Going beyond GDP with a parsimonious indicator: inequality-adjusted healthy lifetime income

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Abstract

Per capita GDP has limited use as a well-being indicator because it does not capture many dimensions that imply a "good life", such as health and equality of opportunity. However, per capita GDP has the virtues of being easy to interpret and to calculate with manageable data requirements. Against this backdrop, there is a need for a measure of well-being that preserves the advantages of per capita GDP, but also includes health and equality. We propose a new parsimonious indicator to fill this gap, and calculate it for 149 countries. This new indicator could be particularly useful in complementing standard well-being indicators during the COVID-19 pandemic. This is because (i) COVID-19 predominantly affects older adults beyond their prime working ages whose mortality and morbidity do not strongly affect GDP, and (ii) COVID-19 is known to have large effects on inequality in many countries.

Keywords: beyond GDP; well-being; health; inequality; human development; lifetime income; COVID-19

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1 Introduction

Per capita GDP has limited use in measuring well-being. The reasons why this is the case are well known:[1] for example, per capita GDP does not capture negative externalities of production, catastrophes increase GDP because of reconstruction efforts and GDP does not take into account the quality of the natural environment. Most importantly – and partly as a consequence of these shortcomings – per capita GDP disregards generally desired aspects such as living a long and healthy life, or providing larger parts of the population the opportunity to share in the gains of economic prosperity (Fitoussi et al. 2009; Jones and Klenow 2016; Fan et al. 2018; Lutz et al. 2018; Bloom et al. forthcoming).

The following comparison between Germany and Iceland in 2013 illustrates the consequences of these omissions. According to the World Bank (2019), the two countries had comparable levels of GDP per capita (USD42,914 and USD42,372, respectively, adjusted for purchasing power). Thus, based on these numbers, one would surmise that the typical German was slightly better off than the typical Icelander. However, this misses the point that life expectancy at birth was 80.49 years in Germany, compared with 82.06 years in Iceland. Even if we disregard the intrinsic value of health, this implies that the *lifetime income* of the average Icelander under current conditions (calculated as life expectancy multiplied by GDP per capita) was higher than that of the average German. Similarly, the Gini index of income inequality in Germany stood at 31.1 (expressed in per cent) and at 25.4 in Iceland. Considering that income distributions are skewed towards higher incomes, this implies that the median Icelander was likely to be better off financially than the median German, even when disregarding differences in lifetime horizons.

Despite the problems outlined above, per capita GDP does have the virtues of being easy to interpret and to calculate with manageable data requirements. Against this backdrop, there is a need for a measure that combines the advantages of per capita GDP with the virtues of including health and equality. In the following, we propose inequality-adjusted healthy lifetime income (IHLI) as such an indicator. The resulting number, expressed in PPP-adjusted dollars, refers to the amount that a new-born in a certain economy can expect to earn over the years in which she is in good health under the given economic and health conditions, and adjusted for the level of inequality.

Our new indicator, IHLI, could be a useful complement to standard well-being indicators, particularly during periods in which levels of health and inequality change drastically. The current COVID-19 pandemic represents just such a situation, because (i) COVID-19 predominantly affects older adults beyond their prime working ages whose mortality and morbidity do not strongly affect GDP, and (ii) COVID-19 is known to have large effects on inequality in many countries.

[1] Simon Kuznets, who is credited with the original formulation of GDP, already warned against its use as a welfare measure.

Even though IHLI is able to address some of the shortcomings of standard well-being measures, it also has limitations: for example, (i) it does not include measures related to education; (ii) it is more difficult to compute and requires more data than per capita GDP; and (iii) it depends on the quality of the underlying health measure, which is known to be difficult to estimate across different countries. Thus, of course, we do not propose IHLI as a substitute for other indicators. We simply hope that IHLI provides additional valuable information for policymakers and the general public.

2 Inequality-adjusted healthy lifetime income

Several indicators have been proposed to address the problems of per capita GDP as a well-being measure, including the Human Development Index (HDI), the Happy Planet Index, the Resource-Infrastructure-Environment (RIE) index, Gross National Happiness and the Better Life Index (see ul Haq 2003; Natoli and Zuhair 2011; Fan et al. 2018; OECD 2019; New Economics Foundation 2019; for detailed information). For example, the HDI considers three components, gross national income (GNI), life expectancy and schooling, and merges the sub-indices constructed out of these components into a single overall index. This index is then used to create country league tables with a country's rank being a proxy for its development level. A similar approach has been proposed by Natoli and Zuhair (2011) in their RIE, with the sub-components comprising indices for the availability of resources, the availability of infrastructure and the quality of the environment.

While these alternative indicators represent highly valuable improvements over GDP along several dimensions, they also tend to have high data requirements (on issues such as schooling, environmental quality, housing, civic engagement and work-life balance). Moreover, these indicators are often based on subjective evaluations of life satisfaction or happiness that are collected by polling a small subset of the population, and they are often hard to interpret because different components with incompatible units of measurement are meshed together to construct an overall index. As an illustration, consider the HDI (ul Haq 2003; Klugman et al. 2011). Because this indicator's components of income, life expectancy and education are measured in different units, an overall index ranging from zero to one must be constructed out of the different components' sub-indices. The resulting index lacks an economic interpretation, and has an upper limit of one by construction. The upper limit implies that further development cannot change the index value appreciably, and that well-developed countries tend to cluster at index values close to one. Thus, at the upper end of the distribution, only marginal differences across countries may be evident in the index value, while the underlying fundamental data on life expectancy, income and schooling could differ substantially.

To address the trade-off of including additional dimensions of economic well-being, while ensuring that the indicator remains easy to calculate, easy to interpret and based on readily available data, we propose using inequality-adjusted healthy lifetime income (IHLI) as a novel and complementary measure of economic well-being. This measure consists of the following components: (i) GDP per capita adjusted for purchasing power (pppGDPpc) to capture a country's material living standard; (ii) healthy life expectancy at birth (HALE) to capture health-related aspects such as environmental quality and access to high-quality medical facilities; and (iii) an inverse measure of the Gini coefficient (1 – Gini) as a proxy for an average person's opportunities to benefit from economic progress (Sen 1976).[2] The following straightforward formulation of the indicator

$$IHLI_i = pppGDPpc_i \times HALE_i \times (1 - Gini_i) \tag{1}$$

implies that it should be interpreted as reflecting the amount that a new-born in economy *i* can expect to earn over the years in which she is in good health under the given economic and health conditions, and adjusted for the level of inequality. Note that the unitary weights of the different components in this formulation follow mathematically from the underlying units of the different components: since the outcome is inequality-adjusted healthy lifetime income, it does not make sense to use a different weighting scheme in Equation (1).[3]

Using the World Bank's (2019) World Development Indicators on pppGDPpc in international dollars with a base year of 2011, the WHO's (2014) Global Health Observatory database on HALE in years and Solt's (2019) Standardized World Income Inequality Database on the Gini coefficient of disposable income, we calculate this indicator for the year 2010 for all countries for which the necessary data inputs are available. Table A.1 in the appendix displays the results. The first column shows each country's rank as measured by the IHLI indicator; the second column provides each country's name; the third to fifth columns show the three components of IHLI; and the sixth column reports the IHLI value.

Interestingly, the IHLI indicator alters some standard rankings that are based solely on per capita GDP. For example, among high-income countries, the United States and Saudi Arabia have comparatively low IHLI values despite their high per capita GDP because of their rather low values for healthy life expectancy and rather high inequality levels. By contrast, some European countries, such as Austria, Belgium, Denmark and Sweden, have comparatively high IHLI values despite their lower per capita GDP because they have rather high healthy life expectancy values and rather low inequality levels.

[2] While there are discussions on the issue of whether a single measure of inequality can capture the entire distribution reasonably well, the Gini coefficient possesses some desirable properties in this regard, and it also tends to be strongly correlated with other inequality measures. For discussions, see Cowell (2011) and Ferreira (2020).

[3] To see why this is the case, consider the following analogue. Assume that we would like to calculate the distance travelled by a car within a certain time span. Then we need to multiply the speed of the car by the duration of the travel. Applying a different weight to the speed of the car and the duration of the travel would be meaningless.

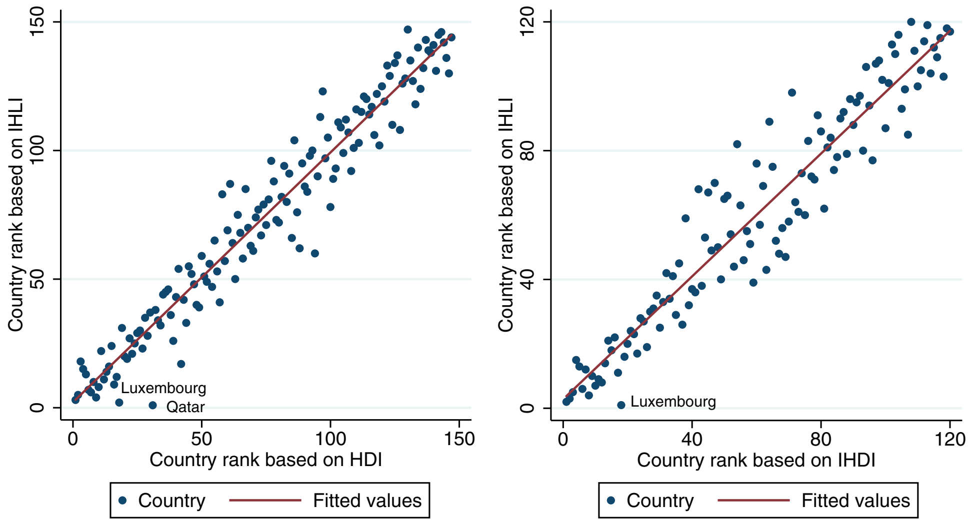
The differences between the traditional ranking based on per capita GDP values and the ranking based on the IHLI indicator can be decomposed into the contributions of the two additional components: the correlation between the differences in the country league table based on per capita GDP and the country league table based on IHLI is -0.654 for the Gini index and 0.299 for HALE, with both coefficients being significant at the 1% level. Thus, changes in the Gini coefficient contribute relatively more in changing the ranking, which is due to the fact that there is more cross-country variation in this variable than in HALE. While it is not uncommon for Gini indices between countries to differ by a factor of two, this is generally not the case for HALE. Overall, considering the additional dimensions of healthy life expectancy and inequality may contribute substantially to revising the ranking of the countries to account for well-being.

While the adjustments discussed above seem reasonable, we compare IHLI with some obvious alternatives – the HDI and its inequality-adjusted version (Hicks 1997; UNDP 2017) – to assess whether the different well-being indicators yield country rankings that are generally in line with one another. This is important, because if the ranking based on IHLI differs substantially from the ranking based on an established indicator such as the HDI and its inequality-adjusted version, it is likely that IHLI is not well suited for assessing cross-country differences in well-being. In our comparison, we need to restrict the dataset to 120 countries because the inequality-adjusted HDI is only available for this subset.

Figure 1 displays the correlation between the country rankings based on the IHLI and the HDI (left diagram; correlation coefficient: 0.9710) and between the IHLI and the inequality-adjusted HDI (right diagram; correlation coefficient: 0.9536). Overall, this analysis shows a strong positive correlation between the rankings based on the different indicators. This result is reassuring, as a different outcome might indicate that we are not measuring well-being accurately, and might therefore be missing important well-being dimensions that the HDI captures. Even though the different measures lead to consistent country rankings, our proposed indicator has the following advantages:

- It has a direct and immediate economic interpretation.
- It does not depend on aggregating different sub-indicators that are based on incompatible units of measurement.
- It is not restricted to a value between zero and one, and is thus not bounded from above, which allows for further development to be measured accurately, and avoids a clustering of countries at the upper bound of the index.
- It is parsimonious in terms of its computation and data input requirements.
- It can be obtained for more countries.
- The weights of its components follow directly from the interpretation of the indicator.

Figure 1:
Comparison between IHLI and HDI rankings, 2010 (left diagram: HDI; right diagram: inequality-adjusted HDI)



3 Variants of IHLI

We view the formulation of IHLI in Equation (1) as an important improvement over per capita GDP. However, using gross national income (GNI) per capita instead of GDP per capita to measure income may prove useful because particularly small, open economies such as Luxembourg are highly dependent on commuters. In this case, GNI might capture income better than GDP because GNI counts only residents' income. In this case, our indicator would change to

$$IHLI_{i,gni} = pppGNIpc_i \times HALE_i \times (1 - Gini_i), \tag{2}$$

where *pppGNIpc* is the ppp-adjusted GNI, and the subscript in the indicator name signifies the use of GNI instead of GDP in the calculation.

Moreover, HALE itself is subject to criticism because it is defined as weighted life expectancy over a complete set of health states, with the weights being between zero (dead) and one (optimal health), as described in Sullivan (1971), Murray et al. (2002) and WHO (2014).[4] Thus, detailed morbidity data (on years of healthy life lost due to disability, YLD) are required to construct HALE, and these data might

[4] We are grateful to two referees who suggested delving more deeply into the problems with using HALE as an indicator of healthy life expectancy.

not be available for all countries over long time spans. In addition, the morbidity data are very difficult to estimate and the methods for their calculation change over time. Thus, while it would be ideal to construct our indicator with a measure of healthy life expectancy, another variant of the proposed indicator could rely on life expectancy at birth (LEXP) instead of HALE. Life expectancy arguably captures health less well than HALE, but it might be available for more countries and more time periods, which could allow for an extension of the sample when reconstructing the index over the past decades. Furthermore, life expectancy is easier to calculate, and is not subject to changes in the method of its calculation over time. In this case, the indicator would need to be renamed inequality-adjusted lifetime income (ILI), and the formula would change to

$$ILI_i = pppGDPpc_i \times LEXP_i \times (1 - Gini_i). \tag{3}$$

As yet another version, we could use life expectancy conditional on reaching a certain age, such as age 20, instead of life expectancy at birth in the construction of the indicator. In this case, we would have the formula

$$IRLI_i^{a=20} = pppGDPpc_i \times LEXP_i^{a=20} \times (1 - Gini_i), \tag{4}$$

where the interpretation of the indicator changes to inequality-adjusted remaining lifetime income (IRLI), and the superscript indicates conditioning on age 20. In addition, we would need to keep in mind that this version of the indicator disregards potentially important information on child mortality.

4 Limitations

Of course, no welfare measure is perfect, and the IHLI also has many limitations. For example, (i) per capita GDP might not be the best proxy of lifetime income because it does not reflect the future growth potential of an economy. If a country has a strong potential for economic growth over the coming decades, then a child born into this economy could expect to earn a much higher lifetime income than a child born into a stagnant or even shrinking economy. However, adjusting for the growth potential of an economy is very complicated, because economic growth can sometimes stall rather unexpectedly (witness Japan in the 1990s, or the global economy during the COVID-19 crisis). (ii) Period healthy life expectancy might not be a good proxy of cohort healthy life expectancy. If mortality continues to decrease for all age groups, a child born today can reasonably expect to outlive current period life expectancy. For this reason, our indicator is on the conservative side. (iii) Income inequality is assumed to be stable over the life cycle, which is generally not the case. (iv) Income inequality is assumed to be a good proxy for health inequality, which might not always be true. (v) Like standard aggregate macroeconomic indicators, this indicator disregards race, gender, migration status, etc. Finally, (vi) in contrast to the HDI and the IHDI, the IHLI lacks the education dimension, which would be difficult to add in terms of interpretation. Overall, of course, we do not claim that our indicator eliminates all of the problems of established indicators, and that it should replace them. Rather, we merely suggest that IHLI solves some of the problems of standard well-being measures, and that it might be worthwhile to report IHLI alongside other indicators.

5 Conclusions

We have proposed a novel indicator for measuring economic well-being that accounts for income, health and inequality, and that can be readily interpreted as inequality-adjusted healthy lifetime income. Although this indicator captures more dimensions of well-being than per capita GDP, it nevertheless remains easy to calculate and easy to interpret, and it requires limited data. A country ranking for the year 2010 shows some reasonable deviations from a ranking based on per capita GDP. While the IHLI-based country rankings are consistent with the rankings based on other established indicators such as the HDI, the IHLI does not share the HDI's shortcomings, and it is available for more countries (149 countries instead of 120 countries for the inequality-adjusted HDI). It might be useful to develop different versions of the indicator in order to further increase the availability of data, and to adjust for distortions that are caused by commuting into small, open economies. Overall, our proposed indicator might allow for better comparisons of well-being across countries and over time.

However, we do not advocate abandoning per capita GDP, as it continues to be a highly valuable gauge of the economic strength of a country. Per capita GDP has many advantages over other proposed indicators because it includes both capital income and wage income. If only the wage level is considered, capital income, which is a substantial source of income for many people, is neglected. If only consumption measures are considered, saving/investment and borrowing are disregarded. In addition, per capita GDP is available over long periods and for many countries, which is typically not the case for alternative income measures.

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Appendix

Table A.1:
Ranking of countries according to the IHLI indicator as of 2010

Rank	Country	pppGDPpc	HALE	Gini	IHLI
1	Qatar	125,141	66.7	0.397	5,033,177
2	Luxembourg	91,743	71.7	0.280	4,736,156
3	Norway	62,350	71.8	0.246	3,375,477
4	Singapore	72,116	74.8	0.393	3,274,319
5	Switzerland	55,866	72.5	0.290	2,875,718
6	Netherlands	46,102	71.4	0.265	2,419,374
7	Denmark	43,998	70.4	0.253	2,313,825
8	Sweden	42,989	71.9	0.254	2,305,808
9	Austria	43,336	71.4	0.282	2,221,639
10	Ireland	43,515	71.5	0.298	2,184,136
11	Belgium	41,086	70.8	0.257	2,161,300
12	Iceland	40,137	72.6	0.260	2,156,306
13	United States	49,479	68.7	0.370	2,141,511
14	Finland	39,848	70.4	0.254	2,092,760
15	Germany	40,429	70.9	0.287	2,043,741
16	Canada	40,699	72.2	0.311	2,024,622
17	Oman	45,336	65.5	0.319	2,022,228
18	Australia	41,464	72.2	0.329	2,008,775
19	France	36,815	72.2	0.294	1,876,574
20	Japan	35,750	73.8	0.314	1,809,896
21	Italy	36,201	72.8	0.331	1,763,112
22	United Kingdom	36,509	71.3	0.335	1,731,046
23	Cyprus	33,913	72.4	0.298	1,723,636

Continued

Table A.1: Continued

Rank	Country	pppGDPpc	HALE	Gini	IHLI
24	New Zealand	32,119	72.0	0.319	1,574,869
25	Spain	32,507	72.9	0.337	1,571,156
26	Saudi Arabia	45,421	64.4	0.478	1,526,916
27	Slovenia	28,678	69.2	0.247	1,494,361
28	Malta	28,359	71.6	0.272	1,478,194
29	Czech Republic	28,353	68.1	0.253	1,442,334
30	Greece	28,726	71.5	0.332	1,372,015
31	Israel	29,665	72.4	0.369	1,355,242
32	Portugal	27,238	70.8	0.337	1,278,584
33	Slovak Republic	25,159	66.8	0.257	1,248,705
34	Bahamas, The	29,222	66.4	0.439	1,088,531
35	Hungary	22,405	65.6	0.271	1,071,469
36	Estonia	22,741	66.7	0.323	1,026,889
37	Croatia	20,758	67.9	0.277	1,019,027
38	Poland	21,771	67.3	0.313	1,006,568
39	Lithuania	21,071	64.5	0.335	903,772
40	Kazakhstan	20,097	60.2	0.261	894,052
41	Malaysia	21,107	65.6	0.412	814,166
42	Seychelles	20,365	64.6	0.410	776,196
43	Belarus	16,261	62.3	0.245	764,841
44	Romania	17,469	65.2	0.331	761,983
45	Latvia	18,252	64.6	0.357	758,145
46	Argentina	18,712	67.3	0.399	756,852
47	Chile	19,442	68.9	0.453	732,738
48	Iran, Islamic Rep.	17,943	63.9	0.382	708,566
49	Uruguay	17,082	68.0	0.393	705,093
50	Lebanon	16,452	65.2	0.348	699,371
51	Turkey	17,959	64.4	0.404	689,319
52	Venezuela, RB	16,545	65.7	0.380	673,943
53	Bulgaria	15,283	65.7	0.332	670,746
54	Mauritius	15,938	64.5	0.366	651,770
55	Montenegro	14,038	67.1	0.312	648,082
56	Barbados	16,425	66.2	0.469	577,372
57	Panama	15,629	68.3	0.473	562,537
58	Mexico	15,716	66.5	0.463	561,225
59	Algeria	12,871	64.5	0.324	561,184
60	Serbia	12,688	66.2	0.339	555,208
61	Iraq	12,718	59.6	0.302	529,062

Continued

Table A.1:
Continued

Rank	Country	pppGDPpc	HALE	Gini	IHLI
62	Thailand	13,487	65.5	0.406	524,722
63	Gabon	15,356	54.8	0.393	510,789
64	Brazil	14,539	64.5	0.463	503,583
65	North Macedonia	11,355	66.5	0.347	493,099
66	Costa Rica	13,000	69.7	0.456	492,918
67	Maldives	12,006	67.6	0.400	486,943
68	Tunisia	10,436	65.1	0.377	423,271
69	St. Lucia	11,788	65.7	0.459	419,006
70	Albania	9,927	66.4	0.383	406,705
71	Jordan	9,473	64.7	0.346	400,829
72	Bosnia and Herzegovina	9,720	66.7	0.394	392,885
73	Dominican Republic	11,133	63.8	0.455	387,090
74	China	9,526	67.6	0.430	367,049
75	Colombia	10,791	65.7	0.498	355,903
76	Ukraine	7,824	62.2	0.270	355,279
77	Egypt, Arab Rep.	9,859	60.0	0.404	352,555
78	Peru	9,957	66.3	0.469	350,524
79	Timor-Leste	8,861	57.3	0.314	348,289
80	Ecuador	9,352	66.8	0.443	347,978
81	Paraguay	9,801	64.5	0.463	339,455
82	Jamaica	7,999	66.1	0.409	312,489
83	Mongolia	7,709	60.2	0.333	309,526
84	Sri Lanka	8,530	66.1	0.488	288,668
85	Botswana	13,053	52.9	0.589	283,793
86	Armenia	6,703	65.2	0.360	279,696
87	Indonesia	8,433	60.4	0.456	277,104
88	Georgia	6,982	64.8	0.401	270,989
89	Fiji	7,352	60.4	0.393	269,548
90	Morocco	6,443	63.5	0.398	246,306
91	South Africa	11,888	50.5	0.594	243,736
92	El Salvador	6,301	64.2	0.407	239,874
93	Bhutan	6,420	58.7	0.395	227,985
94	Guatemala	6,714	62.1	0.467	222,230
95	Samoa	5,400	64.4	0.414	203,783
96	Philippines	5,597	60.6	0.416	198,074
97	Tonga	4,984	63.7	0.377	197,798
98	Cabo Verde	5,828	63.1	0.481	190,869
99	Vietnam	4,408	66.5	0.376	182,921
100	Namibia	8,461	53.4	0.600	180,724

Continued

Table A.1: Continued

Rank	Country	pppGDPpc	HALE	Gini	IHLI
101	Bolivia	5,407	61.0	0.453	180,431
102	Congo, Rep.	5,186	54.2	0.422	162,476
103	Pakistan	4,284	56.2	0.342	158,406
104	Yemen, Rep.	4,479	54.3	0.359	155,888
105	Lao PDR	4,219	56.0	0.351	153,327
106	Moldova	3,911	61.3	0.362	152,951
107	Nicaragua	4,029	65.5	0.429	150,676
108	Myanmar	3,721	56.3	0.328	140,787
109	India	4,463	57.4	0.469	136,035
110	Nigeria	5,083	46.2	0.421	135,969
111	Honduras	3,971	65.5	0.498	130,576
112	Mauritania	3,317	54.5	0.358	116,058
113	Micronesia, Fed. Sts.	3,298	60.3	0.417	115,929
114	Vanuatu	2,948	62.0	0.374	114,419
115	Kyrgyz Republic	2,790	61.1	0.341	112,346
116	Sao Tome and Principe	2,642	59.0	0.302	108,783
117	Bangladesh	2,443	60.7	0.339	98,009
118	Ghana	3,059	54.1	0.412	97,321
119	Cambodia	2,523	58.5	0.343	96,967
120	Senegal	2,725	56.1	0.392	92,931
121	Cameroon	2,930	48.3	0.431	80,520
122	Kenya	2,476	55.5	0.442	76,677
123	Zambia	3,279	50.1	0.540	75,574
124	Nepal	1,986	59.2	0.362	75,010
125	Tajikistan	2,106	62.4	0.440	73,603
126	Côte d'Ivoire	2,690	46.2	0.410	73,331
127	Solomon Islands	1,871	60.6	0.419	65,888
128	Comoros	2,426	54.7	0.529	62,507
129	Afghanistan	1,694	51.6	0.302	61,004
130	Benin	1,819	51.7	0.447	51,999
131	Lesotho	2,366	45.7	0.523	51,568
132	Chad	1,925	45.1	0.414	50,880
133	Guinea	1,574	50.0	0.369	49,645
134	Gambia, The	1,644	52.5	0.426	49,549
135	Madagascar	1,386	55.8	0.417	45,078
136	Uganda	1,516	50.4	0.413	44,847
137	Zimbabwe	1,738	46.7	0.453	44,396

Continued

Table A.1:
Continued

Rank	Country	pppGDPpc	HALE	Gini	IHLI
138	Burkina Faso	1,423	49.7	0.396	42,728
139	Rwanda	1,368	56.2	0.472	40,597
140	Ethiopia	1,074	54.0	0.324	39,199
141	Guinea-Bissau	1,400	48.8	0.436	38,542
142	Togo	1,226	51.1	0.421	36,285
143	Liberia	1,086	51.6	0.356	36,076
144	Sierra Leone	1,200	43.9	0.383	32,503
145	Malawi	1,033	50.4	0.435	29,415
146	Niger	814	49.4	0.359	25,782
147	Mozambique	918	47.6	0.440	24,464
148	Burundi	726	50.3	0.368	23,082
149	Haiti	1,502	32.3	0.529	22,851

Source: Solt (2019); World Bank (2019), WHO (2019) and own calculations.