

Measuring Well-Being beyond GDP: Pollution- and Education-Adjusted Healthy Lifetime Income Estimates for 175 Countries

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Abstract

We measure well-being across 175 countries using a novel indicator: Pollution- and Education-Adjusted Healthy Lifetime Income (PEHLI). This indicator goes beyond the mere consideration of per capita gross domestic product (GDP) and can be interpreted as the income of the average person in an economy during the years that they spend in good health, adjusted for education and pollution in the given country. Our study addresses how incorporating health, education, and environmental quality reshapes cross-country well-being assessments. Our analysis reveals significant differences in country rankings when compared to GDP-based measures. PEHLI ranks pollution-intensive countries lower and cleaner countries higher. Countries with better education levels in terms of attainment and opportunities also tend to rank higher under PEHLI. Across countries, incorporating health and education widens inequality, while incorporating pollution narrows it slightly; higher-latitude countries generally enjoy greater well-being. By adopting PEHLI, policymakers would gain a comprehensive framework for their decision-making processes that incorporates the well-being dimensions of health, longevity, education, and pollution into a single income-based measure.

Keywords: Well-Being; Beyond GDP; Healthy Lifetime Income; Education; SO₂ Emissions; Pollution

Introduction

Gross domestic product (GDP), which is the value of all the goods and services produced in a country in a given year, is often used as a key indicator of well-being (Fleurbaey, 2009). However, it has widely been criticized for its narrow focus on economic output, largely ignoring crucial factors such as health, education, pollution, and overall quality of life (Stiglitz et al., 2009; Stiglitz, 2018, 2019a, 2019b, 2020). This narrow focus renders per capita GDP (GDPpc) an inherently inadequate and incomplete measure for assessing well-being (Bloom et al., 2021; Fan et al., 2018; Lutz et al., 2021). Hence, a need exists to develop alternative measures that are broader in scope.

Many researchers have attempted to develop indicators to measure well-being that vary in complexity and in conceptual background. Broadly, two different approaches can be distinguished: subjective indicators of well-being such as life satisfaction, happiness, and life evaluations (e.g., the Cantril ladder score; Helliwell et al., 2021) are assumed to reflect the authentic self-assessment of people. At the other end of the spectrum, objective indicators of well-being tend to cover several dimensions of well-being mostly based on population-wide statistics such as life expectancy, income, and years of schooling. The most prominent of these multi-dimensional objective indicators is the Human Development Index (HDI), originally introduced by Haq (1995a, 1995b), which is composed of three elements: gross national income per person, life expectancy, and education. It combines the sub-indices created from these individual components using equal weights into a unified index that is used for a ranking of countries that should reflect their development status. Lutz et al. (2021) discuss seven desiderata that an indicator for progress in sustainable development shall exhibit, most importantly, that the dimensions chosen should be based on values shared across most cultures and sub-populations about what constitutes a good life and that the combinations of the different dimensions in one indicator should be theory driven and avoid arbitrary weighting schemes.

A host of indicators have been developed trying to address various shortcomings of existing measures such as the United Nations' Sustainable Development Goals (SDGs), the European Union's Sustainable Development Indicator (Bolcárová & Kološta, 2015;

Eurostat, 2021), China's SDG Index score (Xu et al., 2020), and Germany's National Welfare Index (Diefenbacher et al., 2010; Held et al., 2018). These indicators explicitly include important aspects of development such as poverty, the quality of the environment, and gender equality, underscoring the importance of observing trends in SDGs regionally and worldwide.

A specific group of objective indicators directly incorporates the length of human life measured by life expectancy – reflecting the fact that being alive is a necessary prerequisite for enjoying any quality of life – but also explicitly and meaningfully include other factors to reflect the view that mere survival is not considered enough. Bloom et al. (2021) proposed an indicator of economic well-being termed Inequality-adjusted Healthy Lifetime Income (IHLI). The indicator value is the product of income per capita, Healthy Life Expectancy at birth (HALE), and income equality as measured by the inverse Gini index. In contrast to the HDI, this construction does not rely on arbitrary weights and implies an immediate and straightforward economic interpretation of the indicator. In addition, the indicator is relatively easy to calculate and requires only a limited amount of macroeconomic data. In a similar vein, Zhang et al. (2023, 2025) first suggested using Healthy Lifetime Income (HLI), which is a subcomponent of IHLI (abstracting from the inequality component) to increase data coverage across countries, and subsequently simplified the framework by employing Lifetime Income (LI) and Inequality-adjusted Lifetime Income (ILI) to measure “high-quality development” and track progress toward “common prosperity” in China. Compared with IHLI, HLI is available for more countries globally and can be implemented over a much longer time period. Another indicator called Years of Good Life (YoGL) takes life expectancy rather than income as the main metric variable but only considers those years as good years in which people are out of poverty, without physical and cognitive limitations, and are also above a minimum level of life satisfaction (Lutz et al., 2021). This indicator has the unique advantage that it is not dependent on national accounting and thus can be calculated bottom-up from any sub-population of interest.

None of the above-described indicators, however, explicitly takes environmental factors (e.g., pollution) into account. Some, such as YoGL, are designed to reflect

feedbacks from environmental change in their long-term forecasts, which requires systems modelling to capture those future feedbacks. IHLI and HLI, in addition, do not consider education (see also Graham et al., 2018, and Holdren, 2008, who highlight the importance of education and environmental sustainability for well-being). Meanwhile, many indicators based on the SDGs are usually associated with heavy and demanding data requirements, making their construction technically complex and resource-intensive. In addition, employing these indicators usually also requires imposing arbitrary explicit or implicit weights on the different sub-indicators when they are used as a guide for policymaking. Finally, some components of these indicators are particularly difficult to assess objectively.

To address these shortcomings, we propose the new Pollution- and Education-adjusted Healthy Lifetime Income (PEHLI) indicator, inspired by Bloom et al. (2021); and Zhang et al. (2023; 2025), as an alternative. This indicator extends previous measures to include education and pollution in a systematic and consistent way and in a single number. PEHLI has an intuitive economic interpretation; is comparatively easy to calculate; does not pose burdensome demands on data collection; and comprises the following highly important dimensions of human well-being: income, health, longevity, education, and pollution. With statistical agencies already “stretched thin” maintaining GDP and inflation data (Coyle, 2025; Dynan, 2025), PEHLI provides a practical and accessible public-data-based way to capture well-being without straining statistical systems. In terms of contribution, our study introduces, for the first time, this comprehensive new indicator and calculates it for 175 countries in the world for the year 2019. In addition, we provide the sub-indicators Healthy Lifetime Income (HLI), Education-adjusted Healthy Lifetime Income (EHLI), and Pollution-adjusted Healthy Lifetime Income (PHLI) for the same set of countries to facilitate comparisons and to assess which dimension (environment- or education-adjustments) primarily drives certain changes in PEHLI as compared with HLI and other indicators, making it a useful tool for long-term international monitoring of human well-being.

Results

To ensure an accurate comparison among GDPpc, HLI, EHLI, PHLI, and PEHLI, we focus on 175 countries with complete data for all five indicators. Detailed computation procedures for these indicators are provided in the Materials and Methods section.

Comparison of GDPpc, HLI, EHLI, PHLI, and PEHLI

Figure 1 shows six world maps: (A) the differences in country rankings when using PEHLI versus GDP per capita (PEHLI – GDPpc), and (B–F) the indicator values of PEHLI, GDPpc, HLI, EHLI, and PHLI, in which the different colors of the countries indicate the level of the corresponding indicator. Each map corresponds to one of the indicators, with green or blue colors signifying higher indicator values, white indicating no change, and red colors signifying lower indicator values. Figure 1(A) shows that the rankings of some countries did not change when switching between PEHLI and GDPpc, meaning these countries plausibly show very similar rankings in the other four maps, such as Germany, Luxembourg, and Uzbekistan. However, the rankings of some other countries differ depending on whether the focus is on pollution, education, or pollution and education combined. For example, the PEHLI map, which considers education and SO₂ emissions standardized by land area, shows Argentina, Australia, Canada, New Zealand, and the Russian Federation in better positions than they are on the HLI map. This reflects the fact that these countries have well-developed education systems and comparatively low SO₂ emissions per unit of land. Argentina and the Russian Federation both fare worse when only pollution is considered (PHLI) but better when education is included as well (EHLI). When pollution and education components are both included in PEHLI, these countries rank higher than in the HLI map. New Zealand is interesting because it fares better when both pollution and education are included. By contrast, the PEHLI map shows China in a worse position than it is on the HLI map suggesting that pollution is a challenge for this country and that there is still room for improvement in the education component. In Figure 1(A), China is shown in dark red, indicating a decline of 11 ranks when using PEHLI as compared to using GDPpc. India fares differently than China. It exhibits a decrease on the PHLI map, when the focus is on pollution but not on education. A similar result is visible

for Saudi Arabia suggesting that India and Saudi Arabia both face strong challenges with respect to pollution. Overall, higher-latitude countries generally enjoy greater well-being, supported by better education and longer healthy lives.

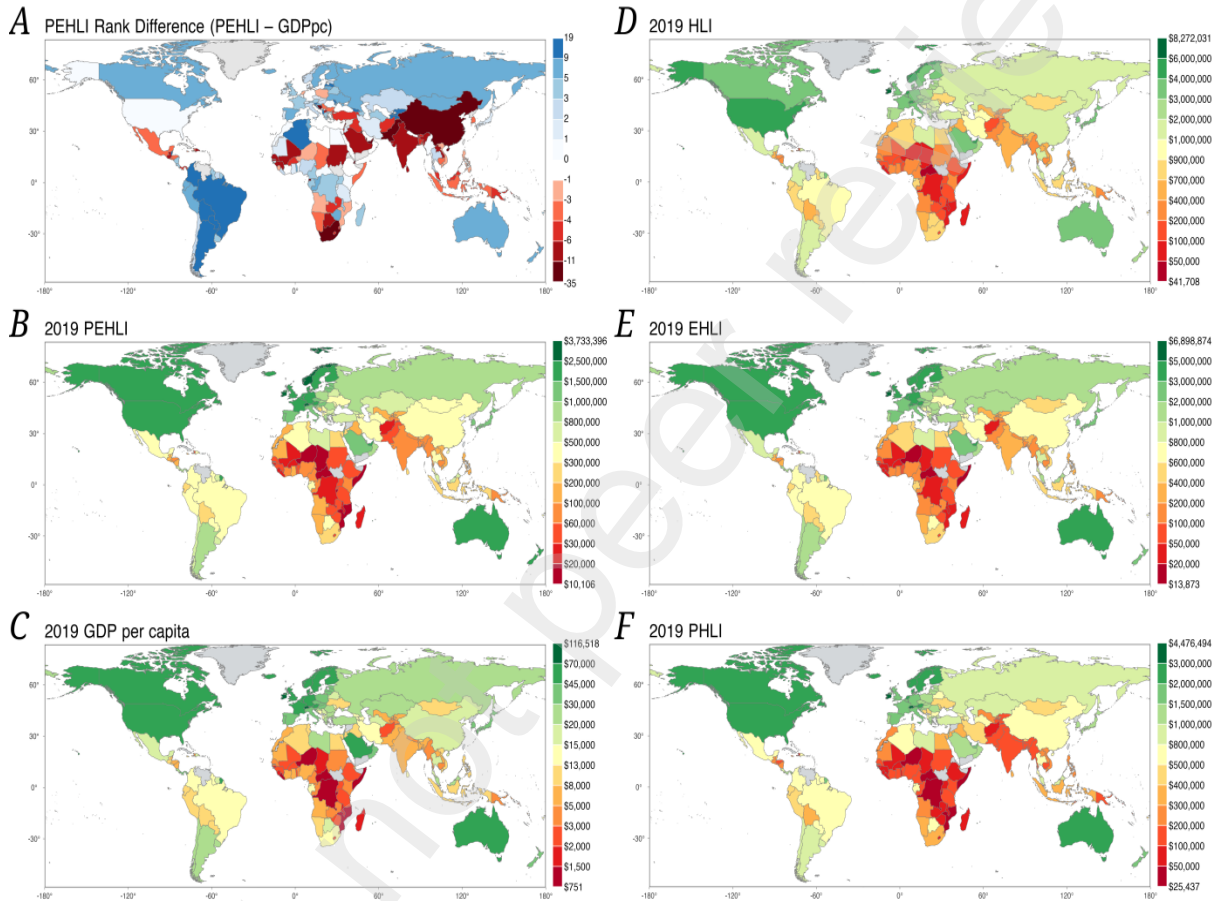


Figure. 1 Global distribution and comparison of the Healthy Lifetime Income (HLI) family of indicators and GDP per capita in 2019

Note: (A) Rank differences between PEHLI and GDP per capita (PEHLI - GDPpc); “-35 (min)”; “19 (max)”; “-1-0” = 0 only; “0-1” = 1 only.” (and so on); (B) Population- and education-adjusted HLI (PEHLI). (C) GDP per capita. (D) Healthy Lifetime Income (HLI). (E) Education-adjusted HLI (EHLI). (F) Pollution-adjusted HLI (PHLI). Countries and regions in gray indicate no data. All values are provided in 2017 international dollars.

Table A1 in the appendix displays the calculated values and the corresponding country rankings for HLI, EHLI, PHLI, and PEHLI for the year 2019. Highlighting the top performer, Luxembourg leads in all four indicators, reflecting a robust overall level of development due to high values in healthy lifetime income (encompassing the dimensions income and health), education, and the environment. Near the bottom, the Central African Republic has an HLI ranking of 174 and remains in that position after including education. When accounting for pollution, this only raises the Central African Republic by one place, to 173rd. Indeed, some low-income countries, even with a favorable environmental factor, change little in the ranking. This outcome illustrates that low values in income, health, and education sub-indicators at the same time limit the potential impact of a favorable environment on the overall ranking.

Shifting to the largest countries, when considering education and environmental factors, the United States moves up two places (from 9th to 7th), the Russian Federation moves up from 51st to 44th, and Brazil from 79th to 70th. Australia and Canada show similar ranking trends. Specifically, when considering education alone, Canada moves up from 19th to 17th, and Australia moves up from 18th to 16th. With the addition of the pollution factor, Canada rises to 10th place, and Australia rises to 12th place. By contrast, after considering education and pollution factors, China's ranking declines from 69th to 82nd place and India's drops from 120th to 126th. This pattern reflects the influence of environmental penalties on rankings. Even with the large territorial sizes of China and India, the very high SO₂ emissions lead to a decline in their rankings, notwithstanding that emissions are standardized by country size.

When considering SO₂ emissions in smaller nations, we notice that these nations are impacted more severely. This effect is particularly evident in land-limited and resource-dependent economies. For example, Singapore shows a substantial drop in the ranking (from 2nd to 19th place). After considering education and pollution factors, similar patterns emerge for the United Arab Emirates (from 7th to 20th place) and Qatar (from 4th to 21st place), suggesting that smaller, oil-rich countries share similar trends. All aspects considered, small countries with comparatively large industry and mining sectors are

especially vulnerable because of the high SO₂ emissions that are concentrated within limited land areas.

Table 1 presents the comparative descriptive statistics for GDPpc, HLI, EHLI, PHLI, and PEHLI in the year 2019. GDPpc is used as the benchmark, with subsequent indicators adding health, education, and pollution adjustments. Each indicator is analyzed based on its maximum, minimum, median, and mean values across countries as well as its median-to-mean ratio, the maximum-to-minimum ratio, the standard deviation, and the coefficient of variation (CV). All values are expressed in 2017 international dollars to ensure global comparability. A higher median-to-mean ratio suggests that well-being is more evenly spread across the countries in the world. This is because outliers at the right tail of the distribution affect the mean but not the median (Zhang et al., 2023). A higher maximum-to-minimum ratio illustrates more pronounced worldwide inequality, as it represents a larger disparity between the highest and the lowest values in the dataset. The CV, defined as the standard deviation divided by the mean, measures overall inequality in well-being with a lower CV indicating reduced cross-country disparity (Zhang et al., 2023).

Table 1. Descriptive Statistics of HLI, EHLI, PHLI, and PEHLI Metrics (2019)

	GDPpc	HLI	EHLI	PHLI	PEHLI
Maximum	116,518	8,272,031	6,898,874	4,476,494	3,733,396
Minimum	751	41,708	13,873	25,437	10,106
Maximum/Minimum	155	201	497	175	369
Median	13,463	856,708	607,494	453,748	329,354
Standard deviation	20,940	1,480,508	1,308,201	765,690	692,248
Mean	20,472	1,379,276	1,104,933	719,850	578,045
Median/Mean	0.658	0.621	0.550	0.630	0.570
Coefficient of variation	1.023	1.073	1.184	1.064	1.198

Source: Own calculations. The maximum-to-minimum ratio reflects the extent of extreme disparity across countries. The median-to-mean ratio measures the equality of well-being, indicating how evenly each indicator is distributed across the world—the higher the ratio, the more equal the distribution. The coefficient of variation (CV), calculated as the standard deviation divided by the mean, reflects the overall variability of each indicator. These measures are computed for GDPpc, HLI, EHLI, PHLI, and PEHLI.

In general, when considering pollution in the indicators (PHLI and PEHLI), this reduces dispersion as compared to situations in which only income (HLI) or income and education (EHLI) are considered. This is largely because SO₂ emissions are often lower in low-income countries than in industry-intensive high-income countries. With the incorporation of education (EHLI), the median-to-mean ratio drops to 0.550, indicating a wider gap between the most and least developed countries. The trends observed in the maximum-to-minimum ratio and in CV closely mirror those in the median/mean ratios, thereby providing a more comprehensive and policy-relevant illustration of how education and environmental factors affect development disparities. Across countries, incorporating health and education widens inequality, while pollution narrows it slightly.

Going from EHLI to PEHLI, the changes in the maximum-to-minimum ratio, the median-to-mean ratio, and the CV are not fully consistent. This indicates that while the gap between the highest- and lowest-performing countries narrowed slightly and the median countries moved closer to the mean, thereby reducing both extreme and median inequality, the overall variability across countries increased slightly, leading to a modest rise in variation (a higher CV).

Pollution Penalty Parameter α

The pollution sub-indicator and the role of the α parameter are described in detail in the Materials and Methods section. To perform a sensitivity analysis, we illustrate the change in the pollution sub-indicator derived from different values for α . This parameter represents a pollution “penalty” ranging from $\alpha=0.05$ to $\alpha=0.3$, as detailed in Table A7 in the appendix and in Figure 2, which illustrates the resulting variation and the overall impact of the pollution sub-indicator. When α is small, the pollution sub-indicator data for all countries tend to be comparatively similar. With a comparatively high value of α , the

environmental sub-indicator dominates all other aspects of well-being. Therefore, in the calculations contained in Table A6, we assume a value of $\alpha=0.2$, which is a balanced and pragmatic compromise between the two extreme cases. Overall, the parameter α is, of course, arbitrary and calls for empirical investigation in future research, for example, via surveys on the perceived importance of the environment or via willingness-to-pay studies to preserve the environment.

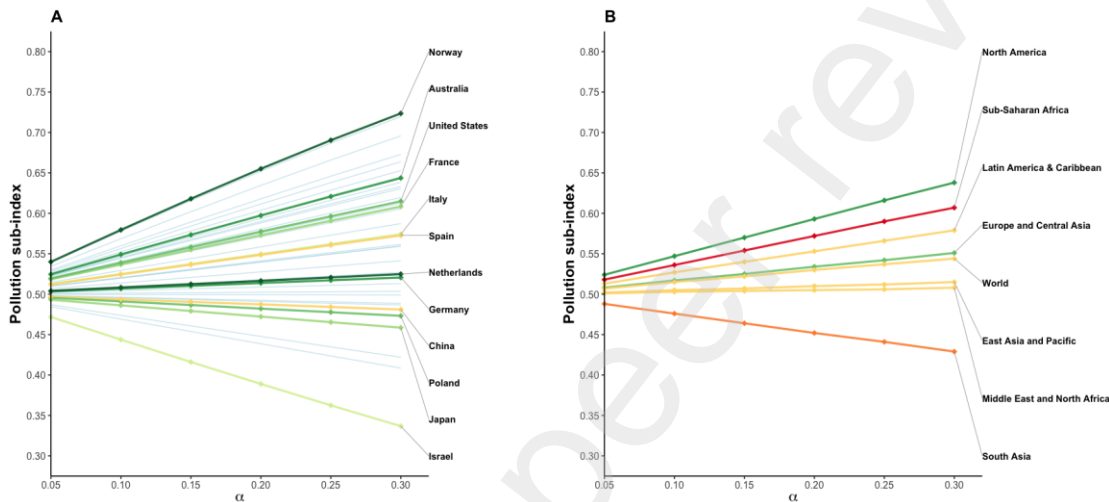


Figure. 2 Sensitivity analysis of the effect of the pollution sub-indicator across (A) OECD countries and (B) World Bank regions.

Note: Color coding of countries and regions is consistent with the classifications presented in the PEHLI map (Fig. 2) and the scatter plots (Fig. 4), facilitating visual comparison across figures. In panel A, highlighted countries from top to bottom are: Norway, Australia, the United States, France, Italy, Spain, the Netherlands, Germany, China, Poland, Japan, and Israel (China is included due to its global economic importance). In panel B, regional groups from top to bottom are: North America, Sub-Saharan Africa, Latin America & Caribbean, Europe and Central Asia, World, East Asia and Pacific, Middle East and North Africa, and South Asia. Detailed values are provided in Table A9.

Figure 2 specifically shows the sensitivity analysis of the effect of the pollution sub-indicator across Organisation for Economic Co-operation and Development (OECD) members and World Bank region groups, clearly illustrating regional disparities and cross-country variations. Within the OECD, out of 38 countries, 30 exhibit an increase in the sub-indicator with an increase in α . Across these countries, Norway exhibits the highest

pollution sub-indicator at a value of 0.7236 for $\alpha=0.3$. In stark contrast, Israel exhibits the lowest value, with its value decreasing sharply to 0.3368 for $\alpha=0.3$. Among the World Bank region groups, only South Asia exhibits a decreasing pattern with α . Europe and Central Asia, Latin America and the Caribbean, Sub-Saharan Africa, and North America surpass the world average, with North America attaining the highest regional value of the pollution sub-indicator.

Comparison with Objective and Subjective Well-Being Indicators

To show that our indicator is able to pick up relevant well-being information, Figure 3(A) shows the correlation between country rankings based on PEHLI and HDI ($R^2= 0.9491$, $p < 0.001$), both reflecting objective well-being. PEHLI, as a comprehensive measure, integrates five critical dimensions: income, longevity, health, education, and pollution, while HDI considers income, health, and education. Despite these differences, both indicators yield highly consistent country rankings in 2019.

Figure 3(B) further shows a strong positive correlation between country rankings based on PEHLI and the Cantril ladder score ($R^2= 0.6885$, $p < 0.001$). The Cantril ladder score is based on survey responses in which individuals rate their current life on a scale from 0 (worst possible) to 10 (best possible) and thus it captures subjective well-being. Scores are averaged over 2018 to 2020, with approximately 1,000 respondents per country (10). Despite these conceptual differences, both measures yield broadly similar country rankings in 2019 (see Table A8). Overall, Figures 3 (A) and (B) are re-assuring because they show that our well-being indicator leads to credible outcomes as compared to other established measures. This alignment further supports PEHLI as a robust tool for cross-country well-being assessments.

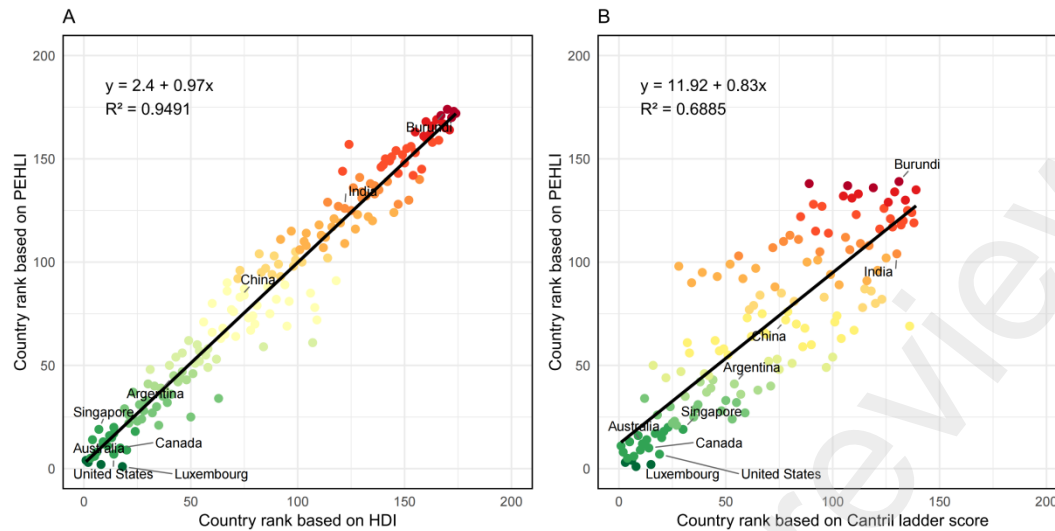


Figure 3. Comparison of PEHLI with Subjective and Objective Well-Being Indicators.

Note: (A) Comparison with objective well-being: Human Development Index (HDI) in 2019, covering 174 countries. (B) Comparison with subjective well-being: Cantril ladder score (average from 2018 to 2020), covering 139 countries. Each dot represents a country, with color reflecting its relative PEHLI rank, ranging from green (top-ranked) to red (bottom-ranked), consistent with the color scheme used in the map.

Discussion

In essence, PEHLI reflects better the true well-being of a nation, which depends on the sustainable income-generating capacity of people who live in good health, receive a solid education, and inhabit environments with lower pollution levels. Building on this concept, PEHLI encompasses five dimensions: income, health, longevity, pollution, and education, which are essential factors in evaluating a country's level of development, the well-being of its citizens, and its sustainability. PEHLI effectively gauges the capacity of a population to fulfil its primary needs. Income determines the amount of consumption that people can afford. Health captures a critical aspect of the quality of life; in addition, healthier individuals live longer, allowing them to enjoy the pleasure derived from consumption over longer periods of time. Poor health leads to major economic losses by diminishing individuals' capacity to generate sustainable income (Chen et al., 2023 a,b), and adequate health investment is therefore essential in sustaining welfare (Chen et al., 2021). Pollution, measured as SO₂ standardized by land area, damages the environment and human health,

reducing productive, healthy years. The education component is derived directly from the education sub-index of HDI and is calculated based on both expected and average years of schooling. Education is a crucial factor in promoting societal equity and enhancing the future well-being of individuals and nations (Heckman, 2006). By integrating all of these dimensions, PEHLI offers a robust framework for sustainable development assessment.

The environmental component consists of data on standardized SO₂ emissions and presents another dimension of well-being. We select SO₂ over CO₂ because SO₂ has more localized effects, whereas CO₂, although emitted locally, has global effects (Yang et al., 2022). The use of absolute levels of SO₂ emissions would be meaningless because larger countries tend to emit more than smaller countries. At the same time, a larger country may have more capacity to deal with the negative effects of SO₂ emissions such as acid rain. When standardizing SO₂ emissions, we therefore divide by land area, thus enabling a meaningful comparison across countries. Standardizing by population is not a good alternative because SO₂ emissions per capita only reveal the intensity of emissions but not the damage to the environment. Instead, SO₂ emissions per unit of land area provides a more accurate picture of a nation's environmental quality. This approach allows PEHLI to capture environmental disparities in well-being accurately and in a way that is relevant to policy makers.

Overall, PEHLI has crucial advantages over the HDI because i) it accounts for the environment as an important dimension of well-being; ii) it is not bounded from above, allowing for a better comparison of development across countries at high indicator values; iii) it has a straightforward interpretation; iv) it offers full global coverage based solely on publicly available data; and v) it avoids subjective weighting schemes, remaining computationally simple and transparent. As compared with HDI, countries with larger industrial and mining sectors fare worse in a PEHLI-based ranking, which is a sensible adjustment given the environmental problems these sectors are associated with, and may indicate that countries with more resource-intensive growth face relative disadvantages in PEHLI rankings.

In examining the global landscape, Luxembourg's well-being is highest. In large and sparsely populated countries like Canada and Australia, we notice a consistent upward shift in their ranking when the pollution sub-indicator is considered. This indicates that countries with lower pollution intensity per unit of land area have an overall advantage in well-being. By contrast, the rankings of populous, industry-intensive countries like China and India fall markedly, demonstrating the more nuanced view on well-being that PEHLI is able to provide. This suggests that PEHLI may be a potent tool to evaluate environmental and human well-being and to monitor the efficacy of policies intended to enhance them.

Compared to subjective indicators, objective indicators are less influenced by economic and cognitive biases. PEHLI is designed as an objective measure of well-being, distinct from subjective indicators that rely on self-reports. Using purely subjective indicators would require tracking the same individuals over time, which poses significant challenges in any survey. Moreover, objective indicators like PEHLI allow for consistent cross-country comparisons and long-term monitoring, which are critical for evidence-based development policy. Both subjective and objective indicators have their strengths, and subjective measures are particularly valuable when complementing objective data (Zhang et al., 2023; Voukelatou et al., 2021; Jahedi & Méndez, 2014).

PEHLI is conceptually comprehensive and computationally feasible, making it a practical tool, particularly for policy analysis. Implementing PEHLI adds little burden, because it benefits from high data availability, as all variables, income, healthy life expectancy, education levels, and SO₂ emissions, are regularly reported by reputable institutions, reducing data collection costs and ensuring broad applicability across countries. With tight budgets (Coyle, 2025; Dynan, 2025), PEHLI can be quickly integrated into existing frameworks to offer a clear and practical measure of progress. Its simple multiplicative structure allows for efficient calculations, easy updates, and intuitive interpretation, making it well-suited for cross-country comparisons and long-term trend analyses.

The adoption of PEHLI as a guide for decision-making would allow for a multidimensional assessment of well-being and environmental sustainability, which can

serve as a warning light that identifies shortfalls in specific dimensions. PEHLI can be applied in policy design, monitoring, and evaluation, which may shift policymaking toward improving sustainability. Its comprehensive yet intuitive structure makes it accessible for both researchers and policymakers, facilitating evidence-based decisions. When used together with per capita GDP and other measures, these indicators can play an important role in public and policy debates (Graham et al, 2018).

Limitation

The exclusion of inequality is a limitation. The reason for excluding inequality is the limited availability of Gini data that would reduce the country coverage of PEHLI substantially. Nevertheless, inequality is partly captured through educational inequality, as more unequal countries tend to have lower overall education levels (Blanden et al., 2022; Morgan et al., 2022). The inclusion of inequality, in addition, remains on our research agenda for future studies.

Materials and Methods

Variants of HLI

Bloom et al. (9) introduced Inequality-adjusted Healthy Lifetime Income (IHLI) and Inequality-adjusted Lifetime Income (ILI) to quantify economic well-being. These indicators are defined as

$$\text{IHLI}_i = \text{GDP}_{\text{pc}i} \times \text{HALE}_i \times (1 - \text{Gini}_i), \quad (1)$$

$$\text{ILI}_i = \text{GDP}_{\text{pc}i} \times \text{LEXP}_i \times (1 - \text{Gini}_i), \quad (2)$$

where the index i refers to the different countries, GDP_{pc} is purchasing power-adjusted per capita GDP, HALE is healthy life expectancy, LEXP is life expectancy, and Gini refers to the Gini coefficient. While these indicators have a straightforward and immediate economic interpretation and they have several advantages over other indicators (for details, see Bloom et al., 2019), their main drawback is the lack of consistent, reliable Gini coefficient data over the past decades for many countries. This limitation makes cross-country and long-term comparisons difficult, especially in low-income settings. To

address this issue and to maximize both country and time coverage of the indicator, Zhang et al. (2003, 2025) propose Healthy Lifetime Income (HLI) and Lifetime Income (LI) as alternative metrics of economic well-being:

$$HLI_i = GDP_{pc_i} \times HALE_i, \quad (3)$$

$$LI_i = GDP_{pc_i} \times LEXP_i. \quad (4)$$

HLI and LI, which are available for most countries or provinces over long periods of time, retain many of IHLI's and ILI's advantages, particularly their immediate economic interpretation. This stems from HLI's methodology of multiplying an economy's average income by the years an inhabitant of this economy is anticipated to be in good health. This indicator thus represents the expected income earned during the healthy years of life. Moreover, HLI and LI are easier to apply in policy and research, allowing systematic tracking of economic well-being over time.

While HLI focuses on income and health and IHLI also considers inequality, neither of these indicators integrates educational or environmental dimensions, which are increasingly recognized as critical for long-term well-being (Zhang et al, 2023). To capture education and the environment, we propose three additional indicators: Education-adjusted Healthy Lifetime Income (EHLI), Pollution-adjusted Healthy Lifetime Income (PHLI), and Pollution- and Education-adjusted Healthy Lifetime Income (PEHLI):

$$EHLI_i = GDP_{pc_i} \times HALE_i \times \text{Education sub-index}_i, \quad (5)$$

$$PHLI_i = GDP_{pc_i} \times HALE_i \times \text{Pollution sub-index}_i, \quad (6)$$

$$PEHLI_i = GDP_{pc_i} \times HALE_i \times \text{Education sub-index}_i \times \text{Pollution sub-index}_i \quad (7)$$

The most comprehensive indicator, PEHLI, consists of the following four components, as shown in Figure 4: i) gross domestic product per capita adjusted for purchasing power (GDPpc) as an indicator of material living standards; ii) healthy life expectancy at birth (HALE) to reflect health and longevity; iii) the education sub-indicator derived from the HDI education component; and iv) the pollution sub-indicator, constructed from standardized SO₂ emissions to capture pollution-related impacts on health and well-being.

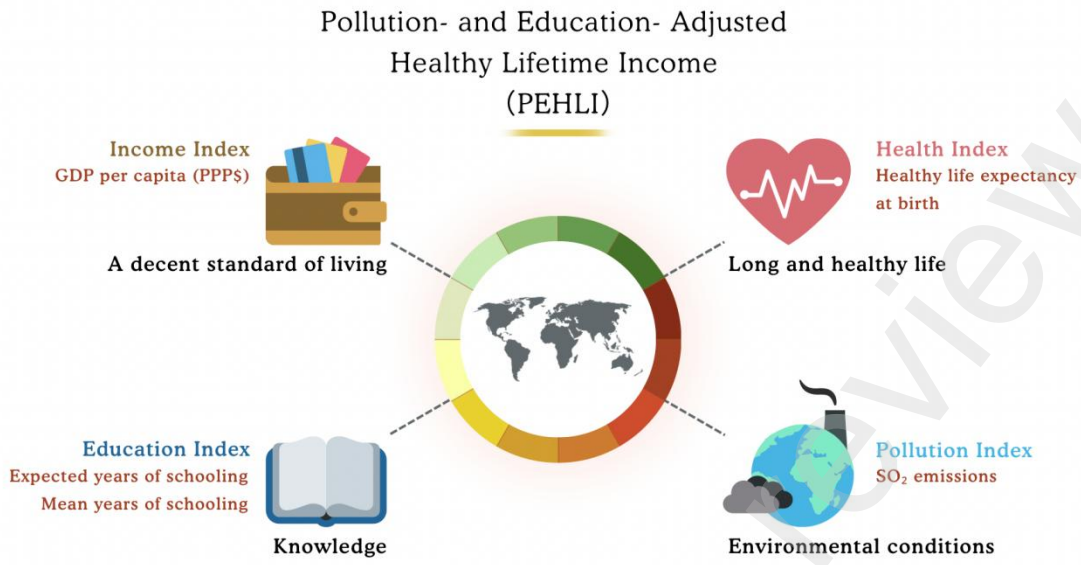


Figure 4. A comprehensive measure of well-being: Pollution- and Education-adjusted Healthy Lifetime Income

Note: PEHLI integrates income, health, longevity, education, and pollution into one measure.

Statistical Analysis

We summarized the distributions of HLI, EHLI, PHLI, and PEHLI using standard descriptive statistics to provide a clear and comparable overview of cross-national patterns. To test the robustness of PEHLI, we conducted a sensitivity analysis by varying the pollution penalty parameter (α) from 0.05 to 0.3. Associations between PEHLI, the Human Development Index (HDI), and the Cantril ladder score were assessed using Spearman rank correlations, R^2 , and p-values.

Data sources

To construct EHLI, PHLI, and PEHLI for a global ranking, we use the World Bank's World Development Indicators data on land area and on GDPpc in international dollars (INT\$) with a base year of 2017 (World Bank, 2022), the Global Burden of Disease Study 2019 (GBD) data on HALE (Global Burden of Disease Collaborative Network, 2020), the Global Data Lab HDI Education sub-index (Global Data Lab, 2023), and Community

Emissions Data System (CEDDS) data on SO₂ emissions (Hoesly et al., 2018; latest data available), ensure comprehensive and consistent global coverage.

Clarification of GDP terminology

Throughout this paper, GDP refers to aggregate gross domestic product, while GDPpc denotes gross domestic product per capita expressed in purchasing power parity (PPP)–adjusted international dollars (2017 INT\$), with 2017 as the base year.

Pollution sub-indicator

SO₂ emissions influence the quality of the environment substantially, especially in densely populated and industrialized regions. While CO₂ impacts global climate change, SO₂ has pronounced localized effects (Yang et al., 2022), which is what we are interested in when measuring well-being across countries. To compare SO₂ emissions across countries, we normalize them based on land area:

$$X = \frac{SO_2 \text{ emissions}}{\text{Land area}}. \quad (8)$$

It is important to note that using absolute emission levels would be misleading because larger countries automatically emit more. In addition, standardizing by population size would only capture the emission intensity in the creation of emissions but not the effect that emissions have on the environment. Instead, standardizing by land area is the most accurate alternative because it measures the intensity of pollution as it impacts upon nature.

To ensure that the value of the pollution component is defined in the range of 0 to 1 and to allow for sensitivity analyses with respect to the importance of pollution for the computation of well-being, we calculate the pollution sub-indicator as

$$Y = \frac{1}{1+X^\alpha}, \quad (9)$$

where α measures the importance of pollution for well-being. In the Results section, we apply a sensitivity test to the choice of the parameter α , which is necessarily arbitrary but also highlights the need for empirical validation in future research.

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Appendix

Table A1 Variants: Healthy Lifetime Income (HLI), Education-Adjusted Healthy Lifetime Income (EHLI), Pollution-Adjusted Healthy Lifetime Income (PHLI), and Pollution- and Education-Adjusted Healthy Lifetime Income (PEHLI) of 175 Countries, 2019 (2017 INT\$)

Country	HLI	Ranking	EHLI	Ranking	PHLI	Ranking	PEHLI	Ranking
Luxembourg	8,272,031	1	6,898,874	1	4,476,494	1	3,733,396	1
Singapore	7,320,274	2	6,251,514	2	1,811,905	18	1,547,367	19
Ireland	6,096,030	3	5,401,083	3	3,646,877	2	3,231,133	2
Qatar	5,966,809	4	4,027,596	6	2,212,071	10	1,493,148	21
Switzerland	5,109,680	5	4,700,906	4	3,084,929	3	2,838,134	3
Norway	4,560,860	6	4,255,283	5	2,987,920	4	2,787,729	4
United Arab Emirates	4,394,754	7	3,775,094	8	1,763,407	20	1,514,766	20
Iceland	4,117,324	8	3,944,397	7	2,428,834	6	2,326,823	5
United States	4,086,788	9	3,698,543	10	2,359,709	7	2,135,537	7
Brunei Darussalam	4,052,656	10	2,824,701	20	1,840,598	17	1,282,897	25
Netherlands	4,010,252	11	3,669,380	11	2,071,483	13	1,895,407	13
Denmark	3,996,888	12	3,717,106	9	2,288,073	9	2,127,908	8
Austria	3,942,096	13	3,362,608	14	2,339,722	8	1,995,782	9
Sweden	3,772,927	14	3,471,093	13	2,460,376	5	2,263,546	6
Germany	3,759,963	15	3,541,885	12	1,931,718	15	1,819,678	14
Belgium	3,621,030	16	3,306,000	15	1,782,890	19	1,627,779	15
Kuwait	3,508,797	17	2,350,894	33	1,216,452	37	815,023	47
Australia	3,466,701	18	3,196,299	16	2,070,765	14	1,909,245	12
Canada	3,464,085	19	3,176,566	17	2,140,630	11	1,962,958	10
Finland	3,417,163	20	3,174,544	18	2,089,451	12	1,941,100	11
France	3,290,368	21	2,717,844	22	1,885,115	16	1,557,105	18
United Kingdom	3,273,591	22	3,028,072	19	1,727,207	21	1,597,666	17
Republic of Korea	3,092,564	23	2,709,086	23	1,384,744	29	1,213,036	29

Japan	3,079,046	24	2,672,612	24	1,454,349	26	1,262,375	26
Italy	3,045,156	25	2,454,396	31	1,673,605	23	1,348,926	24
Saudi Arabia	3,030,609	26	2,454,794	30	1,433,594	27	1,161,211	32
Bahrain	3,017,205	27	2,452,988	32	939,314	48	763,662	48
New Zealand	2,999,902	28	2,804,908	21	1,712,852	22	1,601,516	16
Spain	2,921,371	29	2,462,716	28	1,602,776	24	1,351,140	23
Israel	2,917,700	30	2,599,670	25	1,134,929	42	1,011,222	37
Cyprus	2,902,375	31	2,458,311	29	1,371,600	31	1,161,745	31
Czechia (Czech Republic)	2,811,372	32	2,474,007	27	1,403,552	28	1,235,126	28
Slovenia	2,741,127	33	2,513,613	26	1,577,615	25	1,446,673	22
Estonia	2,479,966	34	2,222,050	35	1,245,936	36	1,116,358	33
Lithuania	2,473,900	35	2,224,036	34	1,381,769	30	1,242,211	27
Portugal	2,453,534	36	1,913,756	37	1,324,043	33	1,032,753	35
Bahamas	2,346,141	37	1,829,990	39	1,351,049	32	1,053,818	34
Poland	2,260,499	38	1,996,021	36	1,089,860	44	962,346	40
Panama	2,177,069	39	1,554,427	45	1,141,755	41	815,213	46
Hungary	2,174,257	40	1,789,413	42	1,246,723	35	1,026,053	36
Slovakia	2,158,686	41	1,800,344	41	1,165,328	40	971,883	38
Greece	2,076,233	42	1,808,399	40	1,056,279	45	920,019	41
Latvia	2,056,617	43	1,834,502	38	1,304,993	34	1,164,054	30
Oman	2,025,912	44	1,564,004	44	1,186,845	38	916,244	42
Croatia	2,001,023	45	1,652,845	43	1,171,000	39	967,246	39
Romania	1,982,501	46	1,528,509	46	1,100,959	43	848,840	43
Turkey	1,912,165	47	1,506,786	47	838,891	57	661,046	54
Malaysia	1,865,905	48	1,360,245	52	920,098	50	670,751	53
Saint Kitts and Nevis	1,804,612	49	1,293,907	53	851,843	55	610,771	56
Trinidad and Tobago	1,748,733	50	1,383,248	51	887,252	54	701,816	52
Russian Federation	1,737,311	51	1,501,037	48	972,325	46	840,089	44
Chile	1,725,893	52	1,430,765	49	893,896	52	741,040	50
Kazakhstan	1,664,386	53	1,406,406	50	889,951	53	752,009	49
Uruguay	1,553,479	54	1,191,518	55	921,399	49	706,713	51
Bulgaria	1,502,568	55	1,149,465	56	784,131	58	599,860	57

Mauritius	1,490,067	56	1,145,862	57	548,829	71	422,049	66
Argentina	1,473,828	57	1,279,283	54	966,705	47	839,100	45
Antigua and Barbuda	1,455,646	58	1,024,775	60	711,007	60	500,549	62
Costa Rica	1,454,935	59	1,094,111	58	844,758	56	635,258	55
Libya	1,426,672	60	870,270	64	918,144	51	560,068	59
Maldives	1,348,459	61	802,333	69	467,696	85	278,279	97
Mexico	1,285,903	62	919,420	63	631,428	64	451,471	64
Thailand	1,261,197	63	921,935	62	638,811	63	466,971	63
Belarus	1,254,341	64	1,038,594	59	694,754	61	575,256	58
Serbia	1,214,225	65	954,381	61	497,742	82	391,225	71
Suriname	1,197,918	66	824,168	68	734,998	59	505,678	61
Dominican Republic	1,182,393	67	841,864	66	536,561	74	382,031	74
North Macedonia	1,096,629	68	782,993	71	517,217	77	369,293	77
China	1,094,894	69	710,586	76	533,600	76	346,306	83
Grenada	1,079,959	70	865,047	65	549,120	70	439,845	65
Equatorial Guinea	1,064,138	71	496,952	99	646,254	62	301,801	91
Barbados	1,033,831	72	790,881	70	454,116	87	347,398	80
Colombia	1,013,777	73	700,520	77	596,224	65	411,991	67
Bosnia and Herzegovina	997,482	74	720,182	74	408,282	96	294,780	92
Iran	995,983	75	758,939	72	484,730	83	369,364	76
Saint Lucia	990,334	76	637,775	86	506,224	80	326,008	89
Turkmenistan	976,928	77	718,042	75	544,353	72	400,100	69
Georgia	966,676	78	832,308	67	594,784	66	512,109	60
Brazil	960,784	79	676,392	79	561,426	69	395,244	70
Lebanon	957,155	80	578,121	91	354,589	102	214,172	104
Albania	940,152	81	740,840	73	510,629	79	402,376	68
Azerbaijan	910,008	82	660,666	82	502,061	81	364,496	79
Armenia	909,851	83	673,290	81	426,442	95	315,567	90
Peru	898,854	84	680,433	78	453,748	88	343,487	84
Botswana	886,853	85	607,494	88	533,985	75	365,780	78
Gabon	879,106	86	593,397	89	572,125	67	386,184	72

Sri Lanka	875,621	87	654,089	84	377,879	99	282,276	96
Saint Vincent and the Grenadines	856,708	88	658,808	83	444,944	91	342,162	86
Moldova	848,670	89	675,541	80	482,721	84	384,246	73
Paraguay	838,292	90	548,243	93	567,748	68	371,307	75
Ukraine	827,476	91	651,224	85	432,168	93	340,116	87
Fiji	816,395	92	630,257	87	449,489	90	347,006	81
Dominica	778,274	93	498,873	98	454,471	86	291,316	94
South Africa	770,187	94	583,802	90	349,865	103	265,197	99
Tunisia	770,179	95	520,641	95	434,284	92	293,576	93
Algeria	763,947	96	515,665	97	513,130	78	346,363	82
Guyana	763,556	97	483,331	101	541,625	73	342,849	85
Ecuador	758,840	98	531,188	94	404,626	97	283,238	95
Mongolia	754,614	99	552,378	92	449,937	89	329,354	88
Bhutan	750,266	100	405,144	107	429,540	94	231,952	102
Indonesia	738,855	101	488,383	100	357,469	100	236,287	101
Egypt, Arab Rep.	734,839	102	515,857	96	384,553	98	269,956	98
Iraq	690,180	103	413,418	105	314,497	106	188,384	107
Jordan	684,574	104	438,128	103	347,024	104	222,096	103
Vietnam	666,242	105	425,728	104	299,917	108	191,647	106
Jamaica	650,304	106	440,906	102	267,031	111	181,047	108
El Salvador	575,134	107	338,754	109	281,750	109	165,951	112
Philippines	559,186	108	375,214	108	262,719	113	176,285	110
Namibia	556,872	109	317,974	112	315,232	105	179,997	109
Bolivia	550,567	110	409,622	106	355,184	101	264,257	100
Guatemala	544,351	111	262,922	116	274,153	110	132,416	119
Morocco	481,675	112	281,780	115	266,819	112	156,089	113
Lao PDR	478,777	113	225,025	120	236,516	118	111,163	123
Belize	465,341	114	309,452	113	312,643	107	207,907	105
Cabo Verde	463,434	115	258,596	117	247,289	114	137,987	117
Uzbekistan	447,348	116	332,380	111	202,995	120	150,825	115
Eswatini (fmr. Swaziland)	437,930	117	248,744	119	245,850	115	139,643	116
Samoa	409,738	118	297,470	114	213,831	119	155,241	114

Tonga	407,550	119	335,414	110	201,678	122	165,981	111
India	404,847	120	218,617	121	178,656	128	96,474	126
Angola	380,880	121	197,677	124	242,049	116	125,624	120
Honduras	361,487	122	187,250	126	189,971	123	98,405	125
Nicaragua	358,210	123	210,986	122	202,116	121	119,046	121
Bangladesh	358,165	124	199,856	123	165,237	132	92,202	127
Kyrgyzstan	341,446	125	253,012	118	185,229	126	137,255	118
Mauritania	332,230	126	140,865	131	238,012	117	100,917	124
Ghana	322,544	127	195,784	125	185,033	127	112,315	122
Djibouti	310,007	128	106,332	142	189,067	125	64,850	140
Pakistan	304,176	129	119,237	137	139,589	137	54,719	143
Côte d'Ivoire	292,910	130	136,203	132	189,116	124	87,939	130
Myanmar	288,421	131	148,825	129	166,082	130	85,698	131
Nigeria	287,787	132	149,937	128	174,470	129	90,899	128
Cambodia	268,611	133	131,082	134	147,257	136	71,861	137
Kenya	259,763	134	134,817	133	162,189	133	84,176	132
Sudan	256,352	135	89,211	146	165,792	131	57,696	142
Sao Tome and Principe	249,458	136	144,187	130	132,639	139	76,666	134
Nepal	243,123	137	130,314	135	127,184	141	68,171	138
Papua New Guinea	241,923	138	107,898	141	150,259	134	67,016	139
Timor-Leste	223,584	139	118,947	138	137,130	138	72,953	136
Tajikistan	221,490	140	155,264	127	126,835	142	88,911	129
Congo (Congo- Brazzaville)	218,134	141	119,537	136	147,428	135	80,790	133
Cameroon	207,482	142	118,057	139	131,656	140	74,912	135
Senegal	201,634	143	69,362	151	111,653	144	38,409	153
Micronesia, Fed. Sts.	196,389	144	114,102	140	91,629	150	53,237	144
Zambia	191,158	145	103,799	143	91,050	151	49,440	147
Benin	186,207	146	84,724	147	113,386	143	51,591	145
Comoros	184,578	147	92,474	145	99,002	147	49,600	146
Vanuatu	179,512	148	99,808	144	110,831	145	61,622	141
Haiti	170,346	149	77,508	149	91,734	149	41,739	151
Tanzania	156,272	150	71,729	150	103,895	146	47,688	148

Solomon Islands	140,286	151	66,916	152	90,030	152	42,944	150
Guinea	138,246	152	47,833	160	88,159	153	30,503	159
Ethiopia	133,775	153	50,165	159	86,689	154	32,509	158
Rwanda	133,278	154	61,174	156	78,174	155	35,882	155
Gambia	129,834	155	52,842	158	74,536	160	30,336	160
Uganda	126,073	156	59,632	157	77,458	156	36,638	154
Mali	125,977	157	35,651	168	91,829	148	25,987	164
Zimbabwe	123,751	158	77,592	148	74,869	158	46,943	149
Togo	120,965	159	63,748	155	74,854	159	39,448	152
Lesotho	120,168	160	64,290	154	66,496	162	35,575	156
Burkina Faso	117,826	161	38,647	165	76,619	157	25,131	165
Kiribati	112,577	162	66,870	153	59,198	166	35,163	157
Afghanistan	111,742	163	42,127	164	59,708	165	22,510	168
Guinea-Bissau	103,974	164	43,045	162	66,917	161	27,704	162
Madagascar	93,226	165	42,138	163	62,682	164	28,332	161
Sierra Leone	92,186	166	38,534	166	58,480	167	24,444	167
Malawi	86,971	167	43,660	161	54,376	168	27,297	163
Liberia	83,609	168	38,209	167	53,909	169	24,636	166
Chad	83,487	169	25,797	170	62,997	163	19,466	170
Niger	67,413	170	17,797	172	49,283	170	13,011	172
Mozambique	65,112	171	25,394	171	42,640	172	16,630	171
Democratic Republic of the Congo	61,854	172	31,360	169	42,200	173	21,395	169
Somalia	61,116	173	13,873	175	44,519	171	10,106	175
Central African Republic	43,244	174	15,914	174	32,785	174	12,065	173
Burundi	41,708	175	16,767	173	25,437	175	10,226	174

Source: Own calculations based on World Bank (2022), GBD (2020), Global Data Lab (2023), and Community Emissions Data System (2021).

Note: "HLI" refers to healthy lifetime income and is measured in purchasing power-adjusted international dollars with a base year of 2017 (2017 INT\$); "EHLI" refers to education-adjusted healthy lifetime income and is measured in purchasing power-adjusted 2017 INT\$; "PHLI" refers to pollution-adjusted healthy lifetime income and is measured in purchasing power-adjusted 2017 INT\$; "PEHLI" refers to pollution- and education-adjusted healthy lifetime income and is measured in purchasing power-adjusted 2017 INT\$.

Tables A2 through A5 show HLI, EHLI, PHLI, PEHLI values in 2019.

Table A2 HLI (Healthy Lifetime Income) Values for 175 Countries, 2019 (2017 INT\$)

Country	GDPpc	HALE	HLI	Ranking
Luxembourg	116,518	70.99	8,272,031	1
Singapore	98,283	74.48	7,320,274	2
Ireland	86,650	70.35	6,096,030	3
Qatar	90,044	66.27	5,966,809	4
Switzerland	70,944	72.02	5,109,680	5
Norway	64,385	70.84	4,560,860	6
United Arab Emirates	68,264	64.38	4,394,754	7
Iceland	56,936	72.32	4,117,324	8
United States	62,459	65.43	4,086,788	9
Brunei Darussalam	62,098	65.26	4,052,656	10
Netherlands	56,784	70.62	4,010,252	11
Denmark	57,162	69.92	3,996,888	12
Austria	55,834	70.60	3,942,096	13
Sweden	52,851	71.39	3,772,927	14
Germany	53,930	69.72	3,759,963	15
Belgium	51,937	69.72	3,621,030	16
Kuwait	49,947	70.25	3,508,797	17
Australia	49,309	70.31	3,466,701	18
Canada	49,172	70.45	3,464,085	19
Finland	48,583	70.34	3,417,163	20
France	46,018	71.50	3,290,368	21
United Kingdom	47,369	69.11	3,273,591	22
Republic of Korea	42,759	72.33	3,092,564	23
Japan	41,697	73.84	3,079,046	24
Italy	42,746	71.24	3,045,156	25
Saudi Arabia	47,000	64.48	3,030,609	26
Bahrain	45,312	66.59	3,017,205	27
New Zealand	43,110	69.59	2,999,902	28
Spain	40,802	71.60	2,921,371	29
Israel	40,626	71.82	2,917,700	30
Cyprus	41,522	69.90	2,902,375	31

Czechia (Czech Republic)	40,981	68.60	2,811,372	32
Slovenia	38,947	70.38	2,741,127	33
Estonia	36,401	68.13	2,479,966	34
Lithuania	37,166	66.56	2,473,900	35
Portugal	34,946	70.21	2,453,534	36
Bahamas	36,522	64.24	2,346,141	37
Poland	33,185	68.12	2,260,499	38
Panama	31,440	69.24	2,177,069	39
Hungary	32,554	66.79	2,174,257	40
Slovakia	31,928	67.61	2,158,686	41
Greece	29,698	69.91	2,076,233	42
Latvia	31,012	66.32	2,056,617	43
Oman	31,284	64.76	2,025,912	44
Croatia	29,336	68.21	2,001,023	45
Romania	29,875	66.36	1,982,501	46
Turkey	28,197	67.81	1,912,165	47
Malaysia	28,421	65.65	1,865,905	48
Saint Kitts and Nevis	28,593	63.11	1,804,612	49
Trinidad and Tobago	26,827	65.18	1,748,733	50
Russian Federation	27,255	63.74	1,737,311	51
Chile	24,931	69.23	1,725,893	52
Kazakhstan	26,352	63.16	1,664,386	53
Uruguay	23,033	67.45	1,553,479	54
Bulgaria	23,266	64.58	1,502,568	55
Mauritius	22,870	65.15	1,490,067	56
Argentina	22,066	66.79	1,473,828	57
Antigua and Barbuda	21,850	66.62	1,455,646	58
Costa Rica	20,971	69.38	1,454,935	59
Libya	21,843	65.32	1,426,672	60
Maldives	19,510	69.11	1,348,459	61
Mexico	19,675	65.36	1,285,903	62
Thailand	18,439	68.40	1,261,197	63
Belarus	19,279	65.06	1,254,341	64
Serbia	18,307	66.33	1,214,225	65
Suriname	19,037	62.93	1,197,918	66
Dominican Republic	18,413	64.22	1,182,393	67

North Macedonia	16,773	65.38	1,096,629	68
China	15,978	68.53	1,094,894	69
Grenada	16,868	64.03	1,079,959	70
Equatorial Guinea	18,600	57.21	1,064,138	71
Barbados	15,500	66.70	1,033,831	72
Colombia	14,572	69.57	1,013,777	73
Bosnia and Herzegovina	14,897	66.96	997,482	74
Iran	14,904	66.83	995,983	75
Saint Lucia	15,201	65.15	990,334	76
Turkmenistan	15,538	62.87	976,928	77
Georgia	14,989	64.49	966,676	78
Brazil	14,736	65.20	960,784	79
Lebanon	14,493	66.04	957,155	80
Albania	13,653	68.86	940,152	81
Azerbaijan	14,442	63.01	910,008	82
Armenia	13,654	66.64	909,851	83
Peru	12,858	69.90	898,854	84
Botswana	16,404	54.06	886,853	85
Gabon	14,946	58.82	879,106	86
Sri Lanka	13,080	66.95	875,621	87
Saint Vincent and the Grenadines	13,463	63.64	856,708	88
Moldova	13,027	65.15	848,670	89
Paraguay	12,616	66.45	838,292	90
Ukraine	12,805	64.62	827,476	91
Fiji	13,684	59.66	816,395	92
Dominica	12,330	63.12	778,274	93
South Africa	13,710	56.18	770,187	94
Tunisia	11,421	67.44	770,179	95
Algeria	11,522	66.30	763,947	96
Guyana	13,082	58.37	763,556	97
Ecuador	11,371	66.74	758,840	98
Mongolia	12,486	60.44	754,614	99
Bhutan	11,865	63.23	750,266	100
Indonesia	11,812	62.55	738,855	101
Egypt, Arab Rep.	11,763	62.47	734,839	102

Iraq	10,890	63.38	690,180	103
Jordan	10,071	67.97	684,574	104
Vietnam	10,134	65.74	666,242	105
Jamaica	9,777	66.51	650,304	106
El Salvador	8,776	65.53	575,134	107
Philippines	8,915	62.73	559,186	108
Namibia	9,809	56.77	556,872	109
Bolivia	8,724	63.11	550,567	110
Guatemala	8,653	62.91	544,351	111
Morocco	7,547	63.83	481,675	112
Lao PDR	7,887	60.71	478,777	113
Belize	7,153	65.06	465,341	114
Cabo Verde	7,172	64.62	463,434	115
Uzbekistan	7,348	60.88	447,348	116
Eswatini (fmr. Swaziland)	8,653	50.61	437,930	117
Samoa	6,628	61.82	409,738	118
Tonga	6,377	63.91	407,550	119
India	6,689	60.52	404,847	120
Angola	6,712	56.75	380,880	121
Honduras	5,736	63.02	361,487	122
Nicaragua	5,446	65.78	358,210	123
Bangladesh	5,550	64.53	358,165	124
Kyrgyzstan	5,258	64.93	341,446	125
Mauritania	5,344	62.17	332,230	126
Ghana	5,540	58.22	322,544	127
Djibouti	5,260	58.94	310,007	128
Pakistan	5,318	57.20	304,176	129
Côte d'Ivoire	5,213	56.19	292,910	130
Myanmar	4,740	60.85	288,421	131
Nigeria	5,135	56.04	287,787	132
Cambodia	4,389	61.20	268,611	133
Kenya	4,459	58.25	259,763	134
Sudan	4,174	61.42	256,352	135
Sao Tome and Principe	4,005	62.28	249,458	136
Nepal	3,953	61.51	243,123	137
Papua New Guinea	4,293	56.36	241,923	138

Timor-Leste	3,627	61.65	223,584	139
Tajikistan	3,581	61.84	221,490	140
Congo (Congo- Brazzaville)	3,826	57.02	218,134	141
Cameroon	3,743	55.43	207,482	142
Senegal	3,368	59.86	201,634	143
Micronesia, Fed. Sts.	3,465	56.68	196,389	144
Zambia	3,470	55.08	191,158	145
Benin	3,287	56.64	186,207	146
Comoros	3,059	60.34	184,578	147
Vanuatu	3,117	57.60	179,512	148
Haiti	3,073	55.43	170,346	149
Tanzania	2,661	58.73	156,272	150
Solomon Islands	2,661	52.73	140,286	151
Guinea	2,566	53.87	138,246	152
Ethiopia	2,221	60.22	133,775	153
Rwanda	2,228	59.83	133,278	154
Gambia	2,226	58.32	129,834	155
Uganda	2,183	57.75	126,073	156
Mali	2,322	54.26	125,977	157
Zimbabwe	2,311	53.56	123,751	158
Togo	2,122	57.01	120,965	159
Lesotho	2,656	45.24	120,168	160
Burkina Faso	2,176	54.16	117,826	161
Kiribati	2,103	53.54	112,577	162
Afghanistan	2,065	54.11	111,742	163
Guinea-Bissau	1,939	53.61	103,974	164
Madagascar	1,619	57.60	93,226	165
Sierra Leone	1,705	54.06	92,186	166
Malawi	1,537	56.58	86,971	167
Liberia	1,470	56.89	83,609	168
Chad	1,580	52.85	83,487	169
Niger	1,224	55.06	67,413	170
Mozambique	1,282	50.80	65,112	171
Democratic Republic of the Congo	1,098	56.34	61,854	172

Somalia	1,186	51.51	61,116	173
Central African Republic	946	45.71	43,244	174
Burundi	751	55.50	41,708	175

Source: World Bank (2022), GBD (2020), and own calculations.

Note: “GDPpc” refers to purchasing power-adjusted per capita GDP in international dollars with a base year of 2017 (2017 INT\$), “HALE” refers to healthy life expectancy at birth, and “HLI” refers to healthy lifetime income measured in 2017 INT\$.

Table A3 EHLI (Education-Adjusted Healthy Lifetime Income) Values of 175 Countries, 2019 (2017 INT\$)

Country	GDPpc	HALE	Educational sub-index	EHLI	Ranking	Changes compared with HLI
Luxembourg	116,518	70.99	0.834	6,898,874	1	0
Singapore	98,283	74.48	0.854	6,251,514	2	0
Ireland	86,650	70.35	0.886	5,401,083	3	0
Switzerland	70,944	72.02	0.92	4,700,906	4	1
Norway	64,385	70.84	0.933	4,255,283	5	1
Qatar	90,044	66.27	0.675	4,027,596	6	-2
Iceland	56,936	72.32	0.958	3,944,397	7	1
United Arab Emirates	68,264	64.38	0.859	3,775,094	8	-1
Denmark	57,162	69.92	0.93	3,717,106	9	3
United States	62,459	65.43	0.905	3,698,543	10	-1
Netherlands	56,784	70.62	0.915	3,669,380	11	0
Germany	53,930	69.72	0.942	3,541,885	12	3
Sweden	52,851	71.39	0.92	3,471,093	13	1
Austria	55,834	70.60	0.853	3,362,608	14	-1
Belgium	51,937	69.72	0.913	3,306,000	15	1
Australia	49,309	70.31	0.922	3,196,299	16	2
Canada	49,172	70.45	0.917	3,176,566	17	2
Finland	48,583	70.34	0.929	3,174,544	18	2
United Kingdom	47,369	69.11	0.925	3,028,072	19	3
Brunei Darussalam	62,098	65.26	0.697	2,824,701	20	-10
New Zealand	43,110	69.59	0.935	2,804,908	21	7
France	46,018	71.50	0.826	2,717,844	22	-1

Republic of Korea	42,759	72.33	0.876	2,709,086	23	0
Japan	41,697	73.84	0.868	2,672,612	24	0
Israel	40,626	71.82	0.891	2,599,670	25	5
Slovenia	38,947	70.38	0.917	2,513,613	26	7
Czechia (Czech Republic)	40,981	68.60	0.88	2,474,007	27	5
Spain	40,802	71.60	0.843	2,462,716	28	1
Cyprus	41,522	69.90	0.847	2,458,311	29	2
Saudi Arabia	47,000	64.48	0.81	2,454,794	30	-4
Italy	42,746	71.24	0.806	2,454,396	31	-6
Bahrain	45,312	66.59	0.813	2,452,988	32	-5
Kuwait	49,947	70.25	0.67	2,350,894	33	-16
Lithuania	37,166	66.56	0.899	2,224,036	34	1
Estonia	36,401	68.13	0.896	2,222,050	35	-1
Poland	33,185	68.12	0.883	1,996,021	36	2
Portugal	34,946	70.21	0.78	1,913,756	37	-1
Latvia	31,012	66.32	0.892	1,834,502	38	5
Bahamas	36,522	64.24	0.78	1,829,990	39	-2
Greece	29,698	69.91	0.871	1,808,399	40	2
Slovakia	31,928	67.61	0.834	1,800,344	41	0
Hungary	32,554	66.79	0.823	1,789,413	42	-2
Croatia	29,336	68.21	0.826	1,652,845	43	2
Oman	31,284	64.76	0.772	1,564,004	44	0
Panama	31,440	69.24	0.714	1,554,427	45	-6
Romania	29,875	66.36	0.771	1,528,509	46	0
Turkey	28,197	67.81	0.788	1,506,786	47	0
Russian Federation	27,255	63.74	0.864	1,501,037	48	3
Chile	24,931	69.23	0.829	1,430,765	49	3
Kazakhstan	26,352	63.16	0.845	1,406,406	50	3
Trinidad and Tobago	26,827	65.18	0.791	1,383,248	51	-1
Malaysia	28,421	65.65	0.729	1,360,245	52	-4
Saint Kitts and Nevis	28,593	63.11	0.717	1,293,907	53	-4
Argentina	22,066	66.79	0.868	1,279,283	54	3
Uruguay	23,033	67.45	0.767	1,191,518	55	-1

Bulgaria	23,266	64.58	0.765	1,149,465	56	-1
Mauritius	22,870	65.15	0.769	1,145,862	57	-1
Costa Rica	20,971	69.38	0.752	1,094,111	58	1
Belarus	19,279	65.06	0.828	1,038,594	59	5
Antigua and Barbuda	21,850	66.62	0.704	1,024,775	60	-2
Serbia	18,307	66.33	0.786	954,381	61	4
Thailand	18,439	68.40	0.731	921,935	62	1
Mexico	19,675	65.36	0.715	919,420	63	-1
Libya	21,843	65.32	0.61	870,270	64	-4
Grenada	16,868	64.03	0.801	865,047	65	5
Dominican Republic	18,413	64.22	0.712	841,864	66	1
Georgia	14,989	64.49	0.861	832,308	67	11
Suriname	19,037	62.93	0.688	824,168	68	-2
Maldives	19,510	69.11	0.595	802,333	69	-8
Barbados	15,500	66.70	0.765	790,881	70	2
North Macedonia	16,773	65.38	0.714	782,993	71	-3
Iran	14,904	66.83	0.762	758,939	72	3
Albania	13,653	68.86	0.788	740,840	73	8
Bosnia and Herzegovina	14,897	66.96	0.722	720,182	74	0
Turkmenistan	15,538	62.87	0.735	718,042	75	2
China	15,978	68.53	0.649	710,586	76	-7
Colombia	14,572	69.57	0.691	700,520	77	-4
Peru	12,858	69.90	0.757	680,433	78	6
Brazil	14,736	65.20	0.704	676,392	79	0
Moldova	13,027	65.15	0.796	675,541	80	9
Armenia	13,654	66.64	0.74	673,290	81	2
Azerbaijan	14,442	63.01	0.726	660,666	82	0
Saint Vincent and the Grenadines	13,463	63.64	0.769	658,808	83	5
Sri Lanka	13,080	66.95	0.747	654,089	84	3
Ukraine	12,805	64.62	0.787	651,224	85	6
Saint Lucia	15,201	65.15	0.644	637,775	86	-10
Fiji	13,684	59.66	0.772	630,257	87	5

Botswana	16,404	54.06	0.685	607,494	88	-3
Gabon	14,946	58.82	0.675	593,397	89	-3
South Africa	13,710	56.18	0.758	583,802	90	4
Lebanon	14,493	66.04	0.604	578,121	91	-11
Mongolia	12,486	60.44	0.732	552,378	92	7
Paraguay	12,616	66.45	0.654	548,243	93	-3
Ecuador	11,371	66.74	0.7	531,188	94	4
Tunisia	11,421	67.44	0.676	520,641	95	0
Egypt, Arab Rep.	11,763	62.47	0.702	515,857	96	6
Algeria	11,522	66.30	0.675	515,665	97	-1
Dominica	12,330	63.12	0.641	498,873	98	-5
Equatorial Guinea	18,600	57.21	0.467	496,952	99	-28
Indonesia	11,812	62.55	0.661	488,383	100	1
Guyana	13,082	58.37	0.633	483,331	101	-4
Jamaica	9,777	66.51	0.678	440,906	102	4
Jordan	10,071	67.97	0.64	438,128	103	1
Vietnam	10,134	65.74	0.639	425,728	104	1
Iraq	10,890	63.38	0.599	413,418	105	-2
Bolivia	8,724	63.11	0.744	409,622	106	4
Bhutan	11,865	63.23	0.54	405,144	107	-7
Philippines	8,915	62.73	0.671	375,214	108	0
El Salvador	8,776	65.53	0.589	338,754	109	-2
Tonga	6,377	63.91	0.823	335,414	110	9
Uzbekistan	7,348	60.88	0.743	332,380	111	5
Namibia	9,809	56.77	0.571	317,974	112	-3
Belize	7,153	65.06	0.665	309,452	113	1
Samoa	6,628	61.82	0.726	297,470	114	4
Morocco	7,547	63.83	0.585	281,780	115	-3
Guatemala	8,653	62.91	0.483	262,922	116	-5
Cabo Verde	7,172	64.62	0.558	258,596	117	-2
Kyrgyzstan	5,258	64.93	0.741	253,012	118	7
Eswatini (fmr. Swaziland)	8,653	50.61	0.568	248,744	119	-2
Lao PDR	7,887	60.71	0.47	225,025	120	-7
India	6,689	60.52	0.54	218,617	121	-1
Nicaragua	5,446	65.78	0.589	210,986	122	1

Bangladesh	5,550	64.53	0.558	199,856	123	1
Angola	6,712	56.75	0.519	197,677	124	-3
Ghana	5,540	58.22	0.607	195,784	125	2
Honduras	5,736	63.02	0.518	187,250	126	-4
Tajikistan	3,581	61.84	0.701	155,264	127	13
Nigeria	5,135	56.04	0.521	149,937	128	4
Myanmar	4,740	60.85	0.516	148,825	129	2
Sao Tome and Principe	4,005	62.28	0.578	144,187	130	6
Mauritania	5,344	62.17	0.424	140,865	131	-5
Côte d'Ivoire	5,213	56.19	0.465	136,203	132	-2
Kenya	4,459	58.25	0.519	134,817	133	1
Cambodia	4,389	61.20	0.488	131,082	134	-1
Nepal	3,953	61.51	0.536	130,314	135	2
Congo (Congo- Brazzaville)	3,826	57.02	0.548	119,537	136	5
Pakistan	5,318	57.20	0.392	119,237	137	-8
Timor-Leste	3,627	61.65	0.532	118,947	138	1
Cameroon	3,743	55.43	0.569	118,057	139	3
Micronesia, Fed. Sts.	3,465	56.68	0.581	114,102	140	4
Papua New Guinea	4,293	56.36	0.446	107,898	141	-3
Djibouti	5,260	58.94	0.343	106,332	142	-14
Zambia	3,470	55.08	0.543	103,799	143	2
Vanuatu	3,117	57.60	0.556	99,808	144	4
Comoros	3,059	60.34	0.501	92,474	145	2
Sudan	4,174	61.42	0.348	89,211	146	-11
Benin	3,287	56.64	0.455	84,724	147	-1
Zimbabwe	2,311	53.56	0.627	77,592	148	10
Haiti	3,073	55.43	0.455	77,508	149	0
Tanzania	2,661	58.73	0.459	71,729	150	0
Senegal	3,368	59.86	0.344	69,362	151	-8
Solomon Islands	2,661	52.73	0.477	66,916	152	-1
Kiribati	2,103	53.54	0.594	66,870	153	9
Lesotho	2,656	45.24	0.535	64,290	154	6

Togo	2,122	57.01	0.527	63,748	155	4
Rwanda	2,228	59.83	0.459	61,174	156	-2
Uganda	2,183	57.75	0.473	59,632	157	-1
Gambia	2,226	58.32	0.407	52,842	158	-3
Ethiopia	2,221	60.22	0.375	50,165	159	-6
Guinea	2,566	53.87	0.346	47,833	160	-8
Malawi	1,537	56.58	0.502	43,660	161	6
Guinea-Bissau	1,939	53.61	0.414	43,045	162	2
Madagascar	1,619	57.60	0.452	42,138	163	2
Afghanistan	2,065	54.11	0.377	42,127	164	-1
Burkina Faso	2,176	54.16	0.328	38,647	165	-4
Sierra Leone	1,705	54.06	0.418	38,534	166	0
Liberia	1,470	56.89	0.457	38,209	167	1
Mali	2,322	54.26	0.283	35,651	168	-11
Democratic Republic of the Congo	1,098	56.34	0.507	31,360	169	3
Chad	1,580	52.85	0.309	25,797	170	-1
Mozambique	1,282	50.80	0.39	25,394	171	0
Niger	1,224	55.06	0.264	17,797	172	-2
Burundi	751	55.50	0.402	16,767	173	2
Central African Republic	946	45.71	0.368	15,914	174	0
Somalia	1,186	51.51	0.227	13,873	175	-2

Source: Own calculations based on World Bank (2022), GBD (2020), and Global Data Lab (2023).

Note: "GDPpc" refers to purchasing power-adjusted per capita GDP in international dollars with a base year of 2017 (2017 INT\$), "HALE" refers to healthy life expectancy at birth, and "EHLI" refers to education-adjusted healthy lifetime income and is measured in purchasing power-adjusted 2017 INT\$. "Changes compared with HLI" refers to changes in country rankings when compared with healthy lifetime income.

Table A4 PHLI (Pollution-Adjusted Healthy Lifetime Income) Values of 175 Countries, 2019 (2017 INT\$)

Country	GDPpc	HALE	Environmental sub-index	PHLI	Ranking	Changes compared with HLI
Luxembourg	116,518	70.99	0.541	4,476,494	1	0

Ireland	86,650	70.35	0.598	3,646,877	2	1
Switzerland	70,944	72.02	0.604	3,084,929	3	2
Norway	64,385	70.84	0.655	2,987,920	4	2
Sweden	52,851	71.39	0.652	2,460,376	5	9
Iceland	56,936	72.32	0.590	2,428,834	6	2
United States	62,459	65.43	0.577	2,359,709	7	2
Austria	55,834	70.60	0.594	2,339,722	8	5
Denmark	57,162	69.92	0.572	2,288,073	9	3
Qatar	90,044	66.27	0.371	2,212,071	10	-6
Canada	49,172	70.45	0.618	2,140,630	11	8
Finland	48,583	70.34	0.611	2,089,451	12	8
Netherlands	56,784	70.62	0.517	2,071,483	13	-2
Australia	49,309	70.31	0.597	2,070,765	14	4
Germany	53,930	69.72	0.514	1,931,718	15	0
France	46,018	71.50	0.573	1,885,115	16	5
Brunei Darussalam	62,098	65.26	0.454	1,840,598	17	-7
Singapore	98,283	74.48	0.248	1,811,905	18	-16
Belgium	51,937	69.72	0.492	1,782,890	19	-3
United Arab Emirates	68,264	64.38	0.401	1,763,407	20	-13
United Kingdom	47,369	69.11	0.528	1,727,207	21	1
New Zealand	43,110	69.59	0.571	1,712,852	22	6
Italy	42,746	71.24	0.550	1,673,605	23	2
Spain	40,802	71.60	0.549	1,602,776	24	5
Slovenia	38,947	70.38	0.576	1,577,615	25	8
Japan	41,697	73.84	0.472	1,454,349	26	-2
Saudi Arabia	47,000	64.48	0.473	1,433,594	27	-1
Czechia (Czech Republic)	40,981	68.60	0.499	1,403,552	28	4
Republic of Korea	42,759	72.33	0.448	1,384,744	29	-6
Lithuania	37,166	66.56	0.559	1,381,769	30	5
Cyprus	41,522	69.90	0.473	1,371,600	31	0
Bahamas	36,522	64.24	0.576	1,351,049	32	5
Portugal	34,946	70.21	0.540	1,324,043	33	3
Latvia	31,012	66.32	0.635	1,304,993	34	9
Hungary	32,554	66.79	0.573	1,246,723	35	5
Estonia	36,401	68.13	0.502	1,245,936	36	-2

Kuwait	49,947	70.25	0.347	1,216,452	37	-20
Oman	31,284	64.76	0.586	1,186,845	38	6
Croatia	29,336	68.21	0.585	1,171,000	39	6
Slovakia	31,928	67.61	0.540	1,165,328	40	1
Panama	31,440	69.24	0.524	1,141,755	41	-2
Israel	40,626	71.82	0.389	1,134,929	42	-12
Romania	29,875	66.36	0.555	1,100,959	43	3
Poland	33,185	68.12	0.482	1,089,860	44	-6
Greece	29,698	69.91	0.509	1,056,279	45	-3
Russian Federation	27,255	63.74	0.560	972,325	46	5
Argentina	22,066	66.79	0.656	966,705	47	10
Bahrain	45,312	66.59	0.311	939,314	48	-21
Uruguay	23,033	67.45	0.593	921,399	49	5
Malaysia	28,421	65.65	0.493	920,098	50	-2
Libya	21,843	65.32	0.644	918,144	51	9
Chile	24,931	69.23	0.518	893,896	52	0
Kazakhstan	26,352	63.16	0.535	889,951	53	0
Trinidad and Tobago	26,827	65.18	0.507	887,252	54	-4
Saint Kitts and Nevis	28,593	63.11	0.472	851,843	55	-6
Costa Rica	20,971	69.38	0.581	844,758	56	3
Turkey	28,197	67.81	0.439	838,891	57	-10
Bulgaria	23,266	64.58	0.522	784,131	58	-3
Suriname	19,037	62.93	0.614	734,998	59	7
Antigua and Barbuda	21,850	66.62	0.488	711,007	60	-2
Belarus	19,279	65.06	0.554	694,754	61	3
Equatorial Guinea	18,600	57.21	0.607	646,254	62	9
Thailand	18,439	68.40	0.507	638,811	63	0
Mexico	19,675	65.36	0.491	631,428	64	-2
Colombia	14,572	69.57	0.588	596,224	65	8
Georgia	14,989	64.49	0.615	594,784	66	12
Gabon	14,946	58.82	0.651	572,125	67	19
Paraguay	12,616	66.45	0.677	567,748	68	22
Brazil	14,736	65.20	0.584	561,426	69	10
Grenada	16,868	64.03	0.508	549,120	70	0
Mauritius	22,870	65.15	0.368	548,829	71	-15
Turkmenistan	15,538	62.87	0.557	544,353	72	5

Guyana	13,082	58.37	0.709	541,625	73	24
Dominican Republic	18,413	64.22	0.454	536,561	74	-7
Botswana	16,404	54.06	0.602	533,985	75	10
China	15,978	68.53	0.487	533,600	76	-7
North Macedonia	16,773	65.38	0.472	517,217	77	-9
Algeria	11,522	66.30	0.672	513,130	78	18
Albania	13,653	68.86	0.543	510,629	79	2
Saint Lucia	15,201	65.15	0.511	506,224	80	-4
Azerbaijan	14,442	63.01	0.552	502,061	81	1
Serbia	18,307	66.33	0.410	497,742	82	-17
Iran	14,904	66.83	0.487	484,730	83	-8
Moldova	13,027	65.15	0.569	482,721	84	5
Maldives	19,510	69.11	0.347	467,696	85	-24
Dominica	12,330	63.12	0.584	454,471	86	7
Barbados	15,500	66.70	0.439	454,116	87	-15
Peru	12,858	69.90	0.505	453,748	88	-4
Mongolia	12,486	60.44	0.596	449,937	89	10
Fiji	13,684	59.66	0.551	449,489	90	2
Saint Vincent and the Grenadines	13,463	63.64	0.519	444,944	91	-3
Tunisia	11,421	67.44	0.564	434,284	92	3
Ukraine	12,805	64.62	0.522	432,168	93	-2
Bhutan	11,865	63.23	0.573	429,540	94	6
Armenia	13,654	66.64	0.469	426,442	95	-12
Bosnia and Herzegovina	14,897	66.96	0.409	408,282	96	-22
Ecuador	11,371	66.74	0.533	404,626	97	1
Egypt, Arab Rep.	11,763	62.47	0.523	384,553	98	4
Sri Lanka	13,080	66.95	0.432	377,879	99	-12
Indonesia	11,812	62.55	0.484	357,469	100	1
Bolivia	8,724	63.11	0.645	355,184	101	9
Lebanon	14,493	66.04	0.370	354,589	102	-22
South Africa	13,710	56.18	0.454	349,865	103	-9
Jordan	10,071	67.97	0.507	347,024	104	0
Namibia	9,809	56.77	0.566	315,232	105	4
Iraq	10,890	63.38	0.456	314,497	106	-3

Belize	7,153	65.06	0.672	312,643	107	7
Vietnam	10,134	65.74	0.450	299,917	108	-3
El Salvador	8,776	65.53	0.490	281,750	109	-2
Guatemala	8,653	62.91	0.504	274,153	110	1
Jamaica	9,777	66.51	0.411	267,031	111	-5
Morocco	7,547	63.83	0.554	266,819	112	0
Philippines	8,915	62.73	0.470	262,719	113	-5
Cabo Verde	7,172	64.62	0.534	247,289	114	1
Eswatini (fmr. Swaziland)	8,653	50.61	0.561	245,850	115	2
Angola	6,712	56.75	0.636	242,049	116	5
Mauritania	5,344	62.17	0.716	238,012	117	9
Lao PDR	7,887	60.71	0.494	236,516	118	-5
Samoa	6,628	61.82	0.522	213,831	119	-1
Uzbekistan	7,348	60.88	0.454	202,995	120	-4
Nicaragua	5,446	65.78	0.564	202,116	121	2
Tonga	6,377	63.91	0.495	201,678	122	-3
Honduras	5,736	63.02	0.526	189,971	123	-1
Côte d'Ivoire	5,213	56.19	0.646	189,116	124	6
Djibouti	5,260	58.94	0.610	189,067	125	3
Kyrgyzstan	5,258	64.93	0.542	185,229	126	-1
Ghana	5,540	58.22	0.574	185,033	127	0
India	6,689	60.52	0.441	178,656	128	-8
Nigeria	5,135	56.04	0.606	174,470	129	3
Myanmar	4,740	60.85	0.576	166,082	130	1
Sudan	4,174	61.42	0.647	165,792	131	4
Bangladesh	5,550	64.53	0.461	165,237	132	-8
Kenya	4,459	58.25	0.624	162,189	133	1
Papua New Guinea	4,293	56.36	0.621	150,259	134	4
Congo(Congo- Brazzaville)	3,826	57.02	0.676	147,428	135	6
Cambodia	4,389	61.20	0.548	147,257	136	-3
Pakistan	5,318	57.20	0.459	139,589	137	-8
Timor-Leste	3,627	61.65	0.613	137,130	138	1
Sao Tome and Principe	4,005	62.28	0.532	132,639	139	-3

Cameroon	3,743	55.43	0.635	131,656	140	2
Nepal	3,953	61.51	0.523	127,184	141	-4
Tajikistan	3,581	61.84	0.573	126,835	142	-2
Benin	3,287	56.64	0.609	113,386	143	3
Senegal	3,368	59.86	0.554	111,653	144	-1
Vanuatu	3,117	57.60	0.617	110,831	145	3
Tanzania	2,661	58.73	0.665	103,895	146	4
Comoros	3,059	60.34	0.536	99,002	147	0
Mali	2,322	54.26	0.729	91,829	148	9
Haiti	3,073	55.43	0.539	91,734	149	0
Micronesia, Fed. Sts.	3,465	56.68	0.467	91,629	150	-6
Zambia	3,470	55.08	0.476	91,050	151	-6
Solomon Islands	2,661	52.73	0.642	90,030	152	-1
Guinea	2,566	53.87	0.638	88,159	153	-1
Ethiopia	2,221	60.22	0.648	86,689	154	-1
Rwanda	2,228	59.83	0.587	78,174	155	-1
Uganda	2,183	57.75	0.614	77,458	156	0
Burkina Faso	2,176	54.16	0.650	76,619	157	4
Zimbabwe	2,311	53.56	0.605	74,869	158	0
Togo	2,122	57.01	0.619	74,854	159	0
Gambia	2,226	58.32	0.574	74,536	160	-5
Guinea-Bissau	1,939	53.61	0.644	66,917	161	3
Lesotho	2,656	45.24	0.553	66,496	162	-2
Chad	1,580	52.85	0.755	62,997	163	6
Madagascar	1,619	57.60	0.672	62,682	164	1
Afghanistan	2,065	54.11	0.534	59,708	165	-2
Kiribati	2,103	53.54	0.526	59,198	166	-4
Sierra Leone	1,705	54.06	0.634	58,480	167	-1
Malawi	1,537	56.58	0.625	54,376	168	-1
Liberia	1,470	56.89	0.645	53,909	169	-1
Niger	1,224	55.06	0.731	49,283	170	0
Somalia	1,186	51.51	0.728	44,519	171	2
Mozambique	1,282	50.80	0.655	42,640	172	-1
Democratic Republic of the Congo	1,098	56.34	0.682	42,200	173	-1

Central African Republic	946	45.71	0.758	32,785	174	0
Burundi	751	55.50	0.610	25,437	175	0

Source: Own calculations based on World Bank (2022), GBD (2020), and Community Emissions Data System (2021).

Note: “GDPpc” refers to purchasing power-adjusted per capita GDP in international dollars with a base year of 2017 (2017 INT\$), “HALE” refers to healthy life expectancy at birth, and “PHLI” refers to pollution-adjusted healthy lifetime income and is measured in purchasing power-adjusted 2017 INT\$. “Changes compared with HLI” refers to changes in country rankings when compared with healthy lifetime income.

Table A5 PEHLI (Pollution- and Education-Adjusted Healthy Lifetime Income) Values of 175 Countries, 2019 (2017 INT\$)

Country	GDPpc	HALE	Educational sub-index	Environmental sub-index	PEHLI	Ranking	Changes compared with HLI
Luxembourg	116,518	70.99	0.834	0.541	3,733,396	1	0
Ireland	86,650	70.35	0.886	0.598	3,231,133	2	1
Switzerland	70,944	72.02	0.92	0.604	2,838,134	3	2
Norway	64,385	70.84	0.933	0.655	2,787,729	4	2
Iceland	56,936	72.32	0.958	0.590	2,326,823	5	3
Sweden	52,851	71.39	0.92	0.652	2,263,546	6	8
United States	62,459	65.43	0.905	0.577	2,135,537	7	2
Denmark	57,162	69.92	0.93	0.572	2,127,908	8	4
Austria	55,834	70.60	0.853	0.594	1,995,782	9	4
Canada	49,172	70.45	0.917	0.618	1,962,958	10	9
Finland	48,583	70.34	0.929	0.611	1,941,100	11	9
Australia	49,309	70.31	0.922	0.597	1,909,245	12	6
Netherlands	56,784	70.62	0.915	0.517	1,895,407	13	-2
Germany	53,930	69.72	0.942	0.514	1,819,678	14	1
Belgium	51,937	69.72	0.913	0.492	1,627,779	15	1
New Zealand	43,110	69.59	0.935	0.571	1,601,516	16	12
United Kingdom	47,369	69.11	0.925	0.528	1,597,666	17	5
France	46,018	71.50	0.826	0.573	1,557,105	18	3
Singapore	98,283	74.48	0.854	0.248	1,547,367	19	-17
United Arab Emirates	68,264	64.38	0.859	0.401	1,514,766	20	-13
Qatar	90,044	66.27	0.675	0.371	1,493,148	21	-17
Slovenia	38,947	70.38	0.917	0.576	1,446,673	22	11
Spain	40,802	71.60	0.843	0.549	1,351,140	23	6

Italy	42,746	71.24	0.806	0.550	1,348,926	24	1
Brunei Darussalam	62,098	65.26	0.697	0.454	1,282,897	25	-15
Japan	41,697	73.84	0.868	0.472	1,262,375	26	-2
Lithuania	37,166	66.56	0.899	0.559	1,242,211	27	8
Czechia (Czech Republic)	40,981	68.60	0.88	0.499	1,235,126	28	4
Republic of Korea	42,759	72.33	0.876	0.448	1,213,036	29	-6
Latvia	31,012	66.32	0.892	0.635	1,164,054	30	13
Cyprus	41,522	69.90	0.847	0.473	1,161,745	31	0
Saudi Arabia	47,000	64.48	0.81	0.473	1,161,211	32	-6
Estonia	36,401	68.13	0.896	0.502	1,116,358	33	1
Bahamas	36,522	64.24	0.78	0.576	1,053,818	34	3
Portugal	34,946	70.21	0.78	0.540	1,032,753	35	1
Hungary	32,554	66.79	0.823	0.573	1,026,053	36	4
Israel	40,626	71.82	0.891	0.389	1,011,222	37	-7
Slovakia	31,928	67.61	0.834	0.540	971,883	38	3
Croatia	29,336	68.21	0.826	0.585	967,246	39	6
Poland	33,185	68.12	0.883	0.482	962,346	40	-2
Greece	29,698	69.91	0.871	0.509	920,019	41	1
Oman	31,284	64.76	0.772	0.586	916,244	42	2
Romania	29,875	66.36	0.771	0.555	848,840	43	3
Russian Federation	27,255	63.74	0.864	0.560	840,089	44	7
Argentina	22,066	66.79	0.868	0.656	839,100	45	12
Panama	31,440	69.24	0.714	0.524	815,213	46	-7
Kuwait	49,947	70.25	0.67	0.347	815,023	47	-30
Bahrain	45,312	66.59	0.813	0.311	763,662	48	-21
Kazakhstan	26,352	63.16	0.845	0.535	752,009	49	4
Chile	24,931	69.23	0.829	0.518	741,040	50	2
Uruguay	23,033	67.45	0.767	0.593	706,713	51	3
Trinidad and Tobago	26,827	65.18	0.791	0.507	701,816	52	-2
Malaysia	28,421	65.65	0.729	0.493	670,751	53	-5
Turkey	28,197	67.81	0.788	0.439	661,046	54	-7
Costa Rica	20,971	69.38	0.752	0.581	635,258	55	4
Saint Kitts and Nevis	28,593	63.11	0.717	0.472	610,771	56	-7

Bulgaria	23,266	64.58	0.765	0.522	599,860	57	-2
Belarus	19,279	65.06	0.828	0.554	575,256	58	6
Libya	21,843	65.32	0.61	0.644	560,068	59	1
Georgia	14,989	64.49	0.861	0.615	512,109	60	18
Suriname	19,037	62.93	0.688	0.614	505,678	61	5
Antigua and Barbuda	21,850	66.62	0.704	0.488	500,549	62	-4
Thailand	18,439	68.40	0.731	0.507	466,971	63	0
Mexico	19,675	65.36	0.715	0.491	451,471	64	-2
Grenada	16,868	64.03	0.801	0.508	439,845	65	5
Mauritius	22,870	65.15	0.769	0.368	422,049	66	-10
Colombia	14,572	69.57	0.691	0.588	411,991	67	6
Albania	13,653	68.86	0.788	0.543	402,376	68	13
Turkmenistan	15,538	62.87	0.735	0.557	400,100	69	8
Brazil	14,736	65.20	0.704	0.584	395,244	70	9
Serbia	18,307	66.33	0.786	0.410	391,225	71	-6
Gabon	14,946	58.82	0.675	0.651	386,184	72	14
Moldova	13,027	65.15	0.796	0.569	384,246	73	16
Dominican Republic	18,413	64.22	0.712	0.454	382,031	74	-7
Paraguay	12,616	66.45	0.654	0.677	371,307	75	15
Iran	14,904	66.83	0.762	0.487	369,364	76	-1
North Macedonia	16,773	65.38	0.714	0.472	369,293	77	-9
Botswana	16,404	54.06	0.685	0.602	365,780	78	7
Azerbaijan	14,442	63.01	0.726	0.552	364,496	79	3
Barbados	15,500	66.70	0.765	0.439	347,398	80	-8
Fiji	13,684	59.66	0.772	0.551	347,006	81	11
Algeria	11,522	66.30	0.675	0.672	346,363	82	14
China	15,978	68.53	0.649	0.487	346,306	83	-14
Peru	12,858	69.90	0.757	0.505	343,487	84	0
Guyana	13,082	58.37	0.633	0.709	342,849	85	12
Saint Vincent and the Grenadines	13,463	63.64	0.769	0.519	342,162	86	2
Ukraine	12,805	64.62	0.787	0.522	340,116	87	4
Mongolia	12,486	60.44	0.732	0.596	329,354	88	11
Saint Lucia	15,201	65.15	0.644	0.511	326,008	89	-13

Armenia	13,654	66.64	0.74	0.469	315,567	90	-7
Equatorial Guinea	18,600	57.21	0.467	0.607	301,801	91	-20
Bosnia and Herzegovina	14,897	66.96	0.722	0.409	294,780	92	-18
Tunisia	11,421	67.44	0.676	0.564	293,576	93	2
Dominica	12,330	63.12	0.641	0.584	291,316	94	-1
Ecuador	11,371	66.74	0.7	0.533	283,238	95	3
Sri Lanka	13,080	66.95	0.747	0.432	282,276	96	-9
Maldives	19,510	69.11	0.595	0.347	278,279	97	-36
Egypt, Arab Rep.	11,763	62.47	0.702	0.523	269,956	98	4
South Africa	13,710	56.18	0.758	0.454	265,197	99	-5
Bolivia	8,724	63.11	0.744	0.645	264,257	100	10
Indonesia	11,812	62.55	0.661	0.484	236,287	101	0
Bhutan	11,865	63.23	0.54	0.573	231,952	102	-2
Jordan	10,071	67.97	0.64	0.507	222,096	103	1
Lebanon	14,493	66.04	0.604	0.370	214,172	104	-24
Belize	7,153	65.06	0.665	0.672	207,907	105	9
Vietnam	10,134	65.74	0.639	0.450	191,647	106	-1
Iraq	10,890	63.38	0.599	0.456	188,384	107	-4
Jamaica	9,777	66.51	0.678	0.411	181,047	108	-2
Namibia	9,809	56.77	0.571	0.566	179,997	109	0
Philippines	8,915	62.73	0.671	0.470	176,285	110	-2
Tonga	6,377	63.91	0.823	0.495	165,981	111	8
El Salvador	8,776	65.53	0.589	0.490	165,951	112	-5
Morocco	7,547	63.83	0.585	0.554	156,089	113	-1
Samoa	6,628	61.82	0.726	0.522	155,241	114	4
Uzbekistan	7,348	60.88	0.743	0.454	150,825	115	1
Eswatini (fmr. Swaziland)	8,653	50.61	0.568	0.561	139,643	116	1
Cabo Verde	7,172	64.62	0.558	0.534	137,987	117	-2
Kyrgyzstan	5,258	64.93	0.741	0.542	137,255	118	7
Guatemala	8,653	62.91	0.483	0.504	132,416	119	-8
Angola	6,712	56.75	0.519	0.636	125,624	120	1
Nicaragua	5,446	65.78	0.589	0.564	119,046	121	2
Ghana	5,540	58.22	0.607	0.574	112,315	122	5
Lao PDR	7,887	60.71	0.47	0.494	111,163	123	-10

Mauritania	5,344	62.17	0.424	0.716	100,917	124	2
Honduras	5,736	63.02	0.518	0.526	98,405	125	-3
India	6,689	60.52	0.54	0.441	96,474	126	-6
Bangladesh	5,550	64.53	0.558	0.461	92,202	127	-3
Nigeria	5,135	56.04	0.521	0.606	90,899	128	4
Tajikistan	3,581	61.84	0.701	0.573	88,911	129	11
Côte d'Ivoire	5,213	56.19	0.465	0.646	87,939	130	0
Myanmar	4,740	60.85	0.516	0.576	85,698	131	0
Kenya	4,459	58.25	0.519	0.624	84,176	132	2
Congo (Congo- Brazzaville)	3,826	57.02	0.548	0.676	80,790	133	8
Sao Tome and Principe	4,005	62.28	0.578	0.532	76,666	134	2
Cameroon	3,743	55.43	0.569	0.635	74,912	135	7
Timor-Leste	3,627	61.65	0.532	0.613	72,953	136	3
Cambodia	4,389	61.20	0.488	0.548	71,861	137	-4
Nepal	3,953	61.51	0.536	0.523	68,171	138	-1
Papua New Guinea	4,293	56.36	0.446	0.621	67,016	139	-1
Djibouti	5,260	58.94	0.343	0.610	64,850	140	-12
Vanuatu	3,117	57.60	0.556	0.617	61,622	141	7
Sudan	4,174	61.42	0.348	0.647	57,696	142	-7
Pakistan	5,318	57.20	0.392	0.459	54,719	143	-14
Micronesia, Fed. Sts.	3,465	56.68	0.581	0.467	53,237	144	0
Benin	3,287	56.64	0.455	0.609	51,591	145	1
Comoros	3,059	60.34	0.501	0.536	49,600	146	1
Zambia	3,470	55.08	0.543	0.476	49,440	147	-2
Tanzania	2,661	58.73	0.459	0.665	47,688	148	2
Zimbabwe	2,311	53.56	0.627	0.605	46,943	149	9
Solomon Islands	2,661	52.73	0.477	0.642	42,944	150	1
Haiti	3,073	55.43	0.455	0.539	41,739	151	-2
Togo	2,122	57.01	0.527	0.619	39,448	152	7
Senegal	3,368	59.86	0.344	0.554	38,409	153	-10
Uganda	2,183	57.75	0.473	0.614	36,638	154	2
Rwanda	2,228	59.83	0.459	0.587	35,882	155	-1
Lesotho	2,656	45.24	0.535	0.553	35,575	156	4

Kiribati	2,103	53.54	0.594	0.526	35,163	157	5
Ethiopia	2,221	60.22	0.375	0.648	32,509	158	-5
Guinea	2,566	53.87	0.346	0.638	30,503	159	-7
Gambia	2,226	58.32	0.407	0.574	30,336	160	-5
Madagascar	1,619	57.60	0.452	0.672	28,332	161	4
Guinea-Bissau	1,939	53.61	0.414	0.644	27,704	162	2
Malawi	1,537	56.58	0.502	0.625	27,297	163	4
Mali	2,322	54.26	0.283	0.729	25,987	164	-7
Burkina Faso	2,176	54.16	0.328	0.650	25,131	165	-4
Liberia	1,470	56.89	0.457	0.645	24,636	166	2
Sierra Leone	1,705	54.06	0.418	0.634	24,444	167	-1
Afghanistan	2,065	54.11	0.377	0.534	22,510	168	-5
Democratic							
Republic of the	1,098	56.34	0.507	0.682	21,395	169	3
Congo							
Chad	1,580	52.85	0.309	0.755	19,466	170	-1
Mozambique	1,282	50.80	0.39	0.655	16,630	171	0
Niger	1,224	55.06	0.264	0.731	13,011	172	-2
Central African	946	45.71	0.368	0.758	12,065	173	1
Republic							
Burundi	751	55.50	0.402	0.610	10,226	174	1
Somalia	1,186	51.51	0.227	0.728	10,106	175	-2

Source: Own calculations based on World Bank (2022), GBD (2020), Global Data Lab (2023), and Community Emissions Data System (2021).

Note: "GDPpc" refers to purchasing power-adjusted per capita GDP in international dollars with a base year of 2017 (2017 INT\$), "HALE" refers to healthy life expectancy at birth, and "PEHLI" refers to pollution- and education-adjusted healthy lifetime income and is measured in purchasing power-adjusted 2017 INT\$. "Changes compared with HLI" refers to changes in country rankings when compared with healthy lifetime income.

Table A6 Pollution Sub-Index for 175 countries ($\alpha=0.2$)

Country	SO2 emissions (t)	Land areas (sq km)	SO2/land areas (X)	X0.2	Environmental sub-index
Afghanistan	327,819	652,230	0.503	0.871	0.534
Albania	11,539	27,400	0.421	0.841	0.543
Algeria	66,458	2,381,741	0.028	0.489	0.672

Angola	77,387	1,246,700	0.062	0.574	0.636
Antigua and Barbuda	554	440	1.260	1.047	0.488
Argentina	108,724	2,736,690	0.040	0.525	0.656
Armenia	53,291	28,470	1.872	1.134	0.469
Australia	1,070,817	7,692,020	0.139	0.674	0.597
Austria	12,433	82,520	0.151	0.685	0.594
Azerbaijan	29,275	82,654	0.354	0.813	0.552
Bahamas	2,170	10,010	0.217	0.737	0.576
Bahrain	41,478	783	52.974	2.212	0.311
Bangladesh	282,453	130,170	2.170	1.168	0.461
Barbados	1,458	430	3.390	1.277	0.439
Belarus	68,803	202,965	0.339	0.805	0.554
Belgium	35,272	30,280	1.165	1.031	0.492
Belize	634	22,810	0.028	0.488	0.672
Benin	12,321	112,760	0.109	0.642	0.609
Bhutan	8,852	38,140	0.232	0.747	0.573
Bolivia	54,565	1,083,300	0.050	0.550	0.645
Bosnia and Herzegovina	320,466	51,200	6.259	1.443	0.409
Botswana	71,415	566,730	0.126	0.661	0.602
Brazil	1,522,168	8,358,140	0.182	0.711	0.584
Brunei Darussalam	13,213	5,270	2.507	1.202	0.454
Bulgaria	70,092	108,560	0.646	0.916	0.522
Burkina Faso	12,311	273,600	0.045	0.538	0.650
Burundi	2,750	25,680	0.107	0.640	0.610
Cabo Verde	2,056	4,030	0.510	0.874	0.534
Cambodia	67,095	176,520	0.380	0.824	0.548
Cameroon	29,957	472,710	0.063	0.576	0.635
Canada	809,870	8,965,590	0.090	0.618	0.618
Central African Republic	2,059	622,980	0.003	0.319	0.758
Chad	4,583	1,259,200	0.004	0.325	0.755
Chile	519,366	743,532	0.699	0.931	0.518
China	12,137,898	9,424,703	1.288	1.052	0.487
Colombia	186,913	1,109,500	0.168	0.700	0.588
Comoros	898	1,861	0.483	0.864	0.536
Congo (Congo-Brazzaville)	8,666	341,500	0.025	0.480	0.676
Costa Rica	10,039	51,060	0.197	0.722	0.581

Côte d'Ivoire	15,836	318,000	0.050	0.549	0.646
Croatia	10,013	55,964	0.179	0.709	0.585
Cyprus	15,999	9,240	1.731	1.116	0.473
Czechia (Czech Republic)	78,387	77,206	1.015	1.003	0.499
Democratic Republic of the Congo	49,681	2,267,050	0.022	0.466	0.682
Denmark	9,294	40,000	0.232	0.747	0.572
Djibouti	2,482	23,180	0.107	0.640	0.610
Dominica	138	750	0.184	0.712	0.584
Dominican Republic	122,050	48,310	2.526	1.204	0.454
Ecuador	127,685	248,360	0.514	0.875	0.533
Egypt, Arab Rep.	624,238	995,450	0.627	0.911	0.523
El Salvador	25,366	20,720	1.224	1.041	0.490
Equatorial Guinea	3,171	28,050	0.113	0.647	0.607
Estonia	40,746	42,750	0.953	0.990	0.502
Eswatini (fmr. Swaziland)	5,007	17,200	0.291	0.781	0.561
Ethiopia	53,347	1,128,571	0.047	0.543	0.648
Fiji	6,621	18,270	0.362	0.816	0.551
Finland	31,487	303,930	0.104	0.635	0.611
France	126,041	547,557	0.230	0.745	0.573
Gabon	11,460	257,670	0.044	0.537	0.651
Gambia	2,274	10,120	0.225	0.742	0.574
Georgia	6,641	69,490	0.096	0.625	0.615
Germany	265,316	349,390	0.759	0.946	0.514
Ghana	51,582	227,540	0.227	0.743	0.574
Greece	108,209	128,900	0.839	0.966	0.509
Grenada	287	340	0.844	0.967	0.508
Guatemala	99,650	107,160	0.930	0.986	0.504
Guinea	14,544	245,720	0.059	0.568	0.638
Guinea-Bissau	1,465	28,120	0.052	0.554	0.644
Guyana	2,274	196,850	0.012	0.410	0.709
Haiti	12,737	27,560	0.462	0.857	0.539
Honduras	67,123	111,890	0.600	0.903	0.526
Hungary	20,801	91,260	0.228	0.744	0.573
Iceland	16,372	100,830	0.162	0.695	0.590
India	9,672,037	2,973,190	3.253	1.266	0.441

Indonesia	2,595,484	1,877,519	1.382	1.067	0.484
Iran	2,117,705	1,622,500	1.305	1.055	0.487
Iraq	1,055,941	434,128	2.432	1.195	0.456
Ireland	9,411	68,890	0.137	0.672	0.598
Israel	206,962	21,640	9.564	1.571	0.389
Italy	109,313	295,717	0.370	0.820	0.550
Jamaica	65,972	10,830	6.092	1.435	0.411
Japan	634,186	364,500	1.740	1.117	0.472
Jordan	77,317	88,794	0.871	0.973	0.507
Kazakhstan	1,347,125	2,699,700	0.499	0.870	0.535
Kenya	44,853	569,140	0.079	0.602	0.624
Kiribati	483	810	0.596	0.902	0.526
Republic of Korea	278,492	97,600	2.853	1.233	0.448
Kuwait	423,480	17,820	23.764	1.884	0.347
Kyrgyzstan	81,837	191,800	0.427	0.843	0.542
Lao PDR	260,222	230,800	1.127	1.024	0.494
Latvia	3,944	62,227	0.063	0.576	0.635
Lebanon	144,967	10,230	14.171	1.699	0.370
Lesotho	10,400	30,360	0.343	0.807	0.553
Liberia	4,889	96,320	0.051	0.551	0.645
Libya	91,711	1,759,540	0.052	0.554	0.644
Lithuania	19,316	62,620	0.308	0.790	0.559
Luxembourg	1,128	2,574	0.438	0.848	0.541
Madagascar	15,985	581,800	0.027	0.487	0.672
Malawi	7,297	94,280	0.077	0.599	0.625
Malaysia	377,090	328,550	1.148	1.028	0.493
Maldives	7,106	300	23.685	1.883	0.347
Mali	8,677	1,220,190	0.007	0.372	0.729
Mauritania	10,019	1,030,700	0.010	0.396	0.716
Mauritius	30,117	2,030	14.836	1.715	0.368
Mexico	2,325,587	1,943,950	1.196	1.037	0.491
Micronesia, Fed. Sts.	1,367	700	1.953	1.143	0.467
Moldova	8,234	32,886	0.250	0.758	0.569
Mongolia	221,719	1,557,258	0.142	0.677	0.596
Morocco	151,102	446,300	0.339	0.805	0.554
Mozambique	31,972	786,380	0.041	0.527	0.655

Myanmar	141,558	652,700	0.217	0.737	0.576
Namibia	217,892	823,290	0.265	0.767	0.566
Nepal	90,237	143,350	0.629	0.912	0.523
Netherlands	24,181	33,670	0.718	0.936	0.517
New Zealand	63,073	263,310	0.240	0.751	0.571
Nicaragua	33,063	120,340	0.275	0.772	0.564
Niger	8,534	1,266,700	0.007	0.368	0.731
Nigeria	105,260	910,770	0.116	0.649	0.606
North Macedonia	44,496	25,220	1.764	1.120	0.472
Norway	14,761	365,094	0.040	0.526	0.655
Oman	54,661	309,500	0.177	0.707	0.586
Pakistan	1,756,768	770,880	2.279	1.179	0.459
Panama	45,476	74,180	0.613	0.907	0.524
Papua New Guinea	38,260	452,860	0.084	0.610	0.621
Paraguay	9,762	397,300	0.025	0.477	0.677
Peru	1,162,677	1,280,000	0.908	0.981	0.505
Philippines	545,618	298,170	1.830	1.128	0.470
Poland	437,664	306,110	1.430	1.074	0.482
Portugal	41,383	91,606	0.452	0.853	0.540
Qatar	161,891	11,490	14.090	1.697	0.371
Romania	75,725	230,080	0.329	0.801	0.555
Russian Federation	4,936,763	16,376,870	0.301	0.787	0.560
Rwanda	4,293	24,670	0.174	0.705	0.587
Saint Kitts and Nevis	455	260	1.750	1.118	0.472
Saint Lucia	488	610	0.800	0.956	0.511
Saint Vincent and the Grenadines	265	390	0.679	0.925	0.519
Samoa	1,795	2,780	0.646	0.916	0.522
Sao Tome and Principe	509	960	0.530	0.881	0.532
Saudi Arabia	3,687,984	2,149,690	1.716	1.114	0.473
Senegal	65,448	192,530	0.340	0.806	0.554
Serbia	540,524	87,460	6.180	1.439	0.410
Sierra Leone	4,591	72,180	0.064	0.576	0.634
Singapore	185,930	716	259.679	3.040	0.248
Slovakia	21,640	48,080	0.450	0.852	0.540
Slovenia	4,394	20,136	0.218	0.738	0.576

Solomon Islands	1,517	27,990	0.054	0.558	0.642
Somalia	4,518	627,340	0.007	0.373	0.728
South Africa	3,036,019	1,213,090	2.503	1.201	0.454
Spain	188,274	499,570	0.377	0.823	0.549
Sri Lanka	245,300	61,864	3.965	1.317	0.432
Sudan	90,830	1,868,000	0.049	0.546	0.647
Suriname	15,461	156,000	0.099	0.630	0.614
Sweden	17,598	407,284	0.043	0.533	0.652
Switzerland	4,813	39,516	0.122	0.656	0.604
Tajikistan	32,127	138,790	0.231	0.746	0.573
Tanzania	28,844	885,800	0.033	0.504	0.665
Thailand	448,505	510,890	0.878	0.974	0.507
Timor-Leste	1,481	14,870	0.100	0.630	0.613
Togo	4,824	54,390	0.089	0.616	0.619
Tonga	798	720	1.108	1.021	0.495
Trinidad and Tobago	4,427	5,130	0.863	0.971	0.507
Tunisia	43,002	155,360	0.277	0.773	0.564
Turkey	2,638,195	769,630	3.428	1.279	0.439
Turkmenistan	148,913	469,930	0.317	0.795	0.557
Uganda	19,528	200,520	0.097	0.628	0.614
Ukraine	371,022	579,400	0.640	0.915	0.522
United Arab Emirates	525,423	71,020	7.398	1.492	0.401
United Kingdom	139,173	241,930	0.575	0.895	0.528
United States	1,921,172	9,147,420	0.210	0.732	0.577
Uruguay	26,589	175,020	0.152	0.686	0.593
Uzbekistan	1,113,426	440,555	2.527	1.204	0.454
Vanuatu	1,114	12,190	0.091	0.620	0.617
Vietnam	852,061	313,429	2.719	1.221	0.450
Zambia	1,194,392	743,390	1.607	1.099	0.476
Zimbabwe	45,897	386,850	0.119	0.653	0.605

Source: Own calculations based on World Bank (2022) and Community Emissions Data System (2021).

Note: Pollution sub-index= $Y = \frac{1}{1+X^{0.2}}$; $X = \frac{SO_2 \text{ emissions}}{\text{Land areas}}$.

Table A7 Sensitivity Analysis of Pollution Sub-Index across 175 Countries

Country	α values					
	0.05	0.10	0.15	0.20	0.25	0.30
Afghanistan	0.5086	0.5172	0.5258	0.5343	0.5429	0.5514
Albania	0.5108	0.5216	0.5324	0.5431	0.5538	0.5645
Algeria	0.5446	0.5885	0.6311	0.6717	0.7099	0.7453
Angola	0.5347	0.5690	0.6027	0.6355	0.6670	0.6972
Antigua and Barbuda	0.4971	0.4942	0.4913	0.4884	0.4856	0.4827
Argentina	0.5402	0.5800	0.6187	0.6559	0.6913	0.7247
Armenia	0.4922	0.4843	0.4765	0.4687	0.4609	0.4531
Australia	0.5246	0.5491	0.5734	0.5973	0.6208	0.6437
Austria	0.5236	0.5472	0.5705	0.5935	0.6161	0.6383
Azerbaijan	0.5130	0.5259	0.5388	0.5517	0.5645	0.5772
Bahamas	0.5191	0.5382	0.5571	0.5759	0.5944	0.6127
Bahrain	0.4505	0.4020	0.3554	0.3113	0.2704	0.2331
Bangladesh	0.4903	0.4806	0.4710	0.4613	0.4517	0.4422
Barbados	0.4847	0.4695	0.4543	0.4393	0.4243	0.4094
Belarus	0.5135	0.5270	0.5405	0.5539	0.5672	0.5804
Belgium	0.4981	0.4962	0.4943	0.4924	0.4905	0.4886
Belize	0.5447	0.5886	0.6312	0.6719	0.7101	0.7455
Benin	0.5276	0.5551	0.5823	0.6089	0.6349	0.6602
Bhutan	0.5182	0.5365	0.5546	0.5725	0.5903	0.6078
Bolivia	0.5373	0.5742	0.6102	0.6451	0.6785	0.7102
Bosnia and Herzegovina	0.4771	0.4543	0.4317	0.4093	0.3873	0.3658
Botswana	0.5259	0.5516	0.5771	0.6021	0.6266	0.6505
Brazil	0.5213	0.5425	0.5635	0.5843	0.6049	0.6250
Brunei Darussalam	0.4885	0.4770	0.4656	0.4542	0.4428	0.4315
Bulgaria	0.5055	0.5109	0.5164	0.5219	0.5273	0.5328
Burkina Faso	0.5387	0.5769	0.6142	0.6503	0.6847	0.7171
Burundi	0.5279	0.5556	0.5830	0.6099	0.6361	0.6616
Cabo Verde	0.5084	0.5168	0.5252	0.5336	0.5420	0.5503
Cambodia	0.5121	0.5242	0.5362	0.5482	0.5602	0.5720
Cameroon	0.5344	0.5685	0.6020	0.6345	0.6659	0.6959
Canada	0.5300	0.5598	0.5892	0.6179	0.6459	0.6729
Central African Republic	0.5709	0.6390	0.7020	0.7581	0.8066	0.8473
Chad	0.5697	0.6368	0.6990	0.7546	0.8028	0.8435
Chile	0.5045	0.5090	0.5135	0.5179	0.5224	0.5269

China	0.4968	0.4937	0.4905	0.4874	0.4842	0.4810
Colombia	0.5222	0.5444	0.5664	0.5881	0.6095	0.6305
Comoros	0.5091	0.5182	0.5273	0.5364	0.5454	0.5544
Congo (Congo- Brazzaville)	0.5458	0.5908	0.6344	0.6759	0.7147	0.7507
Costa Rica	0.5203	0.5406	0.5607	0.5806	0.6003	0.6196
Côte d'Ivoire	0.5374	0.5744	0.6106	0.6456	0.6792	0.7109
Croatia	0.5215	0.5429	0.5642	0.5852	0.6059	0.6263
Cyprus	0.4931	0.4863	0.4794	0.4726	0.4657	0.4589
Czechia (Czech Republic)	0.4998	0.4996	0.4994	0.4992	0.4991	0.4989
Democratic Republic of the Congo	0.5476	0.5944	0.6395	0.6822	0.7222	0.7588
Denmark	0.5182	0.5364	0.5545	0.5725	0.5902	0.6077
Djibouti	0.5279	0.5556	0.5830	0.6099	0.6361	0.6616
Dominica	0.5212	0.5423	0.5632	0.5839	0.6044	0.6245
Dominican Republic	0.4884	0.4768	0.4653	0.4538	0.4423	0.4309
Ecuador	0.5083	0.5166	0.5249	0.5332	0.5415	0.5497
Egypt, Arab Rep.	0.5058	0.5117	0.5175	0.5233	0.5291	0.5349
El Salvador	0.4975	0.4949	0.4924	0.4899	0.4874	0.4848
Equatorial Guinea	0.5272	0.5543	0.5810	0.6073	0.6330	0.6579
Estonia	0.5006	0.5012	0.5018	0.5024	0.5030	0.5036
Eswatini (fmr. Swaziland)	0.5154	0.5308	0.5461	0.5614	0.5765	0.5915
Ethiopia	0.5381	0.5757	0.6125	0.6480	0.6820	0.7141
Fiji	0.5127	0.5254	0.5380	0.5506	0.5631	0.5755
Finland	0.5283	0.5564	0.5842	0.6115	0.6380	0.6638
France	0.5184	0.5367	0.5549	0.5729	0.5908	0.6084
Gabon	0.5388	0.5772	0.6147	0.6508	0.6853	0.7179
Gambia	0.5187	0.5373	0.5557	0.5741	0.5922	0.6101
Georgia	0.5293	0.5584	0.5871	0.6153	0.6427	0.6692
Germany	0.5034	0.5069	0.5103	0.5138	0.5172	0.5206
Ghana	0.5185	0.5370	0.5554	0.5737	0.5917	0.6095
Greece	0.5022	0.5044	0.5066	0.5087	0.5109	0.5131
Grenada	0.5021	0.5042	0.5063	0.5085	0.5106	0.5127
Guatemala	0.5009	0.5018	0.5027	0.5036	0.5045	0.5054
Guinea	0.5353	0.5702	0.6045	0.6377	0.6697	0.7002
Guinea-Bissau	0.5369	0.5733	0.6090	0.6436	0.6767	0.7082

Guyana	0.5555	0.6097	0.6613	0.7093	0.7531	0.7922
Haiti	0.5096	0.5193	0.5289	0.5385	0.5481	0.5576
Honduras	0.5064	0.5128	0.5192	0.5255	0.5319	0.5382
Hungary	0.5185	0.5369	0.5552	0.5734	0.5914	0.6091
Iceland	0.5227	0.5453	0.5678	0.5899	0.6117	0.6331
India	0.4853	0.4705	0.4559	0.4413	0.4268	0.4124
Indonesia	0.4960	0.4919	0.4879	0.4838	0.4798	0.4757
Iran	0.4967	0.4933	0.4900	0.4867	0.4834	0.4800
Iraq	0.4889	0.4778	0.4667	0.4557	0.4447	0.4337
Ireland	0.5249	0.5496	0.5741	0.5982	0.6219	0.6450
Israel	0.4718	0.4438	0.4161	0.3890	0.3625	0.3368
Italy	0.5124	0.5249	0.5373	0.5496	0.5619	0.5741
Jamaica	0.4774	0.4549	0.4327	0.4106	0.3890	0.3677
Japan	0.4931	0.4862	0.4792	0.4723	0.4654	0.4586
Jordan	0.5017	0.5035	0.5052	0.5069	0.5086	0.5104
Kazakhstan	0.5087	0.5174	0.5260	0.5347	0.5433	0.5519
Kenya	0.5317	0.5632	0.5941	0.6244	0.6537	0.6818
Kiribati	0.5065	0.5129	0.5194	0.5258	0.5323	0.5387
Republic of Korea	0.4869	0.4738	0.4608	0.4478	0.4348	0.4220
Kuwait	0.4605	0.4215	0.3834	0.3467	0.3117	0.2788
Kyrgyzstan	0.5106	0.5213	0.5319	0.5425	0.5530	0.5635
Lao PDR	0.4985	0.4970	0.4955	0.4940	0.4925	0.4910
Latvia	0.5344	0.5685	0.6020	0.6345	0.6659	0.6958
Lebanon	0.4669	0.4341	0.4019	0.3705	0.3401	0.3110
Lesotho	0.5134	0.5268	0.5401	0.5534	0.5666	0.5797
Liberia	0.5372	0.5740	0.6099	0.6448	0.6781	0.7098
Libya	0.5369	0.5733	0.6090	0.6436	0.6767	0.7081
Lithuania	0.5147	0.5294	0.5440	0.5585	0.5730	0.5873
Luxembourg	0.5103	0.5206	0.5309	0.5412	0.5514	0.5616
Madagascar	0.5448	0.5889	0.6316	0.6724	0.7107	0.7462
Malawi	0.5319	0.5636	0.5948	0.6252	0.6547	0.6830
Malaysia	0.4983	0.4966	0.4948	0.4931	0.4914	0.4897
Maldives	0.4605	0.4215	0.3835	0.3468	0.3119	0.2790
Mali	0.5615	0.6212	0.6774	0.7289	0.7750	0.8151
Mauritania	0.5577	0.6138	0.6671	0.7164	0.7610	0.8006
Mauritius	0.4663	0.4330	0.4002	0.3683	0.3375	0.3081

Mexico	0.4978	0.4955	0.4933	0.4910	0.4888	0.4866
Micronesia, Fed. Sts.	0.4916	0.4833	0.4749	0.4666	0.4582	0.4500
Moldova	0.5173	0.5346	0.5517	0.5688	0.5857	0.6024
Mongolia	0.5243	0.5486	0.5726	0.5962	0.6195	0.6422
Morocco	0.5135	0.5270	0.5405	0.5539	0.5673	0.5805
Mozambique	0.5399	0.5794	0.6178	0.6549	0.6901	0.7233
Myanmar	0.5191	0.5381	0.5571	0.5758	0.5944	0.6127
Namibia	0.5166	0.5332	0.5497	0.5661	0.5823	0.5984
Nepal	0.5058	0.5116	0.5173	0.5231	0.5289	0.5347
Netherlands	0.5041	0.5083	0.5124	0.5165	0.5207	0.5248
New Zealand	0.5179	0.5357	0.5534	0.5710	0.5884	0.6056
Nicaragua	0.5161	0.5323	0.5483	0.5642	0.5800	0.5957
Niger	0.5622	0.6225	0.6792	0.7311	0.7773	0.8176
Nigeria	0.5269	0.5537	0.5802	0.6062	0.6317	0.6564
North Macedonia	0.4929	0.4858	0.4787	0.4716	0.4646	0.4575
Norway	0.5400	0.5795	0.6180	0.6551	0.6904	0.7236
Oman	0.5217	0.5432	0.5647	0.5858	0.6067	0.6272
Pakistan	0.4897	0.4794	0.4692	0.4589	0.4487	0.4385
Panama	0.5061	0.5122	0.5183	0.5244	0.5305	0.5366
Papua New Guinea	0.5309	0.5615	0.5916	0.6211	0.6497	0.6773
Paraguay	0.5462	0.5916	0.6355	0.6773	0.7164	0.7525
Peru	0.5012	0.5024	0.5036	0.5048	0.5060	0.5072
Philippines	0.4924	0.4849	0.4774	0.4698	0.4623	0.4548
Poland	0.4955	0.4911	0.4866	0.4821	0.4777	0.4732
Portugal	0.5099	0.5199	0.5298	0.5396	0.5495	0.5593
Qatar	0.4670	0.4342	0.4021	0.3707	0.3404	0.3114
Romania	0.5139	0.5278	0.5416	0.5553	0.5690	0.5826
Russian Federation	0.5150	0.5299	0.5448	0.5597	0.5744	0.5890
Rwanda	0.5218	0.5436	0.5652	0.5866	0.6076	0.6282
Saint Kitts and Nevis	0.4930	0.4860	0.4790	0.4720	0.4651	0.4581
Saint Lucia	0.5028	0.5056	0.5084	0.5112	0.5140	0.5167
Saint Vincent and the Grenadines	0.5048	0.5097	0.5145	0.5194	0.5242	0.5290
Samoa	0.5055	0.5109	0.5164	0.5219	0.5273	0.5328
Sao Tome and Principe	0.5079	0.5159	0.5238	0.5317	0.5396	0.5475
Saudi Arabia	0.4933	0.4865	0.4798	0.4730	0.4663	0.4596

Senegal	0.5135	0.5269	0.5404	0.5537	0.5670	0.5802
Serbia	0.4772	0.4546	0.4321	0.4099	0.3881	0.3667
Sierra Leone	0.5344	0.5684	0.6019	0.6344	0.6657	0.6956
Singapore	0.4310	0.3645	0.3028	0.2475	0.1994	0.1587
Slovakia	0.5100	0.5199	0.5299	0.5398	0.5497	0.5596
Slovenia	0.5190	0.5380	0.5568	0.5755	0.5940	0.6122
Solomon Islands	0.5364	0.5724	0.6076	0.6418	0.6745	0.7057
Somalia	0.5614	0.6209	0.6770	0.7284	0.7744	0.8146
South Africa	0.4885	0.4771	0.4657	0.4543	0.4429	0.4316
Spain	0.5122	0.5244	0.5365	0.5486	0.5607	0.5727
Sri Lanka	0.4828	0.4656	0.4485	0.4316	0.4147	0.3981
Sudan	0.5377	0.5750	0.6115	0.6467	0.6805	0.7124
Suriname	0.5289	0.5575	0.5858	0.6136	0.6406	0.6667
Sweden	0.5392	0.5779	0.6157	0.6521	0.6868	0.7196
Switzerland	0.5263	0.5524	0.5783	0.6037	0.6286	0.6529
Tajikistan	0.5183	0.5365	0.5547	0.5726	0.5904	0.6080
Tanzania	0.5427	0.5848	0.6257	0.6648	0.7019	0.7364
Thailand	0.5016	0.5033	0.5049	0.5065	0.5081	0.5098
Timor-Leste	0.5288	0.5574	0.5856	0.6133	0.6403	0.6664
Togo	0.5302	0.5603	0.5899	0.6188	0.6469	0.6741
Tonga	0.4987	0.4974	0.4961	0.4949	0.4936	0.4923
Trinidad and Tobago	0.5018	0.5037	0.5055	0.5074	0.5092	0.5111
Tunisia	0.5161	0.5321	0.5480	0.5639	0.5796	0.5952
Turkey	0.4846	0.4692	0.4539	0.4387	0.4236	0.4086
Turkmenistan	0.5144	0.5287	0.5430	0.5572	0.5713	0.5853
Uganda	0.5291	0.5580	0.5865	0.6144	0.6416	0.6679
Ukraine	0.5056	0.5111	0.5167	0.5223	0.5278	0.5334
United Arab Emirates	0.4750	0.4501	0.4255	0.4013	0.3775	0.3543
United Kingdom	0.5069	0.5138	0.5207	0.5276	0.5345	0.5414
United States	0.5195	0.5389	0.5583	0.5774	0.5963	0.6149
Uruguay	0.5235	0.5470	0.5702	0.5931	0.6156	0.6377
Uzbekistan	0.4884	0.4768	0.4653	0.4538	0.4423	0.4309
Vanuatu	0.5299	0.5595	0.5888	0.6174	0.6452	0.6721
Vietnam	0.4875	0.4750	0.4626	0.4502	0.4378	0.4256
Zambia	0.4941	0.4881	0.4822	0.4763	0.4704	0.4645
Zimbabwe	0.5266	0.5531	0.5793	0.6050	0.6302	0.6546

Note: Pollution sub-index= $Y = \frac{1}{1+X^\alpha}$; $X = \frac{\text{SO}_2 \text{ emissions}}{\text{Land area}}$. We illustrate the change in the pollution sub-indicator derived from different values for α , which represents a pollution “penalty” ranging from $\alpha=0.05$ to $\alpha=0.3$. The parameter α can also be interpreted as a weighting factor within the pollution sub-index. When α is a smaller value, the pollution sub-index data for all countries tend to be comparatively similar. With a comparatively high value of α , the pollution sub-indicator dominates all other aspects of well-being.

Table A8 Changes in Country Rankings Between PEHLI and the Cantril Ladder Score

Country	PEHLI	Cantril ladder score	Rank (PEHLI)	Rank (Cantril ladder score)	Rank change
Guatemala	132,416	6.435	98	28	70
Jamaica	181,047	6.309	90	34	56
Uzbekistan	150,825	6.179	95	39	56
Niger	13,011	5.074	138	89	49
El Salvador	165,951	6.061	93	46	47
Honduras	98,405	5.919	103	56	47
Nicaragua	119,046	5.972	99	52	47
Gambia	30,336	5.051	128	91	37
Senegal	38,409	5.132	122	85	37
Tajikistan	88,911	5.466	107	72	35
Costa Rica	635,258	7.069	50	16	34
Philippines	176,285	5.880	92	58	34
Congo (Congo-Brazzaville)	80,790	5.342	110	77	33
Kyrgyzstan	137,255	5.744	97	64	33
Nepal	68,171	5.269	113	80	33
Guinea	30,503	4.984	127	95	32
Mozambique	16,630	4.794	137	107	30
Brazil	395,244	6.330	61	32	29
Burkina Faso	25,131	4.834	132	105	27
Cameroon	74,912	5.142	111	84	27
Benin	51,591	5.045	115	92	23
Mexico	451,471	6.317	56	33	23
Bahrain	763,662	6.647	44	22	22
Israel	1,011,222	7.157	34	12	22
Mali	25,987	4.723	131	109	22

Liberia	24,636	4.625	133	112	21
Bolivia	264,257	5.716	84	66	18
Uruguay	706,713	6.431	47	29	18
Chad	19,466	4.355	136	119	17
Serbia	391,225	6.078	62	45	17
Bosnia and Herzegovina	294,780	5.813	77	61	16
Ecuador	283,238	5.764	79	63	16
Pakistan	54,719	4.934	114	98	16
Vietnam	191,647	5.411	88	73	15
Peru	343,487	5.840	73	60	13
Ghana	112,315	5.088	100	88	12
Uganda	36,638	4.636	123	111	12
Bangladesh	92,202	5.025	105	94	11
Finland	1,941,100	7.842	11	1	10
Mauritius	422,049	6.049	57	47	10
Colombia	411,991	6.012	58	49	9
Indonesia	236,287	5.345	85	76	9
Burundi	10,226	3.775	139	131	8
Czechia (Czech Republic)	1,235,126	6.965	26	18	8
Lao PDR	111,163	5.030	101	93	8
Mongolia	329,354	5.677	75	67	8
Netherlands	1,895,407	7.464	13	5	8
New Zealand	1,601,516	7.277	16	9	7
Cambodia	71,861	4.830	112	106	6
Chile	741,040	6.172	46	40	6
Denmark	2,127,908	7.620	8	2	6
Saudi Arabia	1,161,211	6.494	30	24	6
Sierra Leone	24,444	3.849	134	129	5
Panama	815,213	6.180	42	38	4
Slovakia	971,883	6.331	35	31	4
Thailand	466,971	5.985	55	51	4
Kazakhstan	752,009	6.152	45	42	3
Madagascar	28,332	4.208	129	126	3
Ethiopia	32,509	4.275	126	124	2

Moldova	384,246	5.766	64	62	2
Australia	1,909,245	7.183	12	11	1
Germany	1,819,678	7.155	14	13	1
Iceland	2,326,823	7.554	5	4	1
Switzerland	2,838,134	7.571	3	3	0
United Kingdom	1,597,666	7.064	17	17	0
Austria	1,995,782	7.268	9	10	-1
Kuwait	815,023	6.106	43	44	-1
Maldives	278,279	5.198	81	82	-1
Sweden	2,263,546	7.363	6	7	-1
Nigeria	90,899	4.759	106	108	-2
Norway	2,787,729	7.392	4	6	-2
Paraguay	371,307	5.653	66	68	-2
Armenia	315,567	5.283	76	79	-3
France	1,557,105	6.690	18	21	-3
Italy	1,348,926	6.483	23	26	-3
Spain	1,351,140	6.491	22	25	-3
United Arab Emirates	1,514,766	6.561	20	23	-3
Afghanistan	22,510	2.523	135	139	-4
Canada	1,962,958	7.103	10	14	-4
Dominican Republic	382,031	5.545	65	69	-4
Kenya	84,176	4.607	109	113	-4
Malawi	27,297	3.600	130	134	-4
Poland	962,346	6.166	37	41	-4
Romania	848,840	6.140	39	43	-4
Belgium	1,627,779	6.834	15	20	-5
Morocco	156,089	4.918	94	99	-5
China	346,306	5.339	72	78	-6
Comoros	49,600	4.289	116	122	-6
Estonia	1,116,358	6.189	31	37	-6
Slovenia	1,446,673	6.461	21	27	-6
Togo	39,448	4.107	121	127	-6
Cyprus	1,161,745	6.223	29	36	-7
Luxembourg	3,733,396	7.324	1	8	-7
Myanmar	85,698	4.426	108	117	-9

Lesotho	35,575	3.512	125	135	-10
Lithuania	1,242,211	6.255	25	35	-10
Singapore	1,547,367	6.377	19	30	-11
Zambia	49,440	4.073	117	128	-11
United States	2,135,537	6.951	7	19	-12
Argentina	839,100	5.929	41	54	-13
Azerbaijan	364,496	5.171	70	83	-13
Haiti	41,739	3.615	120	133	-13
Ireland	3,231,133	7.085	2	15	-13
Rwanda	35,882	3.415	124	137	-13
South Africa	265,197	4.956	83	96	-13
Iraq	188,384	4.854	89	103	-14
Tanzania	47,688	3.623	118	132	-14
Hungary	1,026,053	5.992	33	50	-17
Belarus	575,256	5.534	52	70	-18
North Macedonia	369,293	5.101	68	87	-19
Zimbabwe	46,943	3.145	119	138	-19
Latvia	1,164,054	6.032	28	48	-20
Croatia	967,246	5.882	36	57	-21
Libya	560,068	5.410	53	74	-21
Mauritania	100,917	4.227	102	125	-23
Portugal	1,032,753	5.929	32	55	-23
Eswatini (fmr. Swaziland)	139,643	4.308	96	121	-25
Namibia	179,997	4.574	91	116	-25
India	96,474	3.819	104	130	-26
Albania	402,376	5.117	59	86	-27
Greece	920,019	5.723	38	65	-27
Malaysia	670,751	5.384	48	75	-27
Lebanon	214,172	4.584	87	115	-28
Ukraine	340,116	4.875	74	102	-28
Japan	1,262,375	5.940	24	53	-29
Algeria	346,363	4.887	71	101	-30
Bulgaria	599,860	5.266	51	81	-30
Turkmenistan	400,100	5.066	60	90	-30
Russian Federation	840,089	5.477	40	71	-31

Jordan	222,096	4.395	86	118	-32
Republic of Korea	1,213,036	5.845	27	59	-32
Tunisia	293,576	4.596	78	114	-36
Sri Lanka	282,276	4.325	80	120	-40
Egypt, Arab Rep.	269,956	4.283	82	123	-41
Gabon	386,184	4.852	63	104	-41
Iran	369,364	4.721	67	110	-43
Georgia	512,109	4.891	54	100	-46
Turkey	661,046	4.948	49	97	-48
Botswana	365,780	3.467	69	136	-67

Table A9 Sensitivity Analysis of Pollution Sub-Index across 175 Countries across OECD countries and World Bank regions

Country/Region	α values					
	0.05	0.10	0.15	0.20	0.25	0.30
Australia	0.5246	0.5491	0.5734	0.5973	0.6208	0.6437
Austria	0.5236	0.5472	0.5705	0.5935	0.6161	0.6383
Belgium	0.4981	0.4962	0.4943	0.4924	0.4905	0.4886
Canada	0.53	0.5598	0.5892	0.6179	0.6459	0.6729
Chile	0.5045	0.509	0.5135	0.5179	0.5224	0.5269
Colombia	0.5222	0.5444	0.5664	0.5881	0.6095	0.6305
Costa Rica	0.5203	0.5406	0.5607	0.5806	0.6003	0.6196
Czechia (Czech Republic)	0.4998	0.4996	0.4994	0.4992	0.4991	0.4989
Denmark	0.5182	0.5364	0.5545	0.5725	0.5902	0.6077
Estonia	0.5006	0.5012	0.5018	0.5024	0.503	0.5036
Finland	0.5283	0.5564	0.5842	0.6115	0.638	0.6638
France	0.5184	0.5367	0.5549	0.5729	0.5908	0.6084
Germany	0.5034	0.5069	0.5103	0.5138	0.5172	0.5206
Greece	0.5022	0.5044	0.5066	0.5087	0.5109	0.5131
Hungary	0.5185	0.5369	0.5552	0.5734	0.5914	0.6091
Iceland	0.5227	0.5453	0.5678	0.5899	0.6117	0.6331
Ireland	0.5249	0.5496	0.5741	0.5982	0.6219	0.645
Israel	0.4718	0.4438	0.4161	0.389	0.3625	0.3368
Italy	0.5124	0.5249	0.5373	0.5496	0.5619	0.5741

Japan	0.4931	0.4862	0.4792	0.4723	0.4654	0.4586
Latvia	0.5344	0.5685	0.602	0.6345	0.6659	0.6958
Lithuania	0.5147	0.5294	0.544	0.5585	0.573	0.5873
Luxembourg	0.5103	0.5206	0.5309	0.5412	0.5514	0.5616
Mexico	0.4978	0.4955	0.4933	0.491	0.4888	0.4866
Netherlands	0.5041	0.5083	0.5124	0.5165	0.5207	0.5248
New Zealand	0.5179	0.5357	0.5534	0.571	0.5884	0.6056
Norway	0.54	0.5795	0.618	0.6551	0.6904	0.7236
Poland	0.4955	0.4911	0.4866	0.4821	0.4777	0.4732
Portugal	0.5099	0.5199	0.5298	0.5396	0.5495	0.5593
Slovakia	0.51	0.5199	0.5299	0.5398	0.5497	0.5596
Slovenia	0.519	0.538	0.5568	0.5755	0.594	0.6122
Republic of Korea	0.4869	0.4738	0.4608	0.4478	0.4348	0.422
Spain	0.5122	0.5244	0.5365	0.5486	0.5607	0.5727
Sweden	0.5392	0.5779	0.6157	0.6521	0.6868	0.7196
Switzerland	0.5263	0.5524	0.5783	0.6037	0.6286	0.6529
Turkey	0.4846	0.4692	0.4539	0.4387	0.4236	0.4086
United Kingdom	0.5069	0.5138	0.5207	0.5276	0.5345	0.5414
United States	0.5195	0.5389	0.5583	0.5774	0.5963	0.6149
China	0.4968	0.4937	0.4905	0.4874	0.4842	0.481
East Asia and Pacific	0.502	0.505	0.507	0.51	0.512	0.515
Europe and Central Asia	0.508	0.517	0.525	0.534	0.542	0.551
Latin America & Caribbean	0.513	0.527	0.54	0.553	0.566	0.579
Middle East and North Africa	0.501	0.503	0.504	0.505	0.506	0.508
North America	0.524	0.547	0.57	0.593	0.616	0.638
South Asia	0.488	0.476	0.464	0.452	0.441	0.429
Sub-Saharan Africa	0.518	0.536	0.554	0.572	0.59	0.607
World	0.507	0.515	0.522	0.53	0.537	0.544

Note: Pollution sub-index= $Y = \frac{1}{1+X^\alpha}$; $X = \frac{\text{SO}_2 \text{ emissions}}{\text{Land area}}$. We illustrate the change in the pollution sub-indicator derived from different values for α , which represents a pollution “penalty” ranging from $\alpha=0.05$ to $\alpha=0.3$. The parameter α can also be interpreted as a weighting factor within the pollution sub-index. When α is a smaller value, the pollution sub-index data for all countries tend to be comparatively similar. With a comparatively high value of α , the pollution sub-indicator dominates all other aspects of well-being. China is included due to its global economic importance.