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Happy Planet Index 2016
Methods Paper

The Happy Planet Index (HPI) is a measure of sustainable wellbeing. It compares how efficiently residents of different countries are using natural resources to achieve long, high wellbeing lives.

Equation 1 illustrates, approximately, how HPI scores are calculated.

Equation 1: Happy Planet Index (approximate)

$$\text{Happy Planet Index} \approx \frac{(\text{Life expectancy} \times \text{Experienced wellbeing}) \times \text{Inequality of outcomes}}{\text{Ecological Footprint}}$$

Note: The equation is approximate because it leaves out the statistical adjustments described fully in Equation 6.

In essence, to calculate HPI scores we begin by multiplying the mean life expectancy of residents of a given country by mean experienced wellbeing of residents in the same country. Unlike in previous releases, in the 2016 release we have adjusted the main results to reflect inequalities in the distribution of experienced wellbeing and life expectancy within the population of each country. This gives us the number of inequality-adjusted Happy Life Years experienced by a typical resident in each country.[1]

We then divide the average number of inequality-adjusted Happy Life Years achieved in each country by that country's Ecological Footprint per capita, to reveal the average number of inequality-adjusted Happy Life Years produced per unit of demand on the natural environment from the country's residents.

Box A: Overview of components of the Happy Planet Index

The Happy Planet Index is calculated for a given country by combining:

Life expectancy: the average number of years an infant born in that country is expected to live if prevailing patterns of age-specific mortality rates at the time of birth in the country stay the same throughout the infant's life.[2] Life expectancy is commonly used as an overall indicator of the standard of health in a country.

Experienced wellbeing: the average of all responses from within the population to the following question: "Please imagine a ladder with steps numbered from zero at the bottom to 10 at the top. Suppose we say that the top of the ladder represents the best possible life for you; and the bottom of the ladder represents the worst possible life for you. On which step of the ladder do you feel you personally stand at the present time, assuming that the higher the step the better you feel about your life, and the lower the step the worse you feel about it? Which step comes closest to the way you feel?" This measure of wellbeing is commonly used as an indicator of how people's lives are going overall.

Inequality of outcomes: a measure of how unequal the distribution of life expectancy and experienced wellbeing scores are within a particular country. The inequality of outcomes measure is the difference in the product of mean life satisfaction and mean experienced wellbeing, and the product of inequality-adjusted life satisfaction and inequality-adjusted experienced wellbeing, expressed as a percentage. The methods used to calculated inequality-adjusted life satisfaction and inequality-adjusted experienced wellbeing are described later in this paper.

Ecological Footprint: the average amount of land needed, per head of population, to sustain a typical country's consumption patterns. It includes the land required to provide the renewable resources people use (most importantly food and wood products), the area occupied by infrastructure, and the area required to absorb CO_2 emissions. Crucially it is a measure of consumption, not production. This means that, for example, the CO_2 associated with the manufacture of a mobile phone made in China but bought by someone living in Chile, will count towards Chile's Ecological Footprint, not China's. Ecological Footprint is expressed using a standardized unit: global hectares. A global hectare (gha) is a biologically productive hectare with world average productivity in a given year.[3]

The precise formula used to calculate HPI scores requires some technical adjustments to be made, to ensure that no single component dominates overall HPI scores (see 'Calculating the Happy Planet Index scores' below).

In addition, obtaining the data we needed to calculate HPI scores for every country in the world is challenging. Where it has been possible to impute missing data points robustly, we have done so.

The rest of this paper describes how data for each component of the HPI was prepared, how imputing was carried out to fill data gaps, and how the components were brought togheter to calculate the final HPI scores for all 140 countries.

Components of the Happy Planet Index

This section describes in detail how each component of the HPI is calculated. The following section explains how these components are brought together into the overall HPI score for each country.

Data period

HPI scores ultimately express the relationship between the components from which the Index is constructed. To ensure consistency, we have used data collected in 2012 for each of the components, except where noted.[4] This is because the most recent Ecological Footprint data currently available is for 2012. Therefore, HPI scores relate to circumstances of countries in 2012, and should be interpreted with caution as a guide to current circumstances.

Life expectancy

Life expectancy reflects the number of years an infant born in a country is expected to live if prevailing patterns of age-specific mortality rates in the country at the time of the infant's birth stay the same throughout the infant's life.[5] Life expectancy figures are calculated using 'life tables' which are based on mortality rates for different age groups within a country. We used life expectancy data for the year 2012, prepared by the Population Division of the Department of Economic and Social Affairs of the United Nations.[6] The data is 2015-consistent, which means it is the most up-to-date estimate of 2012 life expectancy data available. The UN Population Division (UNPD) revises the life expectancy data and tables every two years. The next revision will be in 2017.

Experienced wellbeing

We used data on experienced wellbeing drawn from responses to the ladder of life question collected as part of the 2012 Gallup World Poll,[7] which asks samples of around 1,000 individuals aged 15 or over in each of more than 150 countries[8] the following question:

> *Please imagine a ladder with steps numbered from zero at the bottom to 10 at the top. Suppose we say that the top of the ladder represents the best possible life for you; and the bottom of the ladder represents the worst possible life for you. On which step of the ladder do you feel you personally stand at the present time, assuming that the higher the step the better you feel about your life, and the lower the step the worse you feel about it? Which step comes closest to the way you feel?*[9]

Gallup weights the responses to correct for unequal selection probability, nonresponses, and to match the national demographics of each country.

In some countries, Gallup was unable to produce a representative sample of residents. This was typically either because of political instability in certain regions of the country which made carrying out surveys in those regions impossible, or because migrants make up a large proportion of the population, but were not included in the sample. We excluded 17 countries where more than 10% of residents in the country were not included in the sampling frame.[10]

While we were able to obtain mean experienced wellbeing scores from 2012 for most countries, for 16 countries[11] there was no data on experienced wellbeing for 2012. For seven of those countries, we used data from within two years either side of 2012[12] to estimate experienced wellbeing in 2012, assuming a linear trend and in three countries we used data from within five years either side of 2012 to do the same.[13] For example, if mean experienced wellbeing in one country was five out of ten in 2011, and eight out of ten in 2014, we estimated it to be six out of ten in 2012. In six countries, only one experienced wellbeing score within two years of 2012 was available, so we used that as our estimated figure without any adjustments.[14] Details are shown in the Appendix.

We were keen to include Vanuatu in our dataset, because, based on an estimated life satisfaction score, Vanuatu came top of the first HPI produced in 2006,[15] and the country's government has since given significant attention to the wellbeing of its population. Its remote location means that the Gallup World Poll has never been conducted in Vanuatu. However, in 2013, as part of the Pacific Living Standards Survey, 3,295 respondents in Vanuatu were asked the same question as that included in the Gallup World Poll in a survey which we have assessed as being conducted with similar methodological rigour to the Gallup survey. We have used this survey data to generate a mean experienced wellbeing score for Vanuatu.[16]

Adjusting for inequality

In previous releases, HPI scores were calculated using mean life expectancy and mean experienced wellbeing scores. Using the mean tells us something about the extent of economic inequality within countries, because we know that countries that are economically more equal tend to have higher mean life expectancy and higher mean experienced wellbeing scores.[17] [18] However, this year, we have adjusted for inequalities in life expectancy and experienced wellbeing.

Why adjust for inequality?

Inequalities in life expectancy and inequalities in experienced wellbeing are much less extreme than inequalities in income. However, we believe that it's important to reflect the distributions that lead to a particular mean. For example, consider two hypothetical countries: in country A, half the population has a life expectancy of 70 and half the population has a life expectancy of 60. In country B, half the population has a life expectancy of 80, and half the population has a life expectancy of 50. In both countries, the mean life expectancy would be 65. But political philosophers such as John Rawls[19] and economists such as Anthony Atkinson,[20] have long argued that 'social welfare' (which is ultimately what we are measuring) is dependent on the distribution of an outcome, not just the average. Rawls' logic is simple – imagine you are an unborn foetus choosing which of the two countries you would like to be born into, but you don't know which half of the population you will be born into. Most people would prefer country A – where there is less uncertainty of the outcome, because there is less inequality. In other words our social welfare function should give country A a higher score than country B.[21] Adjusting for inequality in life expectancy and in experienced wellbeing scores allows us to reflect that.

Overall approach

Two sets of calculations are outlined in the below sections. Firstly, we calculated inequality-adjusted life expectancy, and inequality-adjusted experienced wellbeing. These components were directly used in the HPI calculations.

Secondly, we created an 'inequality of outcomes' measure which provides an assessment of the combined impact of these two adjustments. This is reported on the HPI website, but is not directly used in the final HPI calculations.

Inequality-adjusted life expectancy

Inequality-adjusted life expectancy is the mean life expectancy of residents of a country, adjusted to reflect inequalities in the distribution of expected length of life within a national population. The inequality adjustment effectively adjusts the average life expectancy score of countries downwards, to a greater extent where the distribution in life expectancy is more unequal, and to a lesser extent where the

distribution in life expectancy is more equal. In a country where every resident was expected to live until the same age, average life expectancy wouldn't be adjusted downwards at all.

The UN Development Programme (UNDP) calculates inequality-adjustments for life expectancy.[22] However, at the time of writing, the UNDP's calculations did not use the latest life tables produced by the UNPD. This is relevant as life tables go through revisions which lead to estimates for earlier years being changed, and because the figures we had for average life expectancy were based on the latest UNPD data, so-called '2015-consistent'. We therefore had to calculate inequality adjustments ourselves, using the UNDP's methodology.

Calculating Atkinson Index for life expectancy

The methodology involves calculating a measure of inequality called the Atkinson Index, [23] based on life expectancy figures. The methodology and parameters used by the UNDP is in effect equivalent to calculating the difference between the geometric mean of life expectancy in a country and the arithmetic mean of life expectancy (Equation 2).[24]

Equation 2: Atkinson Index

$$\text{Atkinson Index of life expectancy} = 1 - \frac{\text{Geometric mean of life expectancy}}{\text{Mean life expectancy}}$$

To calculate this difference, we used the 2015-consistent life tables for the period 2010-2015,[25] prepared by the UNPD, which uses data about the number of people in a population and the number of deaths (or the age-specific death rates) within a certain time period. These life tables are not calculated for every calendar year, but rather for five year periods, hence we used abridged lifetables for the years 2010-2015 (which includes data for 2012).

The life tables allowed us to calculate both the geometric mean of life expectancy for the years 2010-2015, and the arithmetic mean, and hence the Atkinson Index.

Calculating inequality-adjusted life expectancy

Finally, we calculated the inequality-adjusted life expectancy score for each of the countries by bringing together its Atkinson Index (calculated for 2010-2015) and mean life expectancy (for 2012) (see Equation 3).

Equation 3: Inequality-adjusted life expectancy

Inequality-adjusted life expectancy =
(1-Atkinson Index of life expectancy) × Mean life expectancy

Inequality-adjusted experienced wellbeing

Inequality-adjusted experienced wellbeing is the mean experienced wellbeing of residents of a country, adjusted to reflect inequalities in the distribution of experienced wellbeing within the population. The inequality adjustment effectively adjusts the average experienced wellbeing scores of countries downwards, to a greter extent where the distribution in experienced wellbeing is more unequal, and to a lesser extent where the distribution in experienced wellbeing is more equal. In a country where every resident has the same experienced wellbeing score, average experienced wellbeing wouldn't be adjusted downwards at all. Inequality-adjusted experienced wellbeing therefore has an analogous relationship to mean experienced wellbeing as inequality-adjusted life expectancy has to mean life expectancy.

Atkinson Index for experienced wellbeing

As with life expectancy, we used Atkinson Indices to adjust each country's mean experienced wellbeing to reflect inequality in scores within the population. However, we didn't have access to the full distribution of experienced wellbeing data, which we required to calculate the Atkinson Index. Therefore, we used a regression model to estimate Atkinson Indices for each country.

Using Gallup World Poll data from 2011, for which we had access to the full distributional data for experienced wellbeing and were therefore able to calculate Atkinson Indices, we generated a regression model using the standard deviation of experienced wellbeing for each country, mean experienced wellbeing scores, and a quadratic term for mean experienced wellbeing[26] to model the Atkinson Indices of experienced wellbeing in 2011. The model had an R^2 of 0.95, meaning that we were able to estimate the actual Atkinson Indices with an accuracy of 95%.

We then applied the model to the 2012 experienced wellbeing data to estimate Atkinson Indices from means and standard deviations. Where possible, we sourced 2012 standard deviation scores for the Gallup World Poll.[27] In 26 cases, standard deviations were not available for 2012, in which case we used standard deviations from alternative years (see Appendix). For 17 countries, we used standard deviations from 2011.[28] In five cases, we used standard deviations from 2010 – 2006.[29] However, we suspect that it is unlikely that standard deviations will have changed significantly in the interim.

For three countries[30] we were unable to obtain any standard deviations from earlier years. In these instances, we estimated the Atkinson Index for experienced wellbeing using a linear regression model based on variables known to predict experienced wellbeing inequality. We generated the model using data from the countries where the standard deviation of experienced wellbeing was available using a stepwise methodology where many potential variables were considered in parallel to find the model which best predicted the Atkinson Index.[31] We used the four variables that we found to be significant: mean experienced wellbeing, the logarithm of GDP per capita (Purchasing Power Parity),[32] the World Bank measure on control of corruption, [33] and a dummy variable for countries in Latin America.[34] The model has an R^2 of 0.62, indicating that 62% of the variation in Atkinson indices could be predicted by these four variables.[35]

Finally, for Vanuatu, which is not surveyed by Gallup World Poll, we used 2013 data from the Pacific Living Standards Survey, which was also the source of the estimate of mean experienced wellbeing for the country, as described earlier.

Calculating inequality-adjusted experienced wellbeing

The inequality-adjusted experienced wellbeing score for each country was calculated from the Atkinson Index using the same approach as described for inequality-adjusted life expectancy, as described above, substituting life expectancy data with experienced wellbeing data (Equation 4).

Equation 4: Inequality-adjusted experienced wellbeing

Inequality-adjusted experienced wellbeing =

(1−Atkinson Index of experienced wellbeing) × Mean experienced wellbeing

Inequality of outcomes measure

To provide an assessment of the combined impact of these two adjustments, we also calculated an ‘inequality of outcomes’ measure. This is the difference between the product of mean life satisfaction and mean experienced wellbeing, and the product of inequality-adjusted life satisfaction and inequality-adjusted experienced wellbeing, expressed as a percentage (Equation 5). As noted earlier, this measure was not used in the final HPI calculations.

Equation 5: Inequality of outcomes

$$\text{Inequality of outcomes} = 1 - \left(\frac{\text{Inequality-adjusted life expectancy x Inequality-adjusted experienced wellbeing}}{\text{Mean life expectancy x Mean experienced wellbeing}}\right)$$

Ecological Footprint

For 133 of the 140 countries included in the HPI results, we used 2012 Ecological Footprint data (the latest available data), published in the 2016 Edition of the Global Footprint Network's *National Footprint Accounts*.[36] For seven countries not included within these accounts (see Appendix),[37] we estimated the Ecological Footprint using a predictive model generated by undertaking stepwise linear regressions of Ecological Footprint (for all countries where data were available) against a range of country specific variables. The model included the following variables: GDP per capita (Purchasing Power Parity), CO_2 emissions per capita, imports per capita (in United States Dollars), exports per capita (in United States Dollars), exports of manufactured goods per capita (in United States Dollars), the inverse logarithm of population density, and dummy variables indicating whether the country's main population centres are in either in arctic or tropical latitudes. We drew all these variables from the World Bank Development Indicators data,[38] except for the latitudes which were based on the latitude of the largest city in the country, as reported in Wikipedia. We used 2012 data on GDP and population, and the latest data on CO_2 emissions, imports and exports, which were for 2011.

This model had an R^2 of 0.91, meaning that we were able to explain 91% of the variation in Ecological Footprint based on these seven variables.

Calculating the Happy Planet Index scores

As noted earlier, when all the components are brought together.to create final HPI scores, some technical adjustments are made to ensure that no single component dominates the overall score.

We begin by adjusting the inequality-adjusted experienced wellbeing scores so that their coefficient of variance is equivalent to the coefficient of variance of the inequality-adjusted life expectancy scores. In effect, this involves subtracting a constant from the inequality-adjusted experienced wellbeing of each country (α in Equation 6 below). By doing so, we ensure that each of these two variables contribute the same amount of variance to the product term, which is inequality-

adjusted Happy Life Years,Thjs can be understood as ensuring that the Happy Life Years measure is equally sensitive to changes in inequality-adjusted life expectancy and inequality-adjusted experienced wellbeing.

Then, we adjust the Ecological Footprint scores so that their coefficient of variance is equivalent to that of the Happy Life Years measure. Again, this is done by adding a constant to the Ecological Footprint (β in Equation 6). This can be understood as ensuring that the overall Happy Planet Index score is equally sensitive to changes in the Happy Life Years measure and in the Ecological Footprint.

We also incorporate two scaling constants (ϕ and π in Equation 6), such that an HPI score of 100 would indicate excellent performance on all three indicators: namely an inequality adjusted life expectancy of 85 years, a maximum score for inequality adjusted wellbeing (10/10) and an Ecological Footprint of 1.73 global hectares, which is the level of demand that is compatible with environmental sustainability (see Box C below; and. an HPI score of zero would indicate an inequality adjusted life expectancy of 25 years, a minimum score for inequality adjusted experienced wellbeing (0/10) and an Ecological Footprint of 16 global hectares, which is currently higher than any single country in the world.

The final formulat is shown in Equation 6.

Equation 6: Happy Planet Index

$$\text{Happy Planet Index}_{IA} = \Phi \times \frac{((\text{Experienced Wellbeing}_{IA} - \alpha \times \text{Life expectancy}_{IA}) + \pi)}{(\text{Ecological Footprint} + \beta)}$$

where: $_{IA}$ = inequality adjusted, $\alpha = 0.158$, $\beta = 2.067$, $\pi = 3.951$, $\Phi = 0.452$

Colour-coding the results

We colour-coded world maps using a traffic light system – red, amber and green – to give a visual representation of how each country scores on average life expectancy, average experienced wellbeing, inequality of outcomes, Ecological Footprint, and for the overall HPI scores. For each component, we calculated boundaries so that roughly one third of the 140 countries falls into each colour band. Countries where we were unable to access robust data for any of the three components are coloured grey in each component map.

Colour-coding the component maps

Experienced wellbeing map

The experienced wellbeing map is coloured as follows:

- Green: Mean experienced wellbeing is six or more on a scale from zero to ten (45 countries)
- Amber: Mean experienced wellbeing is more than five, but less than six (42 countries)
- Red: Mean experienced wellbeing is five or less (53 countries)

Note this map uses mean experienced wellbeing, rather than the inequality-adjusted figure.

Life expectancy map

The life expectancy map is coloured as follows:

- Green: Mean life expectancy at birth exceeds 75 years (50 countries)
- Amber: Mean life expectancy at birth is higher than 65 but less than 75 (55 countries)
- Red: Mean life expectancy at birth is less than 65 years (35 countries)

Note this map uses mean life expectancy, rather than the inequality-adjusted figure.

Inequality of Outcomes map

The inequality of outcomes map is coloured as follows:

- Green: Inequality of outcomes is less than 15% (38 countries)
- Amber: Inequality of outcomes is 15% to 30% (62 countries)
- Red: Inequality of outcomes is greater than 30% (40 countries)

Ecological Footprint map

The Ecological Footprint map is coloured as follows:

- Green: Ecological Footprint per capita is 1.73 global hectares or less, compatible with environmental sustainability (see Box B) (42 countries)
- Amber: Ecological Footprint per capita is more than 1.73 and less than 3.46 global hectares (46 countries)
- Red: Ecological Footprint per capita is more than 3.46 global hectares, equivalent to more than double the demand placed on the natural environment that is compatible with environmental sustainability (52 countries)

Box B: Global Hectares and environmental sustainability

A global hectare (gha) is a biologically productive hectare of land with world average productivity in terms of ability to provide the renewable resources people use (most importantly food and wood products), the area occupied by infrastructure, and the area required to absorb CO_2 emissions.[39]

The Global Footprint Networks has calculated that in 2012, 1.73 gha is available for each person living on Earth.[40] So if a country's Ecological Footprint per capita is more than 1.73 gha, the residents of that country are demanding more than is environmentally sustainable.

Colour-coding the Happy Planet Index map

We colour-coded the main HPI world map using nine colours ranging from green (for highest HPI score) to red (for lowest HPI score). We assigned colour bands by dividing the range of HPI scores by eight, then allocating countries to bands 2-9 in Table 1, depending on their scores. Band 1, denoted by dark green, represents an HPI score higher than any country actually achieved to make the point that there is room for improvement from even the highest ranking country.

Countries where we were unable to calculate an HPI score, due to lack of robust data, are coloured grey.

Table 1: Colour-coding the HPI map

Band	HPI Score	Number of countries
1 (Best – dark green)	>44.6	0
2	40.7 – 44.6	1
3	36.7 - 40.6	12
4	32.7 - 36.6	20
5	28.7 - 32.6	22
6	24.8 - 28.6	25
7	20.8 - 24.7	27
8	16.8 - 20.7	16
9 (Worst - red)	<16.8	17

Appendix

Data used when data from 2012 was not available for one or more components of the Happy Planet Index. Countries where all data from 2012 was available are not included in this table. All life expectancy data was from 2012.

Country	Experienced wellbeing (mean)	Experienced wellbeing (standard deviation)	Ecological footprint
Belize	2007 & 2014	2007	Imputed
Bhutan	2013	Imputed	Imputed
Burundi	2011 & 2014	2011	2012
Canada	2012	2011	2012
Cote d'Ivoire	2009 & 2013	2009	2012
Cyprus	2012	2011	2012
Czech Republic	2012	2011	2012
Denmark	2012	2012	2012
Djibouti	2011	2011	2012
Ethiopia	2012	2006	2012
Hong Kong	2012	2012	Imputed
Iceland	2012	2012	Imputed
Jamaica	2011 & 2013	2011	2012
Lesotho	2011	2011	2012
Liberia	2010 & 2014	2010	2012
Malta	2012	2012	Imputed
Mauritius	2011 & 2014	2011	2012
Montenegro	2012	2012	2012
Mozambique	2011	2011	2012
Myanmar	2012	2012	2012
Namibia	2007 & 2014	2007	2012
Oman	2011	2011	2012
Palestine	2012	2012	Imputed
Philippines	2012	2011	2012
Russia	2012	2011	2012
Sierra Leone	2011 & 2013	2011	2012
Slovenia	2012	Imputed	2012
Swaziland	2011	Imputed	2012

Country	Experienced wellbeing (mean)	Experienced wellbeing (standard deviation)	Ecological footprint
Thailand	2012	2011	2012
Togo	2011 & 2014	2011	2012
Trinidad and Tobago	2011 & 2013	2011	2012
Vanuatu	From Pacific Living Standards Survey	From Pacific Living Standards Survey	Imputed
Vietnam	2012	2011	2012

Endnotes

[1] The concept of 'happy life years' was originally developed in the work of Ruut Veenhoven, described as 'happy life expectancy'. See Veenhoven, R. (1996) Happy Life Expectancy: A comprehensive masure of quality-of-life in nations. *Social Indicators Research* 39:1-59.
[2] UNDP (2015) *Human Development Report 2015*. New York: United Nations. Retrieved from http://hdr.undp.org/sites/default/files/2015_human_development_report_1.pdf
[3] For more information on how Ecological Footprint is calculated, see http://www.footprintnetwork.org/en/index.php/GFN/page/methodology/
[4] See the Appendix for a full list of exceptions
[5] UNDP (2015) *Human Development Report 2015*. New York: United Nations. Retrieved from http://hdr.undp.org/sites/default/files/2015_human_development_report_1.pdf
[6] United Nations (n.d.) *World Population Prospects, the 2015 Revision: Population indicators*. Retrieved from: http://esa.un.org/unpd/wpp/Download/Standard/Population/
[7] We used Gallup World Poll data published in the World Database of Happiness http://worlddatabaseofhappiness.eur.nl/
[8] For five of the countries, around 500 respondents were surveyed (Republic of Congo, Cyprus, Haiti, Northern Cyprus and Surinam)
[9] Gallup (n.d.) *Understanding How Gallup Uses the Cantril Scale* [webpage]. Retrieved from http://www.gallup.com/poll/122453/understanding-gallup-uses-cantril-scale.aspx
[10] The countries excluded were: Qatar, United Arab Emirates, Central African Republic, Madagascar, Bahrain, Sudan, Kuwait, Libya, Saudi Arabia, Laos, Republic of Congo, Mali, Angola, Azerbaijan, Jordan, Moldova, Singapore
[11] Djibouti, Lesotho, Mozambique, Oman, Swaziland, Bhutan, Liberia, Jamaica, Sierra Leone, Trinidad and Tobago, Burundi, Cote d'Ivoire, Togo, Belize, Namibia, Mauritius
[12] Liberia, Jamaica, Sierra Leone, Trinidad and Tobago, Burundi, Togo, Mauritius
[13] Cote d'Ivoire, Belize, Namibia
[14] Oman, Bhutan, Djibouti, Mozambique, Lesotho, Swaziland.
[15] Marks, N., Abdallah, S., Simms, A. and Thompson, S. (2006) *The (un)Happy Planet Index.* London: New Economics Foundation.
[16] Data kindly supplied by Jamie Tanguay, Vanuatu National Statistics Office [JM – 'kindly supplied' suggests this was some sort of special favour, don't we want this to seem as official as possible?]
[17] Stoll, L., Michaelson, J. & Seaford, C. (2012) *Well-being evidence for policy: A review.* London: New Economics Foundation.
[18] Wilkinson, R. & Pickett, K. (2010) *The Spirit Level: Why Equality is Better for Everyone*. London: Penguin.
[19] Rawls, J. (1971) *A Theory of Justice.* Cambridge, Massachusetts: Belknap Press of Harvard University Press.
[20] Atkinson, A. B. (1970) 'On the measurement of inequality', *Journal of Economic Theory*, 2(3), 244-263.
[21] For more discussion on measuring inequalities in wellbeing, and implications for policy, see Quick, A. (2015) *Inequalities in wellbeing: Challenges and opportunities for research and policy.*London: New Economics Foundation. http://b.3cdn.net/nefoundation/e99d6e3014fff0356e_lqm6i2tiw.pdf
[22] United Nations Development Programme (n.d.) *Inequality-adjusted life expectancy index.* Retrieved from: http://hdr.undp.org/en/content/inequality-adjusted-life-expectancy-index on 11 Mar 2016.
[23] Atkinson, A (1970) *op cit*
[24] The geometric mean of a set of N numbers is calculated by multiplying them together and taking the Nth root. So the geometric mean of 6, 8, and 10 is the cube root of 6x8x10, which is 7.8 (the arithmetic mean would of course be 8). The Atkinson Index is equivalent to the difference between the geometric and arithmetic means when the parameter used in it's calculation (ε) is set to be 1, as the UNDP do and as we have done.
[25] United Nations (2015) World Population Prospects : The 2015 Revision. New York: United Nations. Retrieved from http://esa.un.org/unpd/wpp/Publications/Files/Key_Findings_WPP_2015.pdf
[26] The first model we generated did not include a quadratic term. However, we found a systematic relationship between the residuals calculated based on that model and mean experienced wellbeing, with the Atkinson Index for countries with high experienced wellbeing consistently estimated to be

lower than they really were. As a result, for example, the Atkinson Index for the Netherlands was estimated to be below 0, which is impossible.

[27] We used Gallup World Poll data reported in the World Database of Happiness http://worlddatabaseofhappiness.eur.nl/.

[28] Burundi, Canada, Cyprus, Czech Republic, Djibouti, Jamaica, Lesotho, Mauritius, Mozambique, Oman, Philippines, Russia, Sierra Leone, Thailand, Togo, Trinidad and Tobago, Vietnam

[29] Belize, Cote d'Ivoire, Ethiopia, Liberia, Namibia

[30] Bhutan, Slovenia, Swaziland.

[31] This was partly infomed by analysis into the determinants of wellbeing inequality in Quick A & Abdallah S (2016) 'Inequalities in wellbeing' in E Harrison, A Quick & S Abdallah (eds) *Looking through the wellbeing kaleidoscope* (London: NEF)

[32] World Bank (2015) *World Development Indicators 2015*. World Bank Publications. Retrieved from: https://openknowledge.worldbank.org/bitstream/handle/10986/21634/9781464804403.pdf

[33] World Bank (2014) *The Worldwide Governance Indicators*

[34] Other variables that were considered, but did not reach statistical significance in the model include: GDP per capita (PPP), the five other World Bank Governance measures, gender inequality, the Fraser Institute's measure of Economic Freedom, and dummy variables for 7 other regions.

[35] In the cases of Bhutan and Slovenia, average standard deviations for the period 2012-15 were published in the latest World Happiness Report (http://worldhappiness.report/ed/2016/) after we began our work using data from the World Database of Happiness. We have, in writing this methodology paper, modelled what the effect on our results would have been had we used these newest figures. We estimate that the new figure for Slovenia would not have made any difference to its overall HPI ranking. Had we used the new figure for standard deviation for Bhutan – which ranks it as the most equal country in the world in terms of wellbeing – we estimate that the country would have risen to 47th place instead of 56th in the overall HPI ranking.

[36] Global Footprint Network (8th March 2016) *Data and Results: National Footprint Accounts* [webpage]. Retrieved from http://www.footprintnetwork.org/en/index.php/GFN/page/footprint_data_and_results

[37] Belize, Bhutan, Hong Kong, Iceland, Malta, Palestine, Vanuatu. In the case of Bhutan, the National Footprint Accounts do offer an estimated footprint (4.8 g ha per capita), but another country-specific study estimated Bhutan's footprint to be 1.7 g ha per capita using local data sources (http://www.gnhc.gov.bt/wp-content/uploads/2015/03/Bhutans-Ecological-Footprint-Report.pdf). The key difference is in estimates of the use of firewood in the country. Given the uniqueness of Bhutan, and the Bhutanese government's strong protection laws regarding forestry, we suspect that some of the international data sources used in the National Footrprint Accounts have struggled to capture true consumption patterns in the country. As a result, we have chosen to estimate the country's footprint using the regression model – which gives Bhutan a footprint of 2.3 g ha).

[38] World Bank (2015) World Development Indicators 2015. World Bank Publications. Retrieved from: https://openknowledge.worldbank.org/bitstream/handle/10986/21634/9781464804403.pdf

[39] For more information on how Ecological Footprint is calculated, see http://www.footprintnetwork.org/en/index.php/GFN/page/methodology/

[40] Based on world average yield factors in 2012