction in column 4 of table 11.
These two listings are also available in the WDH datafile States of Nations, respectively as the variables HappinessLS11_Estimated_2010s and HappinessLS10.11_PlusImputation_2010s.

8 CONCLUSIONS

Average *overall happiness* in nations can be estimated from data on *components of happiness*. More specifically, average life-satisfaction in a nation in a year can be predicted from a combination of 1) average level of affect in that nation (the affective component) and 2) average contentment in the nation (the cognitive component) using the following formula:

Life-satisfaction = $0.4638 + S_{0,i} + S_{0,j} + 0.8395 \cdot contentment_{i,j} + 0.1529 \cdot affect_{i,j} + \varepsilon_{i,j}$

This estimate based on the two components of happiness provides a better fit than an estimate based only on the cognitive component, as used earlier in the rank reports of the World Database of Happiness. It also makes more sense conceptually. Thus, for countries/years where survey data on life-satisfaction are missing we can therefore impute estimates of average life-satisfaction on this basis.

This results in a rank-list of average happiness in 160 nations in the 2010s, of which 95 cases are based on one or more assessments of life-satisfaction and 65 cases are imputed. In our view, this is the best available rank list of overall happiness in nation in the 2010s.

REFERENCES

Ben Bolker and David Robinson (2020). broom.mixed: Tidying Methods for Mixed Models. R package version 0.2.6. https://CRAN.R-project.org/package=broom.mixed

Brule, G. & Veenhoven, R. (2015) Geography of happiness: Configurations of affective and cognitive appraisals of life across nations, *International Journal of Happiness and Development* 2, (2) 101-117

Buchanan, W. & Cantril, H. (1953*) How nations see each other. A study in public opinion*. Illinois University Press, Urbana, USA

Cantril, H. (1965) *The pattern of human concerns.* Rutgers University Press, New Brunswicj, NJ USA

Douglas Bates, Martin Maechler, Ben Bolker, Steve Walker (2015). Fitting Linear Mixed-Effects Models Using lme4. *Journal of Statistical Software*, 67(1), 1-48. doi:10.18637/jss.v067.i01.

Durkheim, E. (1897) Le suicide, Alcan, Paris

Johnson, Paul & Schielzeth, Holger. (2017). The coefficient of determination R2 and intra-class correlation coefficient from generalized linear mixed-effects models revisited and expanded. Journal of The Royal Society Interface. 14. 20170213. 10.1098/rsif.2017.0213

Helliwell, J. F., Layard, R. Sachs, J. & De Neve, J-E. (eds). (2021). *World Happiness Report 2021*. New York: Sustainable Development Solutions Network.

Kuznetsova, A., Brockhoff, P., & Christensen, R. (2017). lmerTest Package: Tests in Linear Mixed Effects Models. Journal of Statistical Software, 82(13), 1 - 26. doi: http://dx.doi.org/10.18637/jss.v082.i13

Lüdecke, Makowski, Waggoner & Patil (2020). Assessment of Regression Models Performance. CRAN. Available from https://easystats.github.io/performance/

Veenhoven, R. (1995). World Database of Happiness. *Social Indicators Research*, *34*(3), 299-313.

Veenhoven, R. (2009) How do we assess how happy we are? Tenets, implications and tenability of three theories. In: Dutt, A. K. & Radcliff, B. (eds.) 'Happiness, Economics and Politics: Towards a multi-disciplinary approach', Edward Elger Publishers, Cheltenham UK, Chapter 3, pp 45-69

Veenhoven, R. (2018) *Happiness in nations: Pursuit of greater happiness for a greater number of citizens*. In: Snyder, C.R., Lopez, S.J., Lisa M. Edwards, L.M. & C. Marques, S.C. (eds.) The Oxford Handbook of Positive Psychology, 3rd, Oxford University Press

Veenhoven, R. (2021) *World Database of Happiness: Archive of research findings on subjective enjoyment of life.* Erasmus Happiness Economics Research Organization, Erasmus University Rotterdam, Netherlands. Available at: https://worlddatabaseofhappiness.eur.nl

Wickham, H., Averick, M., Bryan, J., Chang, W., D'Agostino McGowan, L., François, R., Grolemund, G., Hayes, A., Henry, L., Hester, J., Kuhn, M., Pedersen, TL., Miller, E., Bache, SM., Müller, K., Ooms, J., Robinson, D., Seidel, DP., Spinu, V., Takahashi, K., Vaughan, D., Wilke, C., Woo, K. ,

Yutani, H. (2019). Welcome to the {tidyverse}. Journal of Open Source Software, 4(43), 1686. doi:10.21105/joss.01686.

Table 1
Comparable data on average happiness in nations since the 1940s
Number of countries where questions have been used one or more times during a 10-year period (count August 2021)

HAPPINESS MEASURE	ERA								
	1940s	**1950s**	**1960s**	**1970s**	**1980s**	**1990s**	**2000s**	**2010s**	**2020s**
Identical items									
Overall happiness: global satisfaction with one's life-as-a-whole									
Happiness, 3-step verbal	5	1	4	15	13	26	29	1	
Happiness, 4-step verbal	11	5		2	25	37	94	60	
Happiness, 5 step verbal				12	9	3	13	5	
Happiness, 10 step numerical			1				30	63	
Happiness, 11 step numerical							34	36	
Life-satisfaction, 3-step verbal	6			2	2	10	10	1	
Life-satisfaction, 4-step verbal		1	1	9	12	40	63	63	32

Life-satisfaction, 5-step verbal				10	5	10	24	17	5
Life-satisfaction, 7-step verbal						10			
Life-satisfaction, 1-10 numerical			1		20	66	88	58	
Life-satisfaction, 0-10 numerical		1		16	12	10	146	42	
Life-satisfaction, 0-100 numerical						5			
Affective component: Hedonic level of Affect									
Affect Balance: last month (Bradburn)				3	22	32			
Affect Balance: Yesterday's Affect (Gallup)							42	58	
Cognitive component:									
Best-Worst possible life, 10-step numerical (Cantril ladder)						2	9		
Best-Worst possible life, 11-step numerical (Cantril 1adder)		2	10	11	3	3	156	161	
***Combined equivalent items**: transformed to a common 0-10 scale, using Thurstone transformation for verbal scales and linear stretch for numerical scales*									
Happiness transformed: 3+4+5 step verbal scale				23	29	74			

Happiness transformed: 10+11 step numerical scales							34	63	
Life-satisfaction transformed: 4+5 step verbal scales				17	19	48			
Life-satisfaction transformed: 10+11+101 step numerical scales				18	25	72	151	96	
Best-Worst possible life transformed 10+11 step numerical scales		2	10	11	3	5	164	161	
Combined non-equivalent items using regression to estimate the score on one item on the bases of responses to one or more other questions									
Life-satisfaction + estimate from Best-Worst			14	18	27	72	154	157	
Life-satisfaction + estimates from Affect + Contentment (table 11)								**160**	

Table 2

Descriptive analysis of the data according to year.

The first column shows the number of nations with information that year and the percentage of the total available nations.
Columns two, three, and four show the mean, standard deviation, and the name of cases with information.

Year	*Nation*	*Overall*	*Contentment*	*Affect*
2006	104 (63.8%)	6.85 (1.05) (n = 43)	5.2 (1.1) (n = 88)	7.32 (0.73) (n = 88)
2007	116 (71.17%)	6.74 (0.93) (n = 102)	5.43 (1.05) (n = 100)	7.3 (0.68) (n = 100)
2008	125 (76.69%)	5.86 (1.51) (n = 111)	5.42 (1.18) (n = 108)	7.32 (0.77) (n = 108)
2009	121 (74.23%)	6.17 (1.18) (n = 55)	5.46 (1.04) (n = 111)	7.29 (0.76) (n = 111)
2010	123 (75.46%)	6.8 (0.95) (n = 37)	5.51 (1.14) (n = 118)	7.34 (0.81) (n = 118)
2011	143 (87.73%)	6.66 (0.93) (n = 21)	5.4 (1.12) (n = 143)	7.26 (0.83) (n = 143)
2012	140 (85.89%)	6.83 (0.97) (n = 53)	5.44 (1.13) (n = 139)	7.23 (0.86) (n = 139)
2013	136 (83.44%)	6.86 (0.86) (n = 43)	5.38 (1.19) (n = 133)	7.22 (0.81) (n = 133)
2014	141 (86.5%)	6.86 (0.87) (n = 30)	5.37 (1.17) (n = 139)	7.2 (0.79) (n = 139)
2015	140 (85.89%)	7.59 (NA) (n = 1)	5.4 (1.12) (n = 140)	7.15 (0.83) (n = 140)
2016	140 (85.89%)	7.19 (0.76) (n = 25)	5.39 (1.15) (n = 140)	7.13 (0.8) (n = 140)
2017	145 (88.96%)	7.08 (0.65) (n = 22)	5.46 (1.15) (n = 145)	7.06 (0.84) (n = 145)
2018	141 (86.5%)	6.82 (0.84) (n = 42)	5.5 (1.09) (n = 138)	7.08 (0.81) (n = 138)
2019	136 (83.44%)	6.96 (0.78) (n = 15)	5.55 (1.12) (n = 135)	7.14 (0.84) (n = 135)

Table 3

Descriptive analysis of the available data on average happiness on nations for 2006-2019.

The first column shows the number of years with information for that nation and the percentage of the total available years. Columns two, three, and four show the mean, standard deviation, and the name of cases with information.

Nation	*Year*	*Overall*	*Contentment*	*Affect*
Afghanistan	12 (85.71%)	4.13 (NA) (n = 1)	3.59 (0.74) (n = 12)	6.11 (0.83) (n = 12)
Albania	12 (85.71%)	5.74 (1.61) (n = 2)	4.99 (0.45) (n = 12)	6.75 (0.16) (n = 12)
Algeria	8 (57.14%)	5.74 (0.21) (n = 2)	5.38 (0.51) (n = 7)	6.73 (0.29) (n = 7)
Andorra	2 (14.29%)	7.03 (0.33) (n = 2)	NaN (NA) (n = 0)	NaN (NA) (n = 0)
Angola	5 (35.71%)	4.27 (NA) (n = 1)	4.42 (0.82) (n = 4)	6.31 (0.2) (n = 4)
Argentina	14 (100%)	7.18 (0.31) (n = 6)	6.34 (0.3) (n = 14)	7.79 (0.25) (n = 14)
Armenia	13 (92.86%)	5.24 (0.67) (n = 3)	4.44 (0.26) (n = 13)	5.56 (0.27) (n = 13)
Australia	13 (92.86%)	7.57 (0.4) (n = 8)	7.29 (0.08) (n = 12)	7.94 (0.16) (n = 12)
Austria	13 (92.86%)	7.55 (0.42) (n = 8)	7.24 (0.18) (n = 12)	8.07 (0.23) (n = 12)
Azerbaijan	14 (100%)	5.84 (0.52) (n = 3)	4.94 (0.35) (n = 14)	6.71 (0.37) (n = 14)
Bahrein	8 (57.14%)	NaN (NA) (n = 0)	5.82 (0.63) (n = 8)	6.72 (0.85) (n = 8)
Bangladesh	13 (92.86%)	6.29 (1.47) (n = 2)	4.72 (0.28) (n = 13)	6.8 (0.55) (n = 13)
Belarus	14 (100%)	5.77 (0.53) (n = 4)	5.33 (1.03) (n = 13)	6.74 (0.28) (n = 13)
Belgium	14 (100%)	7.31 (0.35) (n = 12)	6.97 (0.14) (n = 12)	7.79 (0.2) (n = 12)
Belize	2 (14.29%)	6.62 (NA) (n = 1)	6.2 (0.35) (n = 2)	7.46 (0.12) (n = 2)
Benin	11 (78.57%)	3.02 (NA) (n = 1)	4.02 (0.84) (n = 11)	6.38 (0.54) (n = 11)
Bhutan	3 (21.43%)	NaN (NA) (n = 0)	5.2 (0.33) (n = 3)	7.66 (0.16) (n = 3)
Bolivia	14 (100%)	6.73 (0.66) (n = 2)	5.75 (0.22) (n = 14)	6.86 (0.23) (n = 14)
Bosnia Herzegovina	12 (85.71%)	6.64 (1.18) (n = 2)	5.16 (0.41) (n = 12)	6.36 (0.41) (n = 12)
Botswana	12 (85.71%)	4.7 (NA) (n = 1)	4 (0.67) (n = 12)	7.4 (0.32) (n = 12)
Brazil	14 (100%)	7.13 (0.71) (n = 5)	6.66 (0.32) (n = 13)	7.45 (0.34) (n = 13)

Bulgaria	14 (100%)	4.73 (0.43) (n = 9)	4.48 (0.53) (n = 11)	6.92 (0.33) (n = 11)
Burkina Faso	13 (92.86%)	3.64 (NA) (n = 1)	4.17 (0.51) (n = 13)	6.6 (0.37) (n = 13)
Burundi	5 (35.71%)	2.94 (NA) (n = 1)	3.55 (0.37) (n = 5)	6.87 (0.65) (n = 5)
Cambodia	14 (100%)	4.89 (NA) (n = 1)	4.25 (0.47) (n = 13)	7.11 (0.38) (n = 13)
Cameroon	14 (100%)	3.94 (NA) (n = 1)	4.58 (0.41) (n = 14)	6.64 (0.23) (n = 14)
Canada	14 (100%)	7.88 (0.25) (n = 9)	7.4 (0.16) (n = 13)	8.03 (0.21) (n = 13)
Central African Republic	6 (42.86%)	4.6 (NA) (n = 1)	3.52 (0.53) (n = 5)	5.85 (0.57) (n = 5)
Chad	14 (100%)	5.36 (NA) (n = 1)	4.04 (0.42) (n = 14)	6.1 (0.55) (n = 14)
Chile	14 (100%)	6.7 (0.26) (n = 3)	6.37 (0.36) (n = 14)	7.55 (0.28) (n = 14)
China	14 (100%)	6.36 (0.59) (n = 5)	5 (0.28) (n = 14)	8.33 (0.21) (n = 14)
Colombia	14 (100%)	7.72 (0.44) (n = 4)	6.29 (0.18) (n = 14)	7.67 (0.16) (n = 14)
Comoros	6 (42.86%)	NaN (NA) (n = 0)	3.95 (0.37) (n = 6)	7.3 (0.32) (n = 6)
Congo (Brazzaville)	10 (71.43%)	3.65 (NA) (n = 1)	4.46 (0.59) (n = 10)	6.31 (0.33) (n = 10)
Congo (Kinshasa)	8 (57.14%)	4.4 (NA) (n = 1)	4.35 (0.27) (n = 8)	6.58 (0.54) (n = 8)
Costa Rica	14 (100%)	8.49 (0.01) (n = 2)	7.18 (0.2) (n = 14)	8 (0.21) (n = 14)
Cote d Ivoire	8 (57.14%)	4.45 (NA) (n = 1)	4.53 (0.68) (n = 8)	6.71 (0.31) (n = 8)
Croatia	13 (92.86%)	6.46 (0.44) (n = 6)	5.56 (0.25) (n = 12)	6.57 (0.17) (n = 12)
Cuba	1 (7.14%)	NaN (NA) (n = 0)	5.42 (NA) (n = 1)	6.85 (NA) (n = 1)
Cyprus	14 (100%)	6.86 (0.38) (n = 8)	6.09 (0.45) (n = 12)	7.17 (0.37) (n = 12)
Czech Republic	11 (78.57%)	6.73 (0.28) (n = 10)	6.58 (0.24) (n = 10)	7.31 (0.38) (n = 10)
Denmark	14 (100%)	8.28 (0.27) (n = 11)	7.67 (0.14) (n = 13)	8.06 (0.21) (n = 13)
Djibouti	3 (21.43%)	5.66 (NA) (n = 1)	4.76 (0.34) (n = 3)	7.44 (0.64) (n = 3)
Dominican Republic	14 (100%)	7.51 (0.13) (n = 2)	5.22 (0.35) (n = 14)	7.41 (0.18) (n = 14)
Ecuador	14 (100%)	6.99 (0.72) (n = 4)	5.77 (0.38) (n = 14)	7.69 (0.25) (n = 14)
Egypt	14 (100%)	5.5 (0.87) (n = 5)	4.49 (0.53) (n = 13)	6.12 (0.44) (n = 13)
El Salvador	14 (100%)	6.68 (NA) (n = 1)	5.99 (0.6) (n = 14)	7.76 (0.34) (n = 14)
Estonia	14 (100%)	6.34 (0.37) (n = 11)	5.57 (0.29) (n = 13)	7.52 (0.48) (n = 13)
Ethiopia	9 (64.29%)	3.98 (NA) (n = 1)	4.38 (0.17) (n = 8)	7.12 (0.37) (n = 8)

Finland	13 (92.86%)	7.96 (0.13) (n = 8)	7.57 (0.18) (n = 12)	7.96 (0.13) (n = 12)
France	14 (100%)	6.56 (0.55) (n = 11)	6.64 (0.21) (n = 13)	7.58 (0.23) (n = 13)
Gabon	9 (64.29%)	NaN (NA) (n = 0)	4.43 (0.45) (n = 9)	6.2 (0.22) (n = 9)
Gambia	3 (21.43%)	NaN (NA) (n = 0)	4.73 (0.54) (n = 3)	7.26 (0.49) (n = 3)
Georgia	14 (100%)	5.18 (1.07) (n = 3)	4.22 (0.34) (n = 14)	6.46 (0.38) (n = 14)
Germany	14 (100%)	7.26 (0.3) (n = 18)	6.82 (0.23) (n = 13)	7.84 (0.21) (n = 13)
Ghana	14 (100%)	5.23 (0.69) (n = 2)	4.78 (0.52) (n = 14)	7.45 (0.37) (n = 14)
Greece	12 (85.71%)	6.14 (0.46) (n = 5)	5.49 (0.56) (n = 12)	6.75 (0.48) (n = 12)
Guatemala	14 (100%)	7.43 (0.36) (n = 3)	6.25 (0.27) (n = 14)	7.79 (0.17) (n = 14)
Guinea	10 (71.43%)	4.5 (NA) (n = 1)	4.11 (0.68) (n = 9)	6.6 (0.38) (n = 9)
Guyana	1 (7.14%)	6.53 (NA) (n = 1)	5.99 (NA) (n = 1)	7.36 (NA) (n = 1)
Haiti	12 (85.71%)	4.5 (0.85) (n = 2)	3.95 (0.47) (n = 11)	6.37 (0.29) (n = 11)
Honduras	14 (100%)	7.04 (NA) (n = 1)	5.39 (0.51) (n = 14)	7.81 (0.24) (n = 14)
Hong Kong	12 (85.71%)	6.7 (0.44) (n = 7)	5.46 (0.15) (n = 10)	7.35 (0.45) (n = 10)
Hungary	14 (100%)	5.82 (0.52) (n = 10)	5.26 (0.5) (n = 12)	7.2 (0.35) (n = 12)
Iceland	7 (50%)	7.92 (0.09) (n = 5)	7.43 (0.24) (n = 7)	8.55 (0.17) (n = 7)
India	14 (100%)	5.82 (0.44) (n = 2)	4.49 (0.56) (n = 14)	6.9 (0.39) (n = 14)
Indonesia	14 (100%)	6.48 (1.15) (n = 2)	5.23 (0.22) (n = 14)	7.95 (0.26) (n = 14)
Iran	11 (78.57%)	5.63 (NA) (n = 1)	4.83 (0.3) (n = 11)	5.82 (0.39) (n = 11)
Iraq	11 (78.57%)	4.93 (0.94) (n = 3)	4.68 (0.24) (n = 10)	5.08 (0.51) (n = 10)
Ireland	14 (100%)	7.25 (0.45) (n = 9)	7.07 (0.21) (n = 13)	8.11 (0.26) (n = 13)
Israel	13 (92.86%)	7.46 (0.24) (n = 6)	7.21 (0.18) (n = 13)	6.82 (0.19) (n = 13)
Italy	13 (92.86%)	6.78 (0.51) (n = 11)	6.23 (0.3) (n = 13)	6.8 (0.32) (n = 13)
Jamaica	6 (42.86%)	6.7 (NA) (n = 1)	5.7 (0.37) (n = 5)	7.56 (0.42) (n = 5)
Japan	13 (92.86%)	6.36 (0.46) (n = 4)	5.97 (0.14) (n = 13)	7.9 (0.19) (n = 13)
Jordan	12 (85.71%)	6.11 (0.35) (n = 4)	5.34 (0.34) (n = 11)	6.69 (0.33) (n = 11)
Kazakhstan	14 (100%)	6.51 (0.33) (n = 4)	5.78 (0.24) (n = 14)	7.71 (0.21) (n = 14)
Kenya	14 (100%)	3.67 (NA) (n = 1)	4.39 (0.28) (n = 14)	7.8 (0.28) (n = 14)

Korea (South)	14 (100%)	6.12 (0.3) (n = 4)	5.88 (0.38) (n = 14)	7.19 (0.29) (n = 14)
Kuwait	11 (78.57%)	6.75 (0.21) (n = 2)	6.28 (0.27) (n = 10)	7.5 (0.63) (n = 10)
Kyrgyzstan	14 (100%)	6.61 (1.62) (n = 3)	5.09 (0.33) (n = 14)	7.71 (0.27) (n = 14)
Laos	8 (57.14%)	6.24 (NA) (n = 1)	4.97 (0.25) (n = 8)	8.06 (0.44) (n = 8)
Latvia	13 (92.86%)	5.85 (0.47) (n = 4)	5.37 (0.54) (n = 13)	6.93 (0.23) (n = 13)
Lebanon	13 (92.86%)	5.71 (0.87) (n = 3)	4.94 (0.37) (n = 13)	5.93 (0.64) (n = 13)
Lesotho	4 (28.57%)	NaN (NA) (n = 0)	4 (0.61) (n = 4)	7.55 (0.39) (n = 4)
Liberia	9 (64.29%)	3.43 (NA) (n = 1)	4.05 (0.71) (n = 9)	6.09 (0.49) (n = 9)
Libya	7 (50%)	6.94 (NA) (n = 1)	5.54 (0.16) (n = 6)	6.65 (0.13) (n = 6)
Lithuania	14 (100%)	6.01 (0.48) (n = 8)	5.79 (0.35) (n = 14)	6.53 (0.25) (n = 14)
Luxembourg	13 (92.86%)	7.61 (0.08) (n = 4)	7.05 (0.18) (n = 11)	7.87 (0.24) (n = 11)
Macao	3 (21.43%)	6.34 (0.26) (n = 3)	NaN (NA) (n = 0)	NaN (NA) (n = 0)
Madagascar	11 (78.57%)	3.73 (NA) (n = 1)	3.98 (0.36) (n = 11)	7.33 (0.51) (n = 11)
Malawi	12 (85.71%)	6.2 (NA) (n = 1)	4.06 (0.57) (n = 12)	7.11 (0.76) (n = 12)
Malaysia	12 (85.71%)	6.69 (0.11) (n = 3)	5.8 (0.32) (n = 12)	7.97 (0.49) (n = 12)
Mali	13 (92.86%)	3.76 (NA) (n = 1)	4.25 (0.4) (n = 13)	7.57 (0.48) (n = 13)
Malta	12 (85.71%)	7.16 (0.12) (n = 3)	6.41 (0.34) (n = 11)	6.76 (0.23) (n = 11)
Mauritania	13 (92.86%)	4.95 (NA) (n = 1)	4.41 (0.27) (n = 13)	7.71 (0.46) (n = 13)
Mauritius	6 (42.86%)	NaN (NA) (n = 0)	5.84 (0.31) (n = 6)	7.89 (0.3) (n = 6)
Mexico	13 (92.86%)	8.23 (0.48) (n = 5)	6.76 (0.35) (n = 13)	7.97 (0.26) (n = 13)
Moldova	14 (100%)	5.3 (0.5) (n = 2)	5.6 (0.35) (n = 14)	6.55 (0.18) (n = 14)
Mongolia	12 (85.71%)	5.66 (NA) (n = 1)	4.98 (0.34) (n = 12)	7.39 (0.29) (n = 12)
Montenegro	12 (85.71%)	6.23 (1.46) (n = 2)	5.28 (0.23) (n = 12)	6.08 (0.13) (n = 12)
Morocco	9 (64.29%)	5.65 (0.23) (n = 2)	5.13 (0.16) (n = 8)	6.9 (0.75) (n = 8)
Mozambique	8 (57.14%)	3.84 (NA) (n = 1)	4.68 (0.23) (n = 8)	6.47 (0.33) (n = 8)
Myanmar	8 (57.14%)	NaN (NA) (n = 0)	4.4 (0.22) (n = 8)	7.75 (0.48) (n = 8)
Namibia	6 (42.86%)	5.2 (NA) (n = 1)	4.63 (0.21) (n = 5)	7.52 (0.46) (n = 5)
Nepal	14 (100%)	5.32 (NA) (n = 1)	4.69 (0.41) (n = 14)	6.81 (0.76) (n = 14)

Netherlands	13 (92.86%)	7.62 (0.16) (n = 24)	7.46 (0.09) (n = 12)	8.19 (0.12) (n = 12)
New Zealand	13 (92.86%)	7.49 (0.28) (n = 3)	7.32 (0.11) (n = 13)	8.23 (0.12) (n = 13)
Nicaragua	14 (100%)	7.39 (0.46) (n = 2)	5.63 (0.55) (n = 14)	7.46 (0.25) (n = 14)
Niger	14 (100%)	3.75 (NA) (n = 1)	4.26 (0.46) (n = 14)	7.36 (0.54) (n = 14)
Nigeria	12 (85.71%)	5.24 (0.54) (n = 3)	4.97 (0.31) (n = 12)	7.63 (0.43) (n = 12)
North Macedonia	12 (85.71%)	5.46 (1.32) (n = 3)	4.9 (0.38) (n = 12)	6.36 (0.27) (n = 12)
Norway	12 (85.71%)	7.94 (0.12) (n = 10)	7.54 (0.1) (n = 9)	8.16 (0.06) (n = 9)
Pakistan	12 (85.71%)	6.37 (1.13) (n = 4)	5.31 (0.41) (n = 12)	6.47 (0.24) (n = 12)
Palestine	14 (100%)	5.04 (0.13) (n = 2)	4.62 (0.2) (n = 14)	5.92 (0.28) (n = 14)
Panama	14 (100%)	7.76 (NA) (n = 1)	6.68 (0.41) (n = 14)	8.23 (0.31) (n = 14)
Paraguay	13 (92.86%)	6.77 (NA) (n = 1)	5.56 (0.34) (n = 13)	8.22 (0.3) (n = 13)
Peru	14 (100%)	6.73 (0.71) (n = 3)	5.59 (0.33) (n = 14)	7.08 (0.28) (n = 14)
Philippines	13 (92.86%)	7.01 (1.21) (n = 4)	5.27 (0.46) (n = 13)	7.36 (0.29) (n = 13)
Poland	14 (100%)	6.92 (0.28) (n = 11)	5.94 (0.2) (n = 12)	7.6 (0.19) (n = 12)
Portugal	13 (92.86%)	5.84 (0.2) (n = 8)	5.42 (0.37) (n = 12)	6.88 (0.25) (n = 12)
Qatar	4 (28.57%)	7.26 (0.73) (n = 2)	6.54 (0.1) (n = 3)	7.16 (0.06) (n = 3)
Romania	14 (100%)	6.51 (0.56) (n = 9)	5.57 (0.46) (n = 12)	6.76 (0.47) (n = 12)
Russia	13 (92.86%)	5.67 (0.36) (n = 10)	5.53 (0.32) (n = 13)	7.31 (0.27) (n = 13)
Rwanda	12 (85.71%)	5.15 (1.3) (n = 2)	3.65 (0.41) (n = 12)	7.51 (0.44) (n = 12)
Saudi Arabia	13 (92.86%)	6.27 (2.02) (n = 2)	6.5 (0.29) (n = 13)	7.31 (0.28) (n = 13)
Senegal	14 (100%)	4.48 (NA) (n = 1)	4.44 (0.48) (n = 14)	7.59 (0.28) (n = 14)
Serbia	13 (92.86%)	5.75 (0.61) (n = 5)	5.18 (0.57) (n = 12)	5.91 (0.29) (n = 12)
Sierra Leone	12 (85.71%)	3.55 (NA) (n = 1)	4.11 (0.58) (n = 12)	5.79 (0.34) (n = 12)
Singapore	14 (100%)	6.78 (0.23) (n = 4)	6.5 (0.27) (n = 13)	7.76 (0.66) (n = 13)
Slovakia	14 (100%)	6.48 (0.46) (n = 7)	6.02 (0.29) (n = 11)	7.22 (0.38) (n = 11)
Slovenia	14 (100%)	7 (0.19) (n = 11)	6.02 (0.27) (n = 12)	6.83 (0.17) (n = 12)
Somalia	3 (21.43%)	NaN (NA) (n = 0)	5.18 (0.45) (n = 3)	8.4 (0.23) (n = 3)
South Africa	14 (100%)	5.78 (0.77) (n = 11)	4.87 (0.42) (n = 14)	7.78 (0.26) (n = 14)

South Sudan	4 (28.57%)	NaN (NA) (n = 0)	3.4 (0.64) (n = 4)	5.57 (0.29) (n = 4)
Spain	14 (100%)	7.06 (0.46) (n = 14)	6.46 (0.33) (n = 13)	6.95 (0.33) (n = 13)
Sri Lanka	13 (92.86%)	5.06 (0.47) (n = 2)	4.31 (0.16) (n = 13)	7.97 (0.34) (n = 13)
Sudan	5 (35.71%)	5 (NA) (n = 1)	4.38 (0.16) (n = 5)	6.85 (0.5) (n = 5)
Surinam	1 (7.14%)	NaN (NA) (n = 0)	6.27 (NA) (n = 1)	7.57 (NA) (n = 1)
Swaziland	3 (21.43%)	NaN (NA) (n = 0)	4.49 (0.34) (n = 3)	7.73 (0.21) (n = 3)
Sweden	14 (100%)	7.79 (0.25) (n = 13)	7.37 (0.11) (n = 13)	8.21 (0.11) (n = 13)
Switzerland	13 (92.86%)	7.99 (0.14) (n = 13)	7.55 (0.11) (n = 9)	8.09 (0.17) (n = 9)
Syria	7 (50%)	5.9 (NA) (n = 1)	4.02 (0.97) (n = 7)	5.17 (1.38) (n = 7)
Taiwan	12 (85.71%)	6.48 (0.25) (n = 3)	6.29 (0.26) (n = 12)	8.58 (0.18) (n = 12)
Tajikistan	14 (100%)	5.1 (NA) (n = 1)	4.91 (0.47) (n = 14)	7.33 (0.34) (n = 14)
Tanzania	14 (100%)	2.45 (NA) (n = 1)	3.69 (0.42) (n = 14)	7.62 (0.3) (n = 14)
Thailand	14 (100%)	6.58 (0.62) (n = 3)	6.1 (0.39) (n = 14)	8.4 (0.3) (n = 14)
Togo	9 (64.29%)	2.62 (NA) (n = 1)	3.56 (0.61) (n = 9)	5.71 (0.39) (n = 9)
Trinidad and Tobago	7 (50%)	7.09 (0.13) (n = 2)	6.28 (0.34) (n = 5)	8.12 (0.45) (n = 5)
Tunisia	11 (78.57%)	5.33 (0.48) (n = 3)	4.73 (0.38) (n = 10)	6.17 (0.6) (n = 10)
Turkey	13 (92.86%)	5.95 (0.75) (n = 8)	5.31 (0.25) (n = 13)	5.95 (0.5) (n = 13)
Turkmenistan	10 (71.43%)	7.2 (NA) (n = 1)	5.6 (0.51) (n = 10)	7.15 (0.63) (n = 10)
Uganda	14 (100%)	4.48 (NA) (n = 1)	4.28 (0.39) (n = 14)	6.78 (0.36) (n = 14)
Ukraine	14 (100%)	5.18 (0.23) (n = 5)	4.73 (0.43) (n = 14)	6.88 (0.19) (n = 14)
United Arab Emirates	10 (71.43%)	7.3 (NA) (n = 1)	6.88 (0.23) (n = 10)	7.58 (0.2) (n = 10)
United Kingdom	14 (100%)	7.27 (0.24) (n = 14)	6.92 (0.19) (n = 13)	7.92 (0.29) (n = 13)
United States of America	14 (100%)	7.23 (0.36) (n = 5)	7.09 (0.19) (n = 14)	7.86 (0.17) (n = 14)
Uruguay	14 (100%)	7.03 (0.43) (n = 2)	6.26 (0.34) (n = 14)	7.81 (0.26) (n = 14)
Uzbekistan	13 (92.86%)	6.85 (1.14) (n = 2)	5.79 (0.43) (n = 13)	8.16 (0.31) (n = 13)
Venezuela	13 (92.86%)	7.8 (NA) (n = 1)	6.04 (1.02) (n = 13)	7.77 (0.71) (n = 13)
Viet Nam	13 (92.86%)	5.43 (NA) (n = 1)	5.32 (0.22) (n = 13)	7.2 (0.38) (n = 13)
Yemen	12 (85.71%)	5.12 (0.45) (n = 2)	3.91 (0.57) (n = 12)	6.19 (0.3) (n = 12)

Zambia	13 (92.86%)	4.31 (NA) (n = 1)	4.53 (0.59) (n = 13)	7.16 (0.54) (n = 13)
Zimbabwe	14 (100%)	4.08 (1.77) (n = 2)	3.94 (0.68) (n = 14)	7.52 (0.35) (n = 14)

Table 4

Descriptive analysis of each quantitative measure in the model.

Second column: Mean (Standard deviation) and number of rows with information

Variables	*Mean (sd) (n = count)*
Overall	6.60 (1.14) (n = 600)
Contentment	5.43 (1.13) (n = 1777)
Affect	7.21 (0.81) (n = 1777)

Table 5

Results and parameters estimation for the three fixed effects model

		Estimate	*Std. Error*	*Value*	
Model 0					
	Intercept	6.532	0.050	129.743	***
Model 1					
	Intercept	1.387	0.174	7.979	***
	Contentment	0.866	0.029	30.091	***
Model 2					
	Intercept	0.231	0.451	0.513	*
	Affect	0.857	0.061	14.028	***
Model 3					
	Intercept	0.767	0.310	2.471	
	Contentment	0.813	0.036	22.415	***
	Affect	0.128	0.053	2.404	*

Where * means $p < 0.01$, ** means $p < 0.001$ and *** means $p \approx 0$

Table 6

Results and parameters estimation for the three mixed-effects models.

Model 0								
	Fixed effects							
		Params	Estimate	95% IC	Std. Error	df	t value	
		(Intercept)	6.165	[5.94-6.39]	0.115	97.745	53.598	***
	Random Effects							
		Group	Name		Variance	Std. Dev.		
		Nation	(Intercept)		1.333	1.155		
		Year	(Intercept)		0.043	0.207		
		Residual			0.227	0.476		
Model 1								
	Fixed effects							
		Params	Estimate		Std. Error	Df	t value	
		(Intercept)	1.716	[1.27-2.16]	0.226	213.506	7.601	***
		contentment	0.815	[0.74-0.89]	0.037	179.296	21.762	***
	Random Effects							
		Group	Name		Variance	Std. Dev.		
		Nation	(Intercept)		0.176	0.420		
		Year	(Intercept)		0.038	0.196		
		Residual			0.246	0.496		
Model 2								
	Fixed effects							
		(Intercept)	1.821	[0.73-2.92]	0.544	403.692	3.348	***
		affect	0.607	[0.46-0.76]	0.073	399.136	8.259	***
	Random Effects							
		Group	Name		Variance	Std. Dev.		
		Nation	(Intercept)		0.844	0.919		
		Year	(Intercept)		0.055	0.234		

Model 3		Residual			0.244	0.494		
	Fixed effects							
		Params	Estimate		Std. Error	df	t value	Pr(>|t|)
		(Intercept)	0,893	[-0.14–1.64]	0,383	206,772	2,331	*
		contentment	0,751	[0.66-0.84]	0,044	221,203	16,959	***
		affect	0,164	[0.04-0.28]	0,062	247,163	2,657	**
	Random Effects							
		Group	Name		Variance	Std. Dev.		
		Nation	(Intercept)		0.172	0.414		
		Year	(Intercept)		0.041	0.202		
		Residual			0.243	0.493		

Where * means p < 0.01, ** means p < 0.001 and *** means p ≈ 0

Table 7

Balance statistics for each model computed using function glance from the broom.mixed package.

Model	*sigma*	*logLik*	*AIC*	*BIC*	*deviance*	*Df.residuals*
0	0.476	-573.134	1154.267	1171.290	1146.267	517
1	0.496	-408.194	826.388	846.901	816.388	442
2	0.494	-489.548	989.096	1009.608	979.096	442
3	0.493	-406.566	825.133	849.748	813.133	441

Table 8

Interclass-correlation coefficient (ICC) for each model. The ICC was computed using the performance R package.

Model	*Adjusted ICC*	*Conditional ICC*
0	0.858	0.858
1	0.466	0.171
2	0.787	0.667
3	0.467	0.168

Table 9

Estimated Intercepts by Nation using model 3

Nation	intercept
Afghanistan	-0.0516
Albania	-0.1094
Algeria	-0.3947
Argentina	0.3474
Armenia	0.0267
Australia	-0.1246
Austria	0.0530
Azerbaijan	0.1765
Bangladesh	0.5014
Belarus	0.4515
Belgium	0.0520
Belize	-0.1274
Benin	-0.5034
Bolivia	0.2874
Bosnia Herzegovina	0.3407
Botswana	-0.4398
Brazil	-0.0056
Bulgaria	-0.2609
Burkina Faso	-0.2816
Burundi	-0.4698
Cameroon	-0.3173
Canada	0.1340
Chad	0.1462
Chile	-0.1241
China	0.3761
Colombia	0.6800
Congo (Brazzaville)	-0.2871
Congo (Kinshasa)	-0.1018
Costa Rica	0.2994
Cote D Ivoire	-0.2206
Croatia	0.1451
Cyprus	0.0309
Czech Republic	-0.2257
Denmark	0.2373
Djibouti	0.0540
Dominican Republic	1.1442
Ecuador	0.3313
Egypt	0.1807
El Salvador	0.2076
Estonia	0.0941
Finland	0.0633
France	-0.4873
Georgia	0.0319

Germany	0.0269
Ghana	-0.3054
Greece	-0.1246
Guatemala	0.3435
Guyana	-0.0094
Haiti	0.2507
Honduras	0.4472
Hong Kong	0.5389
Hungary	0.0443
Iceland	0.0514
India	0.0775
Indonesia	0.1835
Iran	-0.1095
Iraq	-0.3838
Ireland	-0.2856
Israel	0.1077
Italy	0.0071
Japan	-0.2965
Jordan	0.1064
Kazakhstan	0.0751
Kenya	-0.4589
Korea (South)	-0.2870
Kuwait	-0.0897
Kyrgyzstan	0.4799
Laos	-0.0196
Latvia	0.1714
Lebanon	0.1577
Liberia	-0.5189
Lithuania	-0.2239
Luxembourg	0.1154
Madagascar	-0.5510
Malawi	0.1356
Malaysia	0.0067
Mali	-0.4137
Malta	0.2210
Mauritania	0.0228
Mexico	0.7711
Moldova	-0.2477
Mongolia	0.0947
Montenegro	0.3126
Morocco	-0.2163
Mozambique	-0.4896
Nepal	-0.1316
Netherlands	-0.1451
New Zealand	-0.0783
Nicaragua	0.6073
Niger	-0.4373

Nigeria	-0.5288
North Macedonia	0.0396
Norway	0.0526
Pakistan	0.7200
Palestine	-0.1499
Panama	0.1527
Paraguay	0.2543
Peru	0.3017
Philippines	0.6896
Poland	0.3210
Portugal	-0.0344
Qatar	0.0408
Romania	0.4905
Russia	-0.4075
Rwanda	0.2027
Saudi Arabia	-0.5265
Senegal	-0.2596
Serbia	0.0258
Sierra Leone	-0.0356
Singapore	-0.1321
Slovakia	0.1248
Slovenia	0.4567
South Africa	0.1738
Spain	0.0872
Sri Lanka	-0.1161
Sudan	-0.0943
Sweden	0.0166
Switzerland	0.0711
Syria	0.1803
Taiwan	-0.4201
Tajikistan	-0.1298
Tanzania	-1.0565
Thailand	-0.1929
Togo	-0.3007
Tunisia	-0.3403
Turkey	0.0440
Turkmenistan	0.1095
Uganda	-0.2193
Ukraine	-0.4732
United Arab Emirates	0.1070
United Kingdom	-0.1132
United States Of America	-0.2505
Uruguay	0.1702
Uzbekistan	0.4175
Venezuela	0.1604
Viet Nam	-0.1480
Yemen	0.0009

Zambia	-0.3855
Zimbabwe	-0.4889

Table 10
Estimated Intercepts by Year using model 3

Year	(Intercept)
2006	-0.0229
2007	-0.0424
2008	-0.4620
2009	-0.2240
2010	-0.0842
2011	0.0371
2012	0.0612
2013	0.1548
2014	-0.0088
2016	0.0010
2017	0.1166
2018	0.0912
2019	0.1957

Table 11
Average happiness in nations 2010-2019

Nation	Average life-satisfaction			Number of surveys
	Observed response to direct question	Estimated from responses to questions about Affect and Contentment using model 3	Observed + Estimated	
Afghanistan		4,53	4,53	10
Albania	6,30	5,70	6,30	2
Algeria	5,89	5,73	5,89	1
Andorra	7,26		7,26	1
Angola		5,31	5,31	4
Argentina	7,32	7,40	7,32	2
Armenia	5,35	5,21	5,35	2
Australia	6,93	7,62	6,93	2
Austria	7,67	7,79	7,67	5
Azerbaijan	6,13	6,05	6,13	2
Bahrein		6,43	6,43	7
Bangladesh	7,33	6,11	7,33	1
Belarus	5,90	6,46	5,90	2
Belgium	7,50	7,49	7,50	6
Belize		6,44	6,44	1
Benin		4,63	4,63	9
Bhutan		6,10	6,10	3
Bolivia	7,19	6,73	7,19	1
Bosnia Herzegovina	7,47	6,26	7,47	1
Botswana		4,57	4,57	10
Brazil	7,43	7,16	7,43	2
Bulgaria	4,96	5,25	4,96	5
Burkina Faso		4,95	4,95	10
Burundi		4,24	4,24	3
Cambodia		5,36	5,36	10
Cameroon		5,25	5,25	10
Canada	7,85	7,95	7,85	4
Central African Republic		4,40	4,40	4
Chad		5,13	5,13	10
Chile	6,82	6,99	6,82	2
China	6,79	6,56	6,79	2
Colombia	8,10	7,67	8,10	2
Comoros		5,19	5,19	5
Congo (Brazzaville)		5,14	5,14	9
Congo (Kinshasa)		5,25	5,25	7
Costa Rica		7,94	7,94	10

Cote d Ivoire		5,30	5,30	7
Croatia	6,54	6,35	6,54	3
Cyprus	6,78	6,67	6,78	6
Czech Republic	6,83	6,87	6,83	7
Denmark	8,24	8,25	8,24	6
Djibouti		5,41	5,41	1
Dominican Republic		7,28	7,28	10
Ecuador	7,61	7,02	7,61	2
Egypt	4,84	5,36	4,84	2
El Salvador		6,99	6,99	10
Estonia	6,52	6,61	6,52	8
Ethiopia		5,45	5,45	8
Finland	7,95	8,00	7,95	7
France	6,69	6,72	6,69	6
Gabon		5,33	5,33	9
Georgia	5,65	5,38	5,65	2
Germany	7,38	7,47	7,38	11
Ghana	5,71	5,48	5,71	1
Greece	5,88	5,93	5,88	3
Guatemala	7,25	7,27	7,25	1
Guinea		5,15	5,15	9
Haiti	5,10	5,23	5,10	1
Honduras		6,70	6,70	10
Hong Kong	6,57	6,82	6,57	3
Hungary	6,11	6,19	6,11	7
Iceland	7,98	8,09	7,98	5
India	6,13	5,37	6,13	1
Indonesia	7,29	6,42	7,29	1
Iran		5,36	5,36	9
Iraq	4,66	4,89	4,66	2
Ireland	7,06	7,26	7,06	6
Israel	7,57	7,61	7,57	4
Italy	6,99	6,67	6,99	8
Jamaica		6,37	6,37	4
Japan	6,22	6,44	6,22	3
Jordan	6,37	6,09	6,37	2
Kazakhstan	6,64	6,71	6,64	3
Kenya		5,12	5,12	10
Korea (South)	6,06	6,38	6,06	3
Kuwait	6,90	6,80	6,90	1
Kyrgyzstan	7,42	6,65	7,42	2
Laos		5,91	5,91	5
Latvia	6,50	6,51	6,50	1
Lebanon	6,22	5,84	6,22	2
Lesotho		5,25	5,25	4

Liberia		4,49	4,49	7
Libya	6,94	6,47	6,94	1
Lithuania	6,06	6,19	6,06	6
Luxembourg	7,50	7,67	7,50	1
Madagascar		4,57	4,57	9
Malawi		5,15	5,15	9
Malaysia	6,74	6,60	6,74	2
Mali		5,02	5,02	10
Malta	7,10	7,12	7,10	1
Mauritania		5,58	5,58	10
Mauritius		6,67	6,67	6
Mexico	8,14	8,11	8,14	2
Moldova		6,11	6,11	10
Mongolia		6,09	6,09	10
Montenegro	7,26	6,28	7,26	1
Morocco	5,49	5,76	5,49	1
Mozambique		5,05	5,05	5
Myanmar		5,57	5,57	8
Namibia		5,64	5,64	4
Nepal		5,43	5,43	10
Netherlands	7,62	7,76	7,62	19
New Zealand	7,33	7,71	7,33	2
Nicaragua	7,72	7,22	7,72	1
Niger		4,94	4,94	10
Nigeria	5,46	5,45	5,46	2
North Macedonia	6,98	5,80	6,98	1
Norway	7,93	8,03	7,93	7
Pakistan	7,33	6,76	7,33	2
Palestine	5,14	5,33	5,14	1
Panama		7,46	7,46	10
Paraguay		6,84	6,84	9
Peru	7,10	6,76	7,10	2
Philippines	7,07	6,92	7,07	2
Poland	7,08	7,02	7,08	8
Portugal	5,97	6,10	5,97	4
Qatar	7,78	7,12	7,78	1
Romania	6,89	6,78	6,89	4
Russia	5,86	6,01	5,86	6
Rwanda	6,07	5,02	6,07	1
Saudi Arabia		6,45	6,45	10
Senegal		5,27	5,27	10
Serbia	5,91	5,94	5,91	4
Sierra Leone		5,14	5,14	9
Singapore	6,64	7,02	6,64	2
Slovakia	6,79	6,86	6,79	4

Slovenia	7,05	7,10	7,05	8
Somalia		6,20	6,20	3
South Africa	5,92	5,97	5,92	3
South Sudan		4,41	4,41	4
Spain	7,00	6,94	7,00	7
Sri Lanka		5,38	5,38	9
Sudan		5,17	5,17	4
Surinam		6,90	6,90	1
Swaziland		5,67	5,67	3
Sweden	7,75	7,87	7,75	7
Switzerland	8,05	8,06	8,05	8
Syria		4,55	4,55	5
Taiwan	6,62	6,74	6,62	2
Tajikistan		5,80	5,80	10
Tanzania		3,82	3,82	10
Thailand	6,75	6,85	6,75	2
Togo		4,41	4,41	7
Trinidad and Tobago	7,18		7,18	1
Tunisia	5,06	5,19	5,06	2
Turkey	6,15	5,95	6,15	3
Turkmenistan		6,37	6,37	9
Uganda		5,04	5,04	10
Ukraine	5,14	5,06	5,14	3
United Arab Emirates		7,50	7,50	8
United Kingdom	7,37	7,35	7,37	9
United States of America	7,02	7,26	7,02	2
Uruguay	7,33	7,26	7,33	1
Uzbekistan	7,65	7,21	7,65	1
Venezuela		6,78	6,78	10
Viet Nam		5,97	5,97	9
Yemen	5,43	4,81	5,43	1
Zambia		5,09	5,09	9
Zimbabwe	5,34	4,79	5,34	1

Variable in datafile **States of nations**	HappinessLS10.11_2010s	HappinessLS11_Estimated 2010s	HappinessLS10.11_PlusImputations_2010s	

Count at 31-8-2021. More data on the 2010-2019 period may become available after this date and will be included in the latest version of the rank report of average happiness in nations at: https://worlddatabaseofhappiness-archive.eur.nl/hap_nat/findingreports/RankReport_AverageHappiness.php

Table 12

Rank list of average happiness in nations 2010-2019

Based on responses to a question on life-satisfaction, missing cases imputed using estimates based on fitted combinations of responses to questions on affect and contentment (Column 4 of table 11)

OBSERVED + ESTIMATED LIFE SATISFACTION N = 160			ESTIMATED LIFE SATISFACTIONB ONLY N = 157		
Nation	**Mean**	**Rank**	**Nation**	**Mean**	**Rank**
Denmark	8.25	1	Denmark	8,3	1
Mexico	8.11	2	Mexico	8,1	2
Iceland	8.09	3	Switzerland	8,1	3
Switzerland	8.06	4	Iceland	8,1	4
Norway	8.03	5	Finland	8,0	5
Finland	8.01	6	Norway	8,0	6
Canada	7.95	7	Canada	7,9	7
Costa Rica	7.94	8	Costa Rica	7,9	8
Sweden	7.87	9	Sweden	7,9	9
Austria	7.79	10	Austria	7,8	10
Netherlands	7.76	11	Netherlands	7,8	11
New Zealand	7.71	12	Colombia	7,7	12
Colombia	7.67	13	Luxemburg	7,7	13
Luxembourg	7.67	14	New Zealand	7.7	14
Australia	7.62	15	Israel	7,6	15
Israel	7.61	16	Australia	7,6	16
United Arab Emirates	7.51	17	Belgium	7,5	17
Belgium	7.49	18	Panama	7,5	18
Germany	7.47	19	United Arab Emirates	7,5	19
Panama	7.46	20	Germany	7,5	20
Argentina	7.4	21	United Kingdom	7,4	21
United Kingdom	7.35	22	Argentina	7,4	22
Dominican Republic	7.28	23	Dominican Republic	7,3	23
Guatemala	7.27	24	Uruguay	7,3	24
Andorra	7,26	25	Guatemala	7,3	25
USA	7.26	26	Ireland	7.3	26
Ireland	7.26	27	USA	7,3	27
Uruguay	7.26	28	Nicaragua	7,2	28
Nicaragua	7.22	29	Uzbekistan	7,1	29
Uzbekistan	7.21	30	Brazil	7,1	30
Brazil	7.16	31	Qatar	7,1	31
Malta	7.12	32	Malta	7,1	32
Qatar	7.12	33	Slovenia	7,1	33
Slovenia	7.10	34	Equator	7,0	34

Trinidad and Tobago	7.06	35	Poland	7,0	35
Ecuador	7.02	36	El Salvador	7,0	36
Singapore	7.02	37	Chile	7,0	37
Poland	7.02	38	Singapore	7,0	38
Chile	6.99	39	Philippines	6,9	39
El Salvador	6.98	40	Spain	6,9	40
Spain	6.94	41	Surinam	6,9	41
Philippines	6.92	42	Cech Republic	6,9	42
Surinam	6.90	43	Slovakia	6,9	53
Czech Republic	6.87	44	Thailand	6,9	44
Slovakia	6.86	45	Pakistan	6,8	45
Thailand	6.86	46	Peru	6,8	46
Paraguay	6.84	47	Kuwait	6,8	47
Hong Kong	6.81	48	Romania	6,8	48
Kuwait	6.80	49	Venezuela	6,8	49
Venezuela	6.78	50	Paraguay	6,8	50
Romania	6.78	51	Hong Kong	6,8	51
Peru	6.76	52	Bolivia	6,7	52
Pakistan	6.76	53	Italy	6,7	53
Taiwan	6.74	54	Cyprus	6,7	54
Bolivia	6.74	55	France	6,7	55
France	6.72	56	Honduras	6,7	56
Kazakhstan	6.71	57	Mauritius	6,7	57
Honduras	6.71	58	Kazakhstan	6,7	58
Italy	6.67	59	Taiwan	6,7	59
Cyprus	6.67	60	Kyrgyzstan	6,6	60
Mauritius	6.67	61	China	6,6	61
Kyrgyzstan	6.65	62	Malaysia	6,6	62
Estonia	6.61	63	Estonia	6,6	63
Malaysia	6.60	64	Libya	6,5	64
China	6.56	65	Latvia	6,5	65
Latvia	6.51	66	Saudi Arabia	6,5	66
Belarus	6.46	67	Belarus	6,5	67
Saudi Arabia	6.45	68	Indonesia	6,4	68
Belize	6.44	69	Croatia	6,4	69
Japan	6.44	70	Bahrein	6,4	70
Bahrein	6.43	71	Belize	6,4	71
Indonesia	6.42	72	Jamaica	6,4	72
Korea (South)	6.39	73	Turkmenistan	6,4	73
Turkmenistan	6.37	74	Japan	6,4	74
Jamaica	6.37	75	South Korea	6,4	75
Croatia	6.35	76	Bosnia Herzegovina	6,3	76
Montenegro	6.28	77	Montenegro	6,3	77
Bosnia Herzegovina	6.27	78	Somalia	6,2	78
Libya	6.25	79	Hungary	6,2	79
Somalia	6.20	80	Lithuania	6,2	80
Lithuania	6.19	81	Bangladesh	6,1	81

Hungary	6.19	82	Jordan	6,1	82
Bangladesh	6.11	83	Azerbaijan	6.1	83
Moldova	6.11	84	Bhutan	6.1	84
Portugal	6.10	85	Moldova	6,1	85
Bhutan	6.10	86	Mongolia	6.1	86
Mongolia	6.09	87	Portugal	6,1	87
Jordan	6.09	88	Vietnam	6,0	88
Azerbaijan	6.05	89	Russia	6,0	89
Russia	6.01	90	South Africa	6,0	90
Viet Nam	5.97	91	Turkey	5,9	91
South Africa	5.97	92	Greece	5,9	92
Turkey	5.95	93	Laos	5.9	93
Serbia	5.94	94	Serbia	5,9	94
Greece	5.93	95	Macedonia	5,8	95
Laos	5.91	96	Lebanon	5,8	96
Lebanon	5.84	97	Tajikistan	5,8	97
Tajikistan	5.80	98	Morocco	5,8	98
North Macedonia	5.80	99	Albania	5,7	99
Gambia	5.80	100	Algeria	5.7	100
Morocco	5.76	101	Swaziland	5.7	101
Algeria	5.73	102	Myanmar	5,6	102
Albania	5.70	103	Mauritania	5.6	103
Swaziland	5.67	104	Namibia	5,6	104
Namibia	5.64	105	Ghana	5,5	105
Mauritania	5.58	106	Nigeria	5,5	106
Myanmar	5.57	107	India	5.4	107
Ghana	5.48	108	Georgia	5.4	108
Nigeria	5.45	109	Cambodia	5.4	109
Ethiopia	5.44	110	Djibouti	5.4	110
Nepal	5.44	111	Ethiopia	5.4	111
Djibouti	5.41	112	Iran	5,4	112
Sri Lanka	5.38	113	Nepal	5.4	113
Georgia	5.38	114	Sri Lanka	5,4	114
India	5.37	115	Egypt	5,4	115
Iran	5.36	116	Angola	5,3	116
Egypt	5.36	117	Cameroon	5,3	117
Cambodia	5.35	118	Gabon	5,3	118
Palestine	5.34	119	Ivory Coast	5,3	119
Gabon	5.33	120	Senegal	5,3	120
Angola	5.31	121	Palestine	5,3	121
Cote D Ivoire	5.30	122	Bulgaria	5,3	122
Senegal	5.26	123	Armenia	5.2	123
Bulgaria	5.25	124	Comoros	5.2	124
Cameroon	5.25	125	Congo Kinshasa	5.2	125
Congo (Kinshasa)	5.25	126	Guinea	5,2	126
Lesotho	5.25	127	Lesotho	5,2	127
Haiti	5.23	128	Malawi	5,2	128

Armenia	5.21	129	Sudan	5,2	129
Comoros	5.19	130	Haiti	5.2	130
Tunisia	5.19	131	Tunisia	5,2	131
Sudan	5.17	132	Chad	5.1	132
Malawi	5.15	133	Congo (Brazzaville)	5,1	133
Guinea	5.15	134	Kenya	5,1	134
Sierra Leone	5.14	135	Sierra Leone	5,1	135
Congo (Brazzaville)	5.14	136	Ukraine	5,1	136
Chad	5.14	137	Zambia	5,1	137
Kenya	5.12	138	Rwanda	5,0	138
Zambia	5.08	139	Burkina Faso	5,0	139
Ukraine	5.06	140	Mali	5,0	140
Mozambique	5.05	141	Mozambique	5,0	141
Uganda	5.04	142	Uganda	5,0	142
Rwanda	5.02	143	Niger	4,9	143
Mali	5.02	144	Iraq	4,9	144
Burkina Faso	4.96	145	Yemen	4,8	145
Niger	4.94	146	Zimbabwe	4,8	146
Iraq	4.89	147	Benin	4,6	147
Yemen	4.81	148	Botswana	4,6	148
Zimbabwe	4.79	149	Madagascar	4,6	149
Benin	4.63	150	Afghanistan	4,5	150
Botswana	4.57	151	Liberia	4.5	151
Madagascar	4.57	152	Syria	4,5	152
Syria	4.55	153	Central African Rep.	4,4	153
Afghanistan	4.53	154	South Sudan	4,4	154
Liberia	4.49	155	Togo	4,4	155
South Sudan	4.41	156	Burundi	3,2	156
Togo	4.41	157	Tanzania	3,8	157
Central African Rep.	4.4	158			
Burundi	4.24	159			
Tanzania	3.82	160			

Count at 31-8-2021. Data on the 2010-2019 period becoming available after this date will be included in the latest version of the rank report of average happiness in nations at: https://worlddatabaseofhappiness-archive.eur.nl/hap_nat/findingreports/RankReport_AverageHappiness.php

Missing cases for Estimated only: Andorra, Trinidad and Tobago

Table 13

Variance in average happiness in nations explained by societal characteristics

in 57 nations in the 2010s for which all variables are available

Characteristics of society	**Correlation with happiness**		
	Observed life-satisfaction	Estimated life-satisfaction from fitted	
		Affect + Contentment	Contentment only
RGDP_2010-2-19	+.25	+.52	+.47
RuleLaw_2020	+.23	+.45	+.42
FreePress3_2021	+.31	+45	+.40
FreeTravel_2014	+.18	+.35	+.35
GovernmentQuality_2016	+.23	+.48	+.44
Explained variance: R^2	52%	68%	55%

Data: States of Nations

Figure 1

Generalized Pairs Plot of the three measures of average happiness in nations:
1) overall happiness, 2) hedonic level of affect, 3) contentment

The plots in the diagonal represent the density distribution of each variable, the upper diagonal show the correlation between two variables and the lower diagonal show the scatterplot between two variables. The x represents the variable on the top of the plot and the y axis represents the variable on the right of the plot.

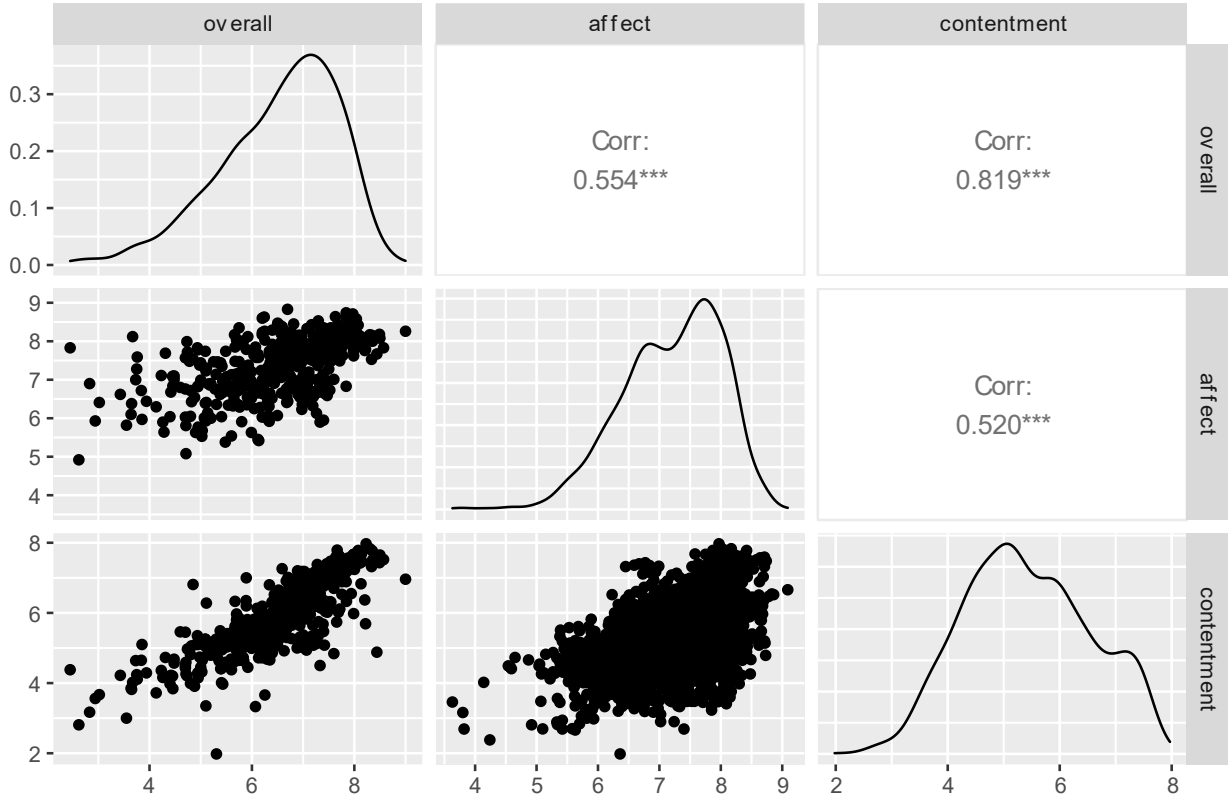


Figure 2
Distribution of the residuals according to each model

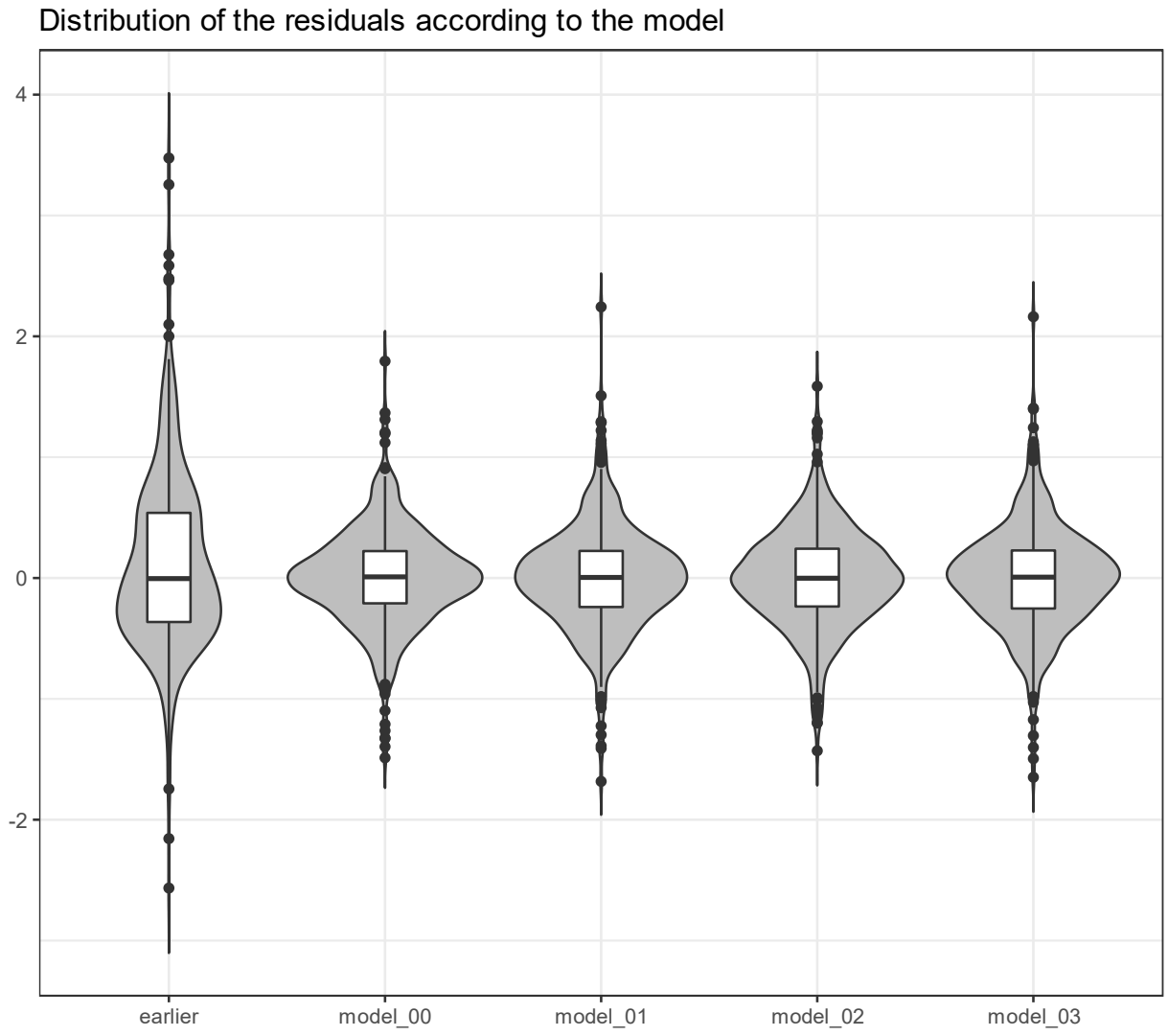
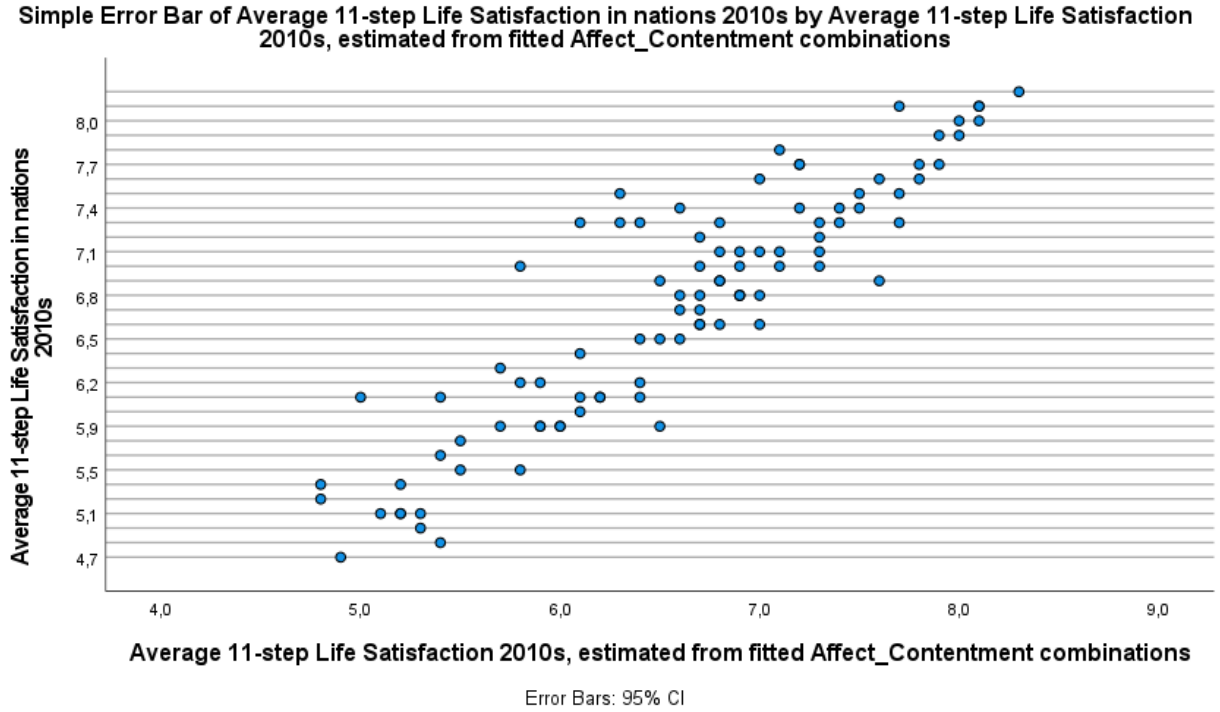


Figure 3

Plot of observed life-satisfaction (vertical) against estimated life-satisfaction (horizontal)

In 96 nations in the 2010s. Ratings on numerical 0-10 scale



Data table 11, columns 2 and 3

Figure 4

Histogram of differences between observed and estimated average life-satisfaction

In 96 nations in the 2010s. Ratings on numerical 0-10 scale

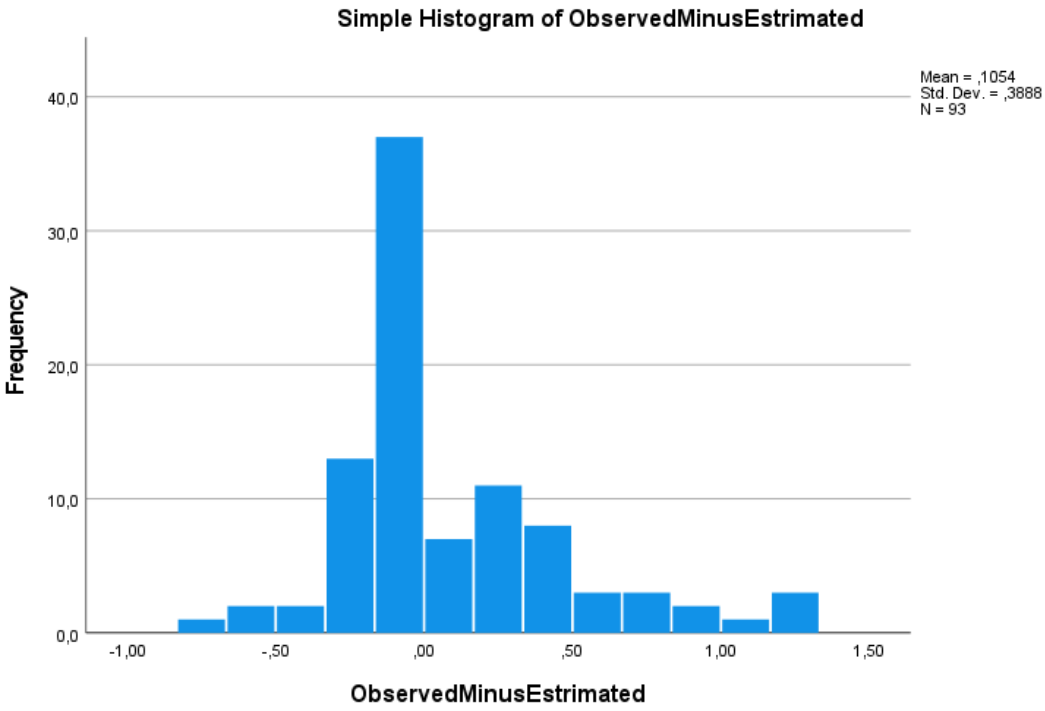


Figure 5

Histogram of differences between observed and estimated *rank* of life-satisfaction

In 96 nations in the 2010s. Ratings on numerical 0-10 scale