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Leaving No Country Behind in Human Development: A Fuzzy Approach

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Abstract

'Leaving no one behind' (LNOB) constitutes one of the core principles underpinning the 2030 Agenda for Sustainable Development. In this paper, we propose a fuzzy logic approach to identify countries left behind in each dimension of human development and to estimate the extent to which certain countries are left behind in terms of overall human development. Following the current analytical framework for measuring the Human Development Index (HDI), we illustrate our proposal by measuring the degree to which a country was left behind in the years 2000 and 2018. In general, we find that the countries left furthest behind at the beginning of the century were those that most reduced gaps with respect to better performing countries. Nevertheless, we cannot clearly speak of convergence in HDI as there are notable exceptions, such as the Central African Republic, Liberia, Yemen, Haiti, and Venezuela, which despite the improvement in their HDI between 2000 and 2018, worryingly increased their gaps in human development relative to the rest of the world. The illustration highlights the significant advantages of measuring cross-country human development using our fuzzy-based LNOB approach to provide new complementary measures consistent with the United Nations' moral imperative of leaving no country behind.

Keywords: human development, cross-country inequality, leaving no one behind, fuzzy approach

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1. Introduction

Improving human wellbeing may be perceived as the ultimate objective of all policymaking efforts across both developing and economically developed countries. In 1990, the United Nations Development Programme (UNDP) identified a long and healthy life, access to knowledge, and a decent standard of living as the keystones of human development and combined the three into the well-known Human Development Index (HDI). Since then, the HDI has constituted the principal measure of countries' development and is probably the most successful multidimensional welfare indicator developed so far. Nowadays, despite its critiques (for a survey, see, e.g., Kovacevic, 2011, which was part of a comprehensive review undertaken by the UNDP) and numerous proposals for improvements (see, e.g., Ibar-Alonso et al., 2019; Lind 2019, Mangaraj and Aparajita, 2020), the HDI continues to be the leading indicator of development around the world. In the last decade, however, a number of complementary development indicators, such as the Inequality-Adjusted Human Development Index (IHDI), the Gender Development Index (GDI), the Gender Inequality Index (GII), and the Multidimensional Poverty Index (MPI), have been developed by the UNDP in order to complement the core information provided by the HDI.

Since its launch, researchers and practitioners have managed to disaggregate a country's HDI score to compare different regions and population groups within that country (see, e.g., Permanyer and Smits, 2018). Thus, the HDI methodology has allowed highlighting internal disparities within countries by documenting the distribution of human development and its components across subpopulations or subnational regions. Nonetheless, international comparisons and the analyses of inequalities between countries based on the HDI methodology are often descriptive (see, e.g., Tudge et al., 1997 or Liang et al., 2019) and no measure has been created to this end. Hence, whether poor countries are closing the gap with rich countries is generally answered by looking at some measures of differences in the HDI or in its core dimensions between poor and rich countries or by assessing whether less developed countries are advancing more rapidly than more developed ones. Following this procedure, it can be claimed that, on average, living in a developing country is now more similar—at least in terms of the basic indicators of health, education, and living standards included in the HDI—to living in an economically developed country than was the case 40 or even 20 years ago (Alkire and Santos, 2011; UNDP, 2019a). However, this is not true for all developing countries, and countries with similar starting points have experienced remarkably different evolutions over time. In fact, disparities in human development remain widespread and to some extent unknown, so that it is frequently argued that 'assessing and responding to inequalities in human development demands a revolution in metrics' (UNDP, 2019a, p. 13).

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Despite the fact that Goal 10 of the Sustainable Development Goals (SDGs) calls for reducing inequalities within and among countries (UN, 2015), cross-country inequalities frequently tend to be neglected or overlooked as if they were a natural condition of today's world and more emphasis is placed on inequality within countries. Indeed, let us recall that there is nothing that obliges countries to reduce the unequal distribution of outcomes across countries (see, e.g., Anderson, 2016; Donald and Saez, 2017; MacNaughton, 2017). Moreover, the targets and indicators of Goal 10 are not accurately aligned with the norm on reducing inequality between countries. This is also the case for the current human development approach, which does not pay adequate attention to inequalities between countries beyond a simple comparison between levels and progress. In particular, it does not account for the core principle of 'leaving no one behind' (LNOB) underlying the 2030 Agenda for Sustainable Development and the SDGs at both individual and country levels—that is, which individuals are left behind within a country but also which countries are left behind (Klasen and Fleurbaey, 2019). In fact, a key concern in the 2030 Agenda negotiations was that leaving no one behind at the individual level should not eclipse the moral imperative of leaving no country behind (OECD, 2018).

The purpose of this paper is to provide a measure that identifies countries left behind in each dimension of human development and to estimate the extent to which they have been left behind in terms of overall human development. We illustrate our proposal using the measurement of the degree to which a country was left behind in human development in the year 2000—when the Millennium Development Goals (MDGs) were established—and in 2018, using the latest available data at the time of writing, and analyse the relative changes across countries over this period. We thus aim to examine the cross-country changes in human development under the LNOB principle over the two decades prior to the COVID-19 pandemic—a milestone that could mark the first overall decline in the HDI since it was first created in 1990 and hence a potential turnaround in the distribution of human development across the globe (UNCTAD, 2020; UNDP, 2020). We follow the current analytical framework for measuring human development and proceed in three steps. First, we use a fuzzy approach to estimate the degree to which a country is left behind in each of the HDI dimensions by aggregating its shortfalls relative to better positioned countries. Then, we aggregate information across the three dimensions for each country to capture the degree to which a country is left behind in terms of human development using a new measure we call LB-HDI. Finally, we aggregate information across countries to obtain a worldwide measure of the degree to which countries are left behind in terms of human development.¹

Our proposal contributes to the literature in different ways. First, while inequality across the population within the same country has been introduced in the measurement of human development, there is no relative aspect that considers a country's situation with regard to that of others. The LB-HDI provides a way of measuring inequality in countries' HDIs and permits an assessment of the evolution of the extent to which countries have fallen behind over time. This approach allows for a more complete analysis of human development because inequality assessment across countries is neglected when only absolute HDI levels are analysed and higher absolute levels of HDI in poor and rich countries are not incompatible with an increase in the human development gap across countries. Second, as the same level of overall inequality in HDI worldwide may be due to different distributions, it is of interest to examine inequality in greater depth and estimate how far each country is from the best performing countries. In this regard, our measure

¹ Note that we compare achievements in human development across countries differently than, for instance, Kharas et al. (2018) and McArthur and Rasmussen (2019), who focus on shortfalls of each country with respect to the SDG targets (and once a country surpasses the threshold it is not considered) rather than on shortfalls of countries with respect to other countries for each SDG.

goes beyond average levels of development for each country to investigate average inequality across countries. Specifically, we identify countries that fall significantly behind others in each of the dimensions and in the HDI and quantify the extent to which a country has been left behind. Hence, LB-HDI allows incorporating the LNOB principle into human development measurement and each of its dimensions from a global, cross-national perspective. Third, our measure captures the extent of countries' shortfalls in such a way that these shortfalls are assessed, not with respect to some threshold of adequacy, but instead relative to the best performing countries, thus introducing a relative assessment with regard to countries with better human development outcomes. We therefore avoid imposing an ad hoc threshold and the bias introduced by focusing only on those countries below a certain threshold.

The proposed measure is not intended to be a substitute for but rather a complement to the HDI in the same way that the IHDI and other human development indicators are. The advantage of this measure is that it allows gauging cross-country inequalities using the LNOB principle, specifically by assessing how much each country is left behind. This feature may be particularly interesting from a development policy viewpoint at both national and international levels, as it may shed light on countries' achievements in human development in global, comparative terms.

The remainder of the paper is as follows. In Section 2, we describe our methodological approach. In Section 3, we present and discuss the results of our illustration. Finally, some conclusions and policy implications are discussed.

2. Methodology

Before presenting our methodological approach, some brief remarks on the HDI are in order. The HDI is a summary composite index that measures a country's average achievements in the three core dimensions of human development: (i) a long and healthy life using life expectancy at birth as a variable (LE); (ii) the variables access to knowledge measured as mean years of schooling (MS) and expected years of schooling (ES) defined as the years of schooling that a child can expect to receive given current enrolment rates, both of which are summarized using the arithmetic mean (S); and (iii) a decent standard of living measured as the natural log of GNI per capita at purchasing power parity (Y).

In order to calculate the HDI, three dimension indices, I_{LE} , I_S , and I_Y , are first created. To that end, minimum and maximum values (goalposts) are set in order to transform the variables into indices between 0 and 1. These goalposts act as the 'natural zeros' and 'aspirational targets', respectively. In particular, the minimum values are set at 20 years for LE, at 0 years for both education variables (LE and MS), and at

\$100 for Y, while the maximum values are set at 85 years for LE, at 15 and 18 for MS and ES, respectively, and at \$75,000 for Y. Having defined the minimum and maximum values, the dimension indices are calculated as:

$$\text{Dimension index} = \frac{\text{actual value} - \text{minimum value}}{\text{maximum value} - \text{minimum value}}. \quad (1)$$

For education, equation (1) is applied to each of the two subcomponents and then the arithmetic mean of the two subindices is taken. For living standards, equation (1) is modified to incorporate the natural logarithm of income for all entries.

After calculating the normalized dimension indices in the 0 to 1 range, they are aggregated to produce the HDI as the geometric mean of the three dimension indices, adopting equal weights for each dimension. Thus, the formula to compute HDI is as follows:

$$HDI = I_{LE}^{1/3} \cdot I_S^{1/3} \cdot I_Y^{1/3}. \quad (2)$$

In this paper, we introduce the concept of LNOB for countries in the HDI and attach to each country a measure of the extent to which it is falling behind. We work with the same three dimensions considered in the HDI by using the respective variables without any transformation and proceed in three steps. First, we estimate the degree a country is left behind in each specific dimension. Then, for each country, we aggregate information from the three dimensions to obtain the degree to which the country is left behind in development. Finally, we aggregate across countries and provide an overall measure of the extent to which the set of countries are left behind in human development.

In order to gauge how far each country is left behind in each dimension, we apply fuzzy set theory. Fuzzy logic, introduced by Zadeh (1965), has been previously applied to many fields of knowledge, including the measurement of human development (see, for instance, Lee et al., 2006; Ishida, 2009; Zheng and Zheng, 2015; Abdullah and Chong, 2016; Berg-Schlosser, 2018). In our case, however, we apply fuzzy logic to model the concept of leaving a country behind. Our proposal is novel in this regard as we consider between-country inequalities in the measurement of human development through the lens of the LNOB principle underpinning the 2030 Agenda.

We start by defining a fuzzy set for each dimension. Our aim is to measure the concept of being left behind in a specific dimension by assigning a value between 0 and 1 that indicates the degree to which a country is left behind. We use the membership function proposed by García-Pardo et al. (2021), which is based on the mean deprivation for individual i introduced by Hey and Lambert (1979). Hence, for country i , $LB_h^*(i)$ represents the *degree to which the country i is left behind in terms of dimension h* and is defined as

$$LB_h^*(i) = \left(1 - L(x_{h,i})\right) - \frac{x_{h,i}}{\eta_h} \left(1 - F(x_{h,i})\right), \quad (3)$$

where $x_{h,i}$ is the value of dimension h for country i and η_h is the average of $x_{h,i}$, $F(x_{h,i})$ is the distribution function and $L(x_{h,i})$ is the value of the Lorenz curve² for country i . That is, the value of the membership function assigned to each country is the average of the relative shortfalls of a country's achievements in a specific dimension with respect to other countries with better achievements divided by the average achievement in that dimension.

For convenience sake, we define $LB_h(i) = 1 - LB_h^*(i) = L(x_{h,i}) + \frac{x_{h,i}}{\eta_h} (1 - F(x_{h,i})) = L(x_{h,i}) + \frac{x_{h,i}}{\eta_h} S(x_{h,i})$, where $S(x_{h,i}) = 1 - F(x_{h,i})$ is the survival function. Thus, for a given dimension such as health, $LB_{LE}(i)$ represents the degree to which country i is left behind in terms of life expectancy. Thus, for a country i that leads the ranking in dimension h , we have that $LB_h(i) = 1$, while for a country i that is totally left behind in dimension h , that is, it is at the bottom of the distribution, we have that $LB_h(i) = \frac{x_{h,i}}{\eta}$, and $LB_h(i) = 0$ whenever $x_{h,i} = 0$.

The information provided by this membership function (the extent to which countries are left behind) is complementary to the level of achievement in the sense that even a country with a high level of achievement may be at the bottom of the distribution. Moreover, it should be emphasized that we do not establish thresholds or censor information but work with all the information on country achievements to compute the extent to which each country is left behind in each specific dimension.

The next step is to aggregate the information across dimensions for each country, thus permitting an unambiguous ranking of countries. According to the current HDI approach, we consider as an aggregation function the geometric mean of one minus³ the degrees to which a country is left behind in each of the core dimensions of human development in the following way:

$$LB-HDI(i) = ((LB_{LE}(i))(LB_S(i))(LB_Y(i)))^{\frac{1}{3}}, \quad (4)$$

² Assuming n countries, the Lorenz curve is: $L(x_{h,i}) = \frac{\sum_{j=1}^i x_{h,j}}{\sum_{j=1}^n x_{h,j}}$.

³ It should be noted that although $LB(i) = 0$ is a possible value, in practice $LB(i)$ can be close to zero but not exactly equal to zero as $x_{h,i} > 0$.

where LB-HDI represents *the degree to which a country is left behind in terms of HDI*. As result, a country i is totally left behind in human development if LB-HDI is 0; that is, it is at the bottom of the ranking in any of the dimensions. Country i is not left behind at all if the LB-HDI measure is 1 ($LB_h = 1$ in all dimensions); that is, it leads the ranking in all dimensions. Otherwise, the degree to which a country is left behind in development will be between 0 and 1: the lower the value, the more left behind. Let us recall that the geometric mean takes into account the complementarity, across dimensions, so that the measure captures how well balanced the degree to which a country lags behind is across all three dimensions and penalizes to some extent disparities in the degree to which it lags behind across dimensions.

Our approach allows us to assess the concept of being left behind in human development as a matter of degree for each country in comparison to other countries as well as to identify which countries are further away from better positioned ones and how far they are. This is a novel proposal that attempts to incorporate the LNOB principle in the human development paradigm for the first time, thus providing a new global approach for appraising human development across countries in a highly consistent way in the spirit of the 2030 Agenda and the SDGs.

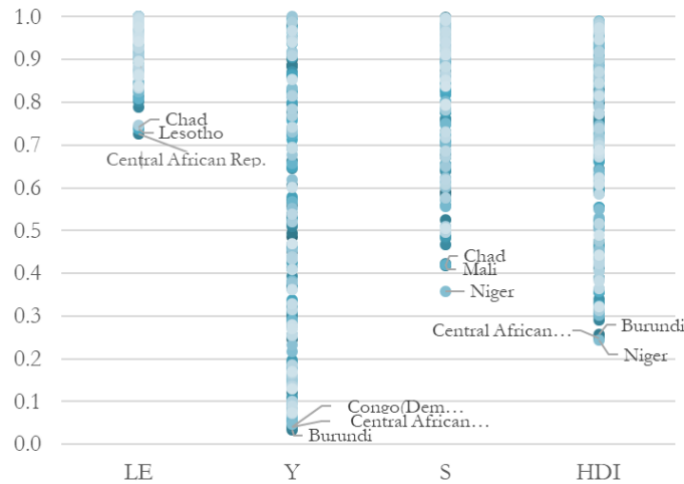
Finally, the average of LB-HDI(i) across countries provides an overall measure of the degree to which countries are left behind in terms of development.

3. Empirical analysis

In order to examine the extent to which countries are left behind in terms of human development, we analysed data on HDI for 174 countries for 2000 and 2018. A list of the countries is provided in Table A1 of the Appendix.

As mentioned in the previous section, we proceed in three steps. First, the extent to which each country is left behind in each dimension is computed; information on the three dimensions for each country is then aggregated; and, finally, information across countries is aggregated to obtain a measure of the overall degree countries are left behind in terms of HDI (LB-HDI). These measures by dimension, LB_h , and by country for LB-HDI in 2018 are displayed in Table A2 of the Appendix and are represented in Figure 1. Let us recall that the lower the LB_h , the more the country is left behind.

Figure 1. LB_h for each human development dimension and LB-HDI by country in 2018



Note: The mean values of the dimension indices and LB-HDI are LB_{LE} : 0.943; LB_Y : 0.470; LB_S : 0.837, and $LB-HDI$: 0.689.

Source: Authors' computation (UNDP, 2019b).

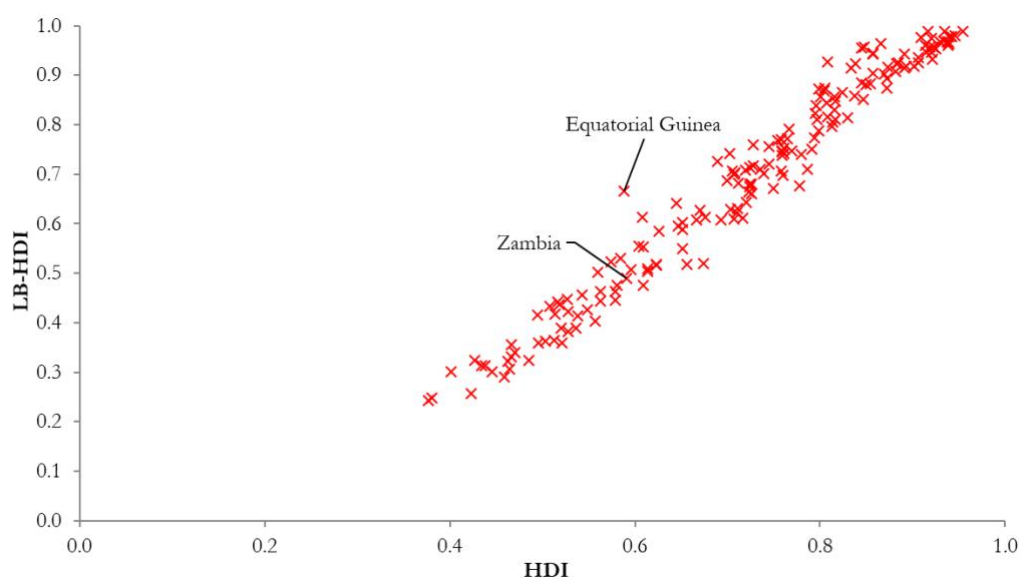
Figure 1 shows the values of LB_h by dimension. The closer the values are to 0, the further away the country. The dispersion in LB_Y is greater than in the other dimensions, thus indicating that some countries are more left behind in living standards than in the rest of the dimensions. This feature results in the overall LB_h values, which show that countries are more left behind in income (mean value of this dimension index is 0.470) than in education (0.837) and life expectancy (0.943), as the income values are closer to 0. Nevertheless, despite the higher LB_{LE} in life expectancy, some countries fall significantly behind the rest. Central African Republic, Lesotho, and Chad fall remarkably behind in health—they have the lowest LB_{LE} values—while Niger, Mali, and Chad fall noticeably behind in education as they have the lowest LB_S values. With regard to the living standards dimension, even though we cannot identify specific countries that are remarkably far from the rest, in general, the sub-Saharan African countries are clearly the most left behind across the world. In fact, 30 out of 36 of the most left-behind countries are located in sub-Saharan Africa; the others are Yemen, Haiti, Afghanistan, the Solomon Islands, the Syrian Arab Republic, and Nepal.

The information on the extent to which each country is left behind in each dimension is aggregated for each country through a geometric mean, obtaining $LB-HDI(i)$. Thus, falling behind in any dimension is directly reflected in the $LB-HDI(i)$, taking into consideration the complementarity among dimensions. It acknowledges that the degree to which a country is falling behind in health, education, and living standards separately is important, assuming that the level of priority assigned to a dimension should not be invariant to the level of attainments (see, e.g., Klugman et al., 2011; Luque et al., 2016; Krishnakumar, 2018). As regards the replacement of the arithmetic mean for the geometric mean in the computation of the HDI in

2010, Ravallion (2010, 2012) pointed out that there are still considerable troubling trade-offs that might involve inappropriate implications in terms of development policy.

Figure 2 shows the scatter plot for HDI and LB-HDI by country for 2018. As can be seen, for example, Equatorial Guinea and Zambia have similar HDI values but noticeably different LB-HDI values. This indicates that—regardless of the similarity in the HDI of these countries—when we take into account each country’s gap in each dimension with respect to countries with greater achievements, Zambia is falling further behind than Equatorial Guinea. In fact, Table A2 of the Appendix shows that Equatorial Guinea falls further back than Zambia in health and education. Meanwhile, Zambia falls even further in living standards, which cannot be compensated for by the outcomes in the other dimensions, resulting in a more concerning situation than Equatorial Guinea’s.

Figure 2. HDI and LB-HDI by country in 2018

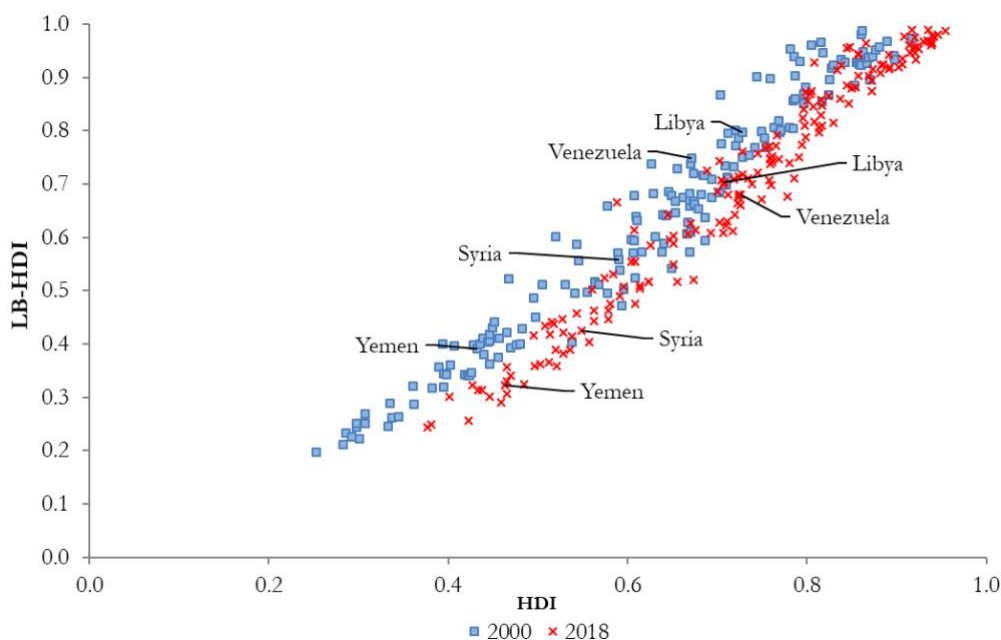


Source: Authors’ computation (UNDP, 2019b).

Note that the $LB-HDI(i)$ can also be used to contextualize the equilibrium of the relative achievements in the three dimensions, since if a country focuses its efforts only on increasing achievement in some dimensions, it can end up falling behind the other countries in the rest of the dimensions as captured in the LB-HDI. For example, Niger is not falling further away in life expectancy (it is in the third quintile of the LBLE), but it is in the lowest quintile for the LBh in the rest of the dimensions and in the lowest quintile for the LB-HDI. Furthermore, even though a country can improve achievements in the three dimensions, it can still fall further away from the other countries if the other countries have improved their achievements even more.

In Figure 3 we compare the scatter plot for the HDI and the LB-HDI for each country in 2000 and 2018 and corroborate that, in general, even though the level of development has increased for almost all countries, the level at which countries are left behind remains similar, as the scatter plot shifts to the right but only slightly upwards. That is, the HDI increases for all countries (except Libya and the Syrian Arab Republic), while the LB-HDI slightly increases in most countries. There are some exceptions, however. In particular, 17 of the 174 countries analysed were left further behind in 2018 than in 2000, namely, the Central African Republic, Liberia, Yemen, Haiti, Madagascar, the Syrian Arab Republic, Jamaica, the Bolivarian Republic of Venezuela, Jordan, Libya, Barbados, Kuwait, the Bahamas, Bahrain, Brunei Darussalam, Qatar, and Luxembourg. As can be observed, these countries have different levels of human development, as they have suffered wars, natural catastrophes, political tensions, or the consequences of certain adverse socio-economic circumstances in terms of human wellbeing.

Figure 3. HDI and LB-HDI per country and year



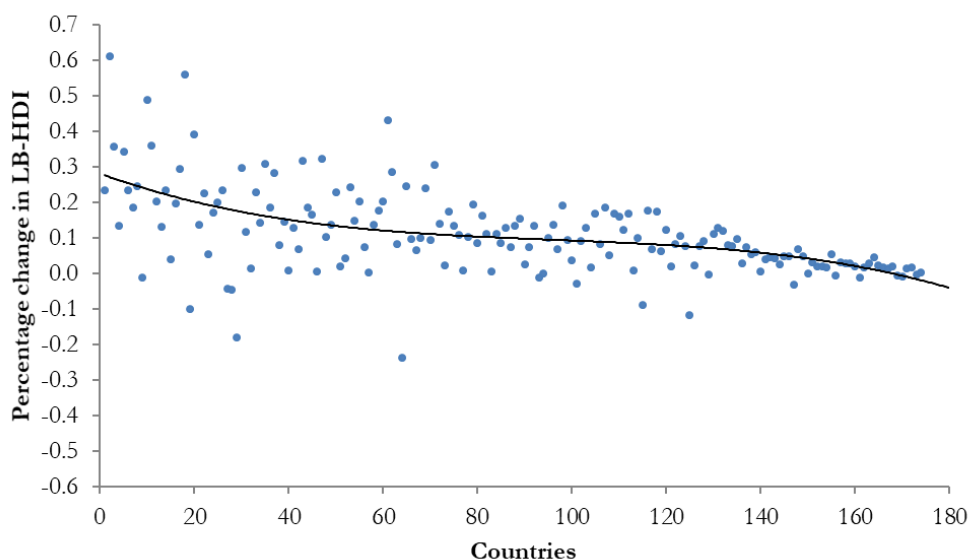
Source: Authors' computation (UNDP, 2019b).

By way of example, Figure 3 depicts four countries. On the one hand, the Syrian Arab Republic and Libya decreased both their HDI (they move towards the left) and their LB-HDI (they shift downwards) during the period 2000–2018, thus increasing their gaps with better performing countries. On the other, even though Yemen and Venezuela increased their HDI (they move towards the right), their LB-HDI decreased (they shift downwards), thus increasing their gaps with respect to countries that perform better. These two countries would probably be identified as countries that move backwards as they have reduced their HDI,

but only if we measure the extent to which a country is left behind, can we identify which countries are most left behind, despite their absolute improvements in HDI. Moreover, beyond the overall value of the LB-HDI, we should examine the specific dimensions in which their distance from the better performing countries increased in order to identify the nature of the relative deterioration. In this regard, it should be noted that some countries fell further behind in 2018 than in 2000 in all dimensions (i.e., the Bahamas, Jordan, Kuwait, Libya, and the Syrian Arab Republic), while other countries fell further behind in only one dimension such as living standards (i.e., Yemen, Madagascar, Haiti, and the Central African Republic). Yet others, however, such as Brunei Darussalam and Qatar, decreased the gap in living standards, even though the gap between the best performing countries increased in health and education and they ended up falling further behind in 2018 than in 2000 in terms of human development.

Changes in the LB-HDI provide insight as to whether the progress in world human development since 2000 has contributed to reducing the gaps between the most left-behind countries and those better positioned at the outset of the millennium. In Figure 4 we examine if changes in the LB-HDI have favoured left-behind countries and replicate the analysis by dimension in Figure 5. We do not compare average changes for groups of countries but individually compute the percentage changes in the extent that each country has been left behind in the first two decades of the century.

Figure 4. Percentage change in LB-HDI (2000–2018)



Note: Countries are ranked in increasing order of the LB-HDI in 2000. Percentage change in LB-HDI = $(\text{LB-HDI}_{2018}/\text{LB-HDI}_{2000})-1$.

Source: Authors' computation (UNDP, 2019b).

Figure 4 shows the percentage change in the LB-HDI in the vertical axis for each country, with those that are more left behind ranked first. We observe a decreasing curve which shows that, in general, changes across the globe in the LB-HDI favoured left-behind countries as the greatest increases (i.e., those countries that most reduced gaps with respect to better performing countries) initially had the lowest LB-HDI. Nonetheless, a variety of results that do not clearly suggest convergence can be observed. In fact, among the countries belonging to the lowest quintile of the LB-HDI in 2000, Myanmar, Cambodia, Ethiopia, Rwanda, and Bangladesh reduced their degree of being left behind; however, the human development gap between the rest of the world and countries such as Yemen, Liberia, Haiti, Madagascar, and the Central Africa Republic significantly increased.⁴

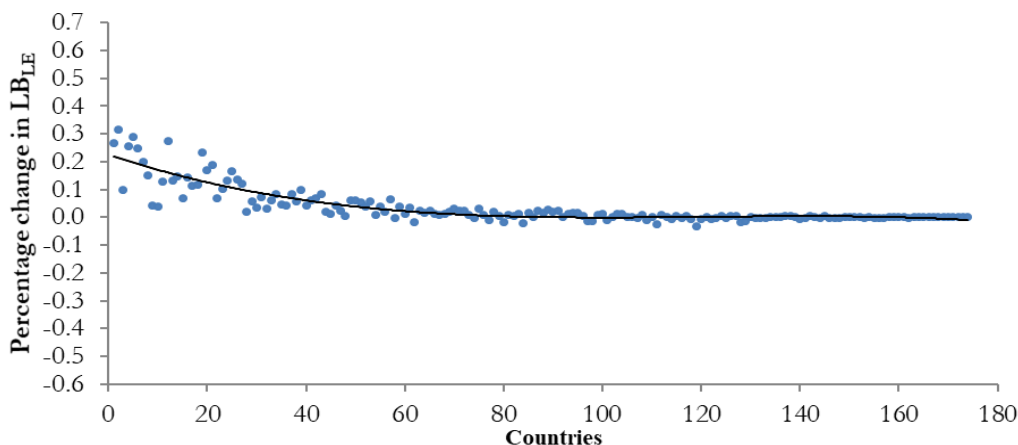
By dimension (Figure 5), the pattern of change suggests that the global bottom (countries that were more left behind in 2000) is catching up in health and even more in education, while the pattern is not so favourable towards left-behind countries in terms of living standards. This reflects the fact that, although the rate of progress in health and education of the most left-behind countries at the beginning of the century has tended to diminish in general terms,⁵ the gap between the most and least left-behind countries in living standards is not closing and displays a variety of patterns. Thus, by country quintiles in LB_V in 2000, we observe that 8 out of 35 countries in the lowest quintile in 2000 increased the degree to which they were left behind in living standards in 2018 (Liberia, Burundi, the Central African Republic, Haiti, Madagascar, Gambia, the Solomon Islands, and Niger—most of which are in sub-Saharan Africa). We also find other countries, which had been in higher quintiles in 2000, falling further away from the rest of the world in terms of income—even those in the fifth quintile (the Bahamas, Oman, the United Arab Emirates, Bahrain, Luxembourg, Italy, and Kuwait).

⁴ The Syrian Arab Republic deserves special mention as it was ranked the 64th most left-behind country at the beginning of the century and has suffered the greatest setback in human development over these two decades, essentially as a consequence of the bloody civil war that erupted in 2011.

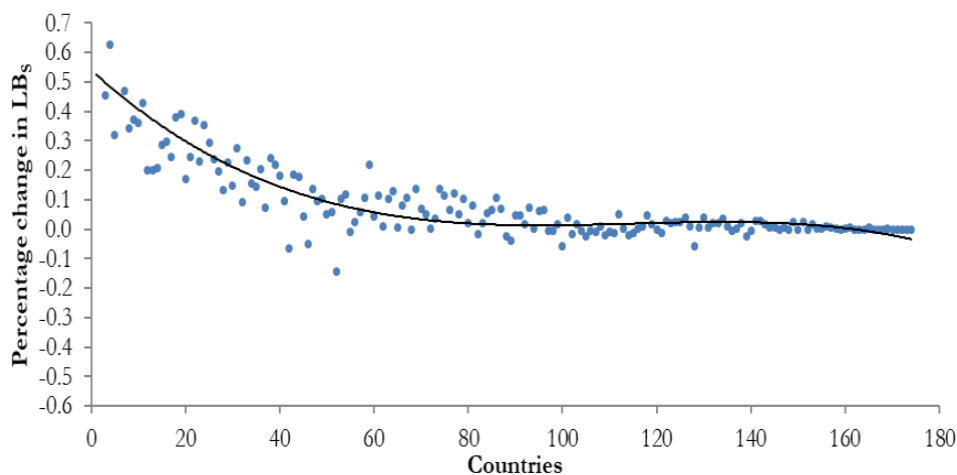
⁵ Note, nevertheless, that 47 countries were more left behind in health in 2018 with respect to 2000, even though only nine decreased more than 1 percentage point (Syria, Venezuela, Tonga, Fiji, Iraq, Jamaica, Saint Vincent and the Grenadines, Mexico, and Libya). Likewise, 39 countries worsened their relative situation in education with respect to the LNOB principle, particularly Syria, Liberia, Jordan, Dominica, Equatorial Guinea, Guyana, Qatar, Kuwait, and the Bahamas.

Figure 5. Percentage change in LB by dimension (2000–2018)

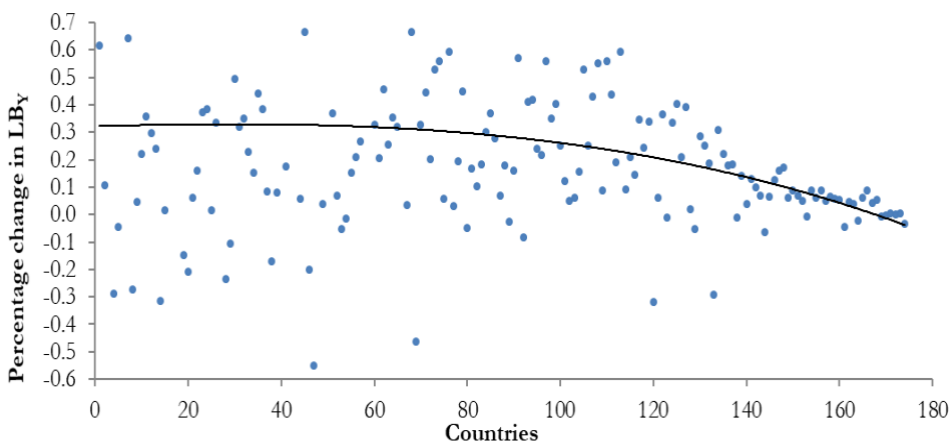
Health



Education



Living standards



Note: Countries ranked in increasing order of LB_h in 2000 with h being LE, S, and Y, respectively.

Source: Authors' computation (UNDP, 2019b).

4. Conclusions

Despite considerable gains in health, education, and living standards since the MDGs were established in 2000, the world has witnessed inequalities within and between countries. Such inequalities pose a serious threat to achieving the 2030 Agenda, making the LNOB principle highly relevant. Although the HDI was chiefly intended for international comparisons across countries, the HDI methodology only allows for descriptive comparisons that may sometimes be misleading. Thus, a country may be improving its HDI and, at the same time, its level of human development may be falling behind in comparison to the rest of the countries. This leads us to think that cross-country inequality is to some extent neglected when comparing human development. Furthermore, summary average measures of inequality (for instance, comparison of average levels of HDI of rich and poor countries or the use of an inequality measure in HDI such as the Gini coefficient) paint only a partial picture as they aggregate complex information into one number and disguise valuable evidence. Consequently, a new generation of metrics is needed to properly assess cross-country inequality, taking into account not only the level but also the distribution of outcomes, in an attempt to attend to the measurement of the principle of leaving no one behind.

In this paper, we have proposed using a fuzzy approach to gauge cross-country inequality in human development by incorporating the LNOB principle underpinning the 2030 Agenda into a human development measurement with a global, cross-national perspective. We have identified countries that have been left behind in each dimension of human development and estimated the extent to which a country is left behind in terms of overall human development. Our approach, nevertheless, is not intended to provide a substitute measure for the HDI, but rather to complement it in the same way as the IHDI or other human development measures such as the GDI, the GII, and the MPI.

The results are particularly interesting from a national and international policy viewpoint as they may shed light on the real relative situation of the most disadvantaged countries in terms of human development. We corroborate that there has been remarkable progress over this century that has enabled most countries, including numerous developing and emerging economies, to increase their human wellbeing. Overall, we have revealed that human development progress over the last decades has been favourable towards left-behind countries as the countries that most reduced their gaps with respect to better performing countries were the most left behind at the beginning of the century, even though there are significant exceptions that the international community should not overlook. Our approach can identify countries that have seen their human development gaps widen with respect to better performing ones despite their increase in the HDI. This is the case for the Central African Republic, Liberia, Yemen, Haiti, Madagascar, Jamaica,

Venezuela, Jordan, Barbados, Kuwait, the Bahamas, Bahrain, Brunei Darussalam, Qatar, and Luxembourg. With respect to the dimensions of human development, we found that while the Bahamas, Jordan, and Kuwait fell further behind in 2018 than in 2000 in all dimensions, other countries only fell further behind in income, such as Yemen, Haiti, Madagascar, the Central African Republic, and Luxembourg, or in health and education, such as Qatar and Brunei Darussalam. On a more positive note, countries such as Mozambique, Sierra Leone, Rwanda, Madagascar, and Pakistan have made relative improvements over the last decades regarding the extent to which they are left behind in human development. By dimension, overall, we find that countries that were more left behind at the beginning of the century are catching up in health and even more in education, while the pattern is not so favourable towards left-behind countries in terms of income and there have been a variety of outcomes.

All in all, the assessment of the degree each country is being left behind is a crucial aspect that complements a country's level of human development achievement, thus providing valuable information on inequality among countries, which, alongside within-country inequality, should constitute a persistent cause for concern. Furthermore, as the COVID-19 pandemic has had significant impacts on all of human development's constitutive elements and some developing countries are expected to be particularly affected (UNCTAD, 2020; UNDP 2020), it is urgent to incorporate the United Nations' moral imperative of leaving no country behind in the metrics of human development, especially given the possibility that COVID-19 will deepen the existing inequalities between countries.

References

- Abdullah, L. and Chong, Y.H. (2016). ‘Human Development Index using membership functions of fuzzy sets’, *International Journal of Ecological Economics and Statistics*, 37(4), 105–118.
- Alkire, S. and Santos, M. E. (2011). ‘Training material for producing national human development reports: The Multidimensional Poverty Index (MPI)’, OPHI Rresearch in Progress 31a, Oxford Poverty and Human Development Initiative (OPHI), University of Oxford.
- Anderson, E. (2016). ‘Equality as a global goal’, *Ethics and International Affairs*, 30(2), 189–200.
- Berg-Schlosser, D. (2018). ‘Calibrating and aggregating multi-dimensional concepts with fuzzy sets: “Human development” and the quality of democracy’, *Australasian Marketing Journal*, 26(4), 350–357.
- Donald, K. and Saez, I. (2017). ‘tackling inequality through Sustainable Development Goals: Inequality in practice’, *International Journal of Human Rights*, 21(8), 1029–1049.
- García-Pardo, F., Bárcena-Martín, E., and Pérez-Moreno, S. (2021). ‘Measuring the “leaving no one behind” principle in the European countries: An AROPE-based fuzzy logic approach’, *Fuzzy Sets and Systems*. Forthcoming.
- Greco S., Ishizaka A., Tasiou M., and Torrisi G. (2019). ‘On the methodological frame-work of composite indices: A review of the issues of weighting, aggregation, and robustness’, *Social Indicators Research*, 141:61–94.
- Hey, J. and Lambert, P. (1980). ‘Relative deprivation and the Gini coefficient: Comment’, *Quarterly Journal of Economics*, 95(3), 567–573.
- Ibar-Alonso, R., Cosculluela-Martínez, C., and Hewings, G.J.D. (2019). ‘Time indicator of the Human Development Index’, *Time & Society*, 28(1), 273–296.
- Ishida, A. (2009). ‘Application potentialities of the fuzzy set qualitative comparative analysis: Reconstruction of the Human Development Index by fsQC’, *Sociological Theory and Methods*, 24(2), 203–218.
- Kharas, H., McArthur, J. W., and Rasmussen, K. (2018). ‘How many people will the world leave behind?’, Brookings Global Economy and Development Working Paper 123, Washington DC: The Brookings Institution.
- Klasen, S. and M. Fleurbaey (2018). ‘Leaving no one behind: Some conceptual and empirical issues’, CDP Background Paper 44, United Nations Department of Economic and Social Affairs.

- Klugman, J., Rodríguez, F., and Choi, H.-J. (2011). 'The HDI 2010: New controversies, old critiques', *The Journal of Economic Inequality*, 9(2), 249–288.
- Krishnakumar, J. (2018). 'Trade-offs in a multidimensional human development index', *Social Indicators Research*, 138(3), 991–1022.
- Lee HS., Lin K. and Fang HH. (2006). 'A fuzzy multiple objective DEA for the Human Development Index' in B. Gabrys, R.J. Howlett, and L.C. Jain (eds), *Knowledge-Based Intelligent Information and Engineering Systems. KES 2006. Lecture Notes in Computer Science*, 4252, pp. 922–928, Heidelberg, Berlin: Springer.
- Liang, M., Niu, S., Li, Z., and Qiang, W. (2019). 'International comparison of Human Development Index corrected by greenness and fairness indicators and policy implications for China', *Social Indicators Research*, 142(1), 1–24.
- Lind, N. (2019). 'A development of the Human Development Index', *Social Indicators Research*, 146, 409–423.
- Luque, M., Pérez-Moreno, S., and Rodríguez, B. (2016). 'Measuring human development: A multi-criteria approach', *Social Indicators Research*, 125(3), 713–733.
- MacNaughton, G. (2017). 'Vertical inequalities: Are the SDGs and human rights up to the challenges?', *The International Journal of Human Rights*, 21(8), 1050–1072.
- Mangaraj, B.K. and Aparajita, U. (2020). 'Constructing a generalized model of the Human Development Index', *Socio-Economic Planning Sciences*, 30, 100778.
- McArthur, J. W. and Rasmussen, K. (2019). 'Classifying Sustainable Development Goal trajectories: A country-level methodology for identifying which issues and people are getting left behind', *World Development*, 123, 104608.
- OECD (2018). *Development Co-operation Report 2018: Joining Forces to Leave No One Behind*, Paris: OECD Publishing.
- Permanyer, I. and Smits, J. (2018). 'The Subnational Human Development Index: Moving beyond country-level averages', [UNDP Human Development Reports, 31 May 2018](#).
- Ravallion, M. (2010). 'Troubling tradeoffs in the Human Development Index', Policy Research Working Paper 5484, World Bank.

- Ravallion, M. (2012). 'Troubling tradeoffs in the Human Development Index', *Journal of Development Economics*, 99, 201–209.
- Tudge, J., Shanahan, M.J., and Valsiner, J. (eds.) (1997). *Comparisons in Human Development: Understanding Time and Context*, Cambridge: Cambridge University Press.
- UN. (2015). *Transforming Our World: The 2030 Agenda for Sustainable Development*. A/RES/70/1, New York: United Nations.
- UNCTAD. (2020). 'The Covid-19 shock to developing countries: Towards a 'whatever it takes' programme for the two-thirds of the world's population being left behind', Trade and Development Report Update, [UNCTAD / GDS / INF / 2020 / 2](#), March.
- UNDP (2011). *Human Development Report 2011: Sustainability and Equity - A Better Future for All*. UN, New York.
- UNDP (2019a). *Human Development Report 2019: Beyond Income, Beyond Averages, Beyond Today - Inequalities in Human Development in the 21st Century*, New York: United Nations.
- UNDP (2019b). 'Human Development Data (1990–2018)', [UNDP Human Development Reports](#), accessed 23 September 2019.
- UNDP (2020). *COVID-19 and Human Development: Assessing the Crisis, Envisioning the Recovery*, New York: UNDP.
- Zadeh, L. (1965). 'Fuzzy sets', *Information and Control*, 8, 338–353.
- Zheng, B and Zheng, C. (2015). 'Fuzzy ranking of human development: A proposal', *Mathematical Social Sciences*, 78, 39–47.

Appendix

Table A1. Countries examined

Afghanistan	Brazil	Cyprus	Greece	Kiribati	Micronesia	Philippines	Spain	Uzbekistan
Albania	Brunei Darussalam	Czechia	Guatemala	Korea	Moldova	Poland	Sri Lanka	Venezuela
Algeria	Bulgaria	Denmark	Guinea	Kuwait	Mongolia	Portugal	Sudan	Vietnam
Andorra	Burkina Faso	Djibouti	Guyana	Kyrgyzstan	Morocco	Qatar	Sweden	Yemen
Angola	Burundi	Dominica	Haiti	Lao People's Democratic Republic	Mozambique	Romania	Switzerland	Zambia
Argentina	Cabo Verde	Dominican Republic	Honduras	Latvia	Myanmar	Russian Federation	Syrian Arab Republic	Zimbabwe
Armenia	Cambodia	Ecuador	Hong Kong, China (SAR)	Lesotho	Namibia	Rwanda	Tajikistan	
Australia	Cameroon	Egypt	Hungary	Liberia	Nepal	Saint Lucia	Tanzania	
Austria	Canada	El Salvador	Iceland	Libya	Netherlands	Saint Vincent and the Grenadines	Thailand	
Azerbaijan	Central African Republic	Equatorial Guinea	India	Liechtenstein	New Zealand	Samoa	Timor-Leste	
Bahamas	Chad	Estonia	Indonesia	Lithuania	Nicaragua	Sao Tome and Principe	Togo	
Bahrain	Chile	Eswatini	Iran	Luxembourg	Niger	Saudi Arabia	Tonga	
Bangladesh	China	Ethiopia	Iraq	Madagascar	North Macedonia	Senegal	Trinidad and Tobago	
Barbados	Colombia	Fiji	Ireland	Malawi	Norway	Serbia	Tunisia	

Belarus	Comoros	Finland	Israel	Malaysia	Oman	Seychelles	Turkey
Belgium	Congo	France	Italy	Maldives	Pakistan	Sierra Leone	Uganda
Belize	Congo (Democratic Republic of the)	Gabon	Jamaica	Mali	Palau	Singapore	Ukraine
Benin	Costa Rica	Gambia	Japan	Malta	Panama	Slovakia	United Arab Emirates
Bolivia	Côte d'Ivoire	Georgia	Jordan	Mauritania	Papua New Guinea	Slovenia	United Kingdom
Bosnia and Herzegovina	Croatia	Germany	Kazakhstan	Mauritius	Paraguay	Solomon Islands	United States
Botswana	Cuba	Ghana	Kenya	Mexico	Peru	South Africa	Uruguay

Table A2. LB by dimension and LB-HDI in 2018

Countries	LB _{LE}	LB _Y	LB _S	LB-HDI
Afghanistan	0.8773	0.0889	0.5899	0.3583
Albania	0.9901	0.4523	0.9446	0.7507
Algeria	0.9833	0.4842	0.8785	0.7478
Andorra	0.9983	0.9124	0.9186	0.9423
Angola	0.8326	0.2460	0.7014	0.5238
Argentina	0.9824	0.5682	0.9684	0.8146
Armenia	0.9736	0.3694	0.9437	0.6976
Australia	0.9997	0.8870	0.9984	0.9602
Austria	0.9976	0.8998	0.9898	0.9613
Azerbaijan	0.9596	0.5206	0.9056	0.7677
Bahamas	0.9662	0.7405	0.9318	0.8736
Bahrain	0.9854	0.8611	0.9280	0.9234
Bangladesh	0.9548	0.1892	0.7307	0.5092
Barbados	0.9919	0.5349	0.9551	0.7973
Belarus	0.9716	0.5573	0.9810	0.8099
Belgium	0.9977	0.8852	0.9902	0.9563
Belize	0.9710	0.3020	0.9053	0.6427
Benin	0.8414	0.1070	0.6550	0.3892
Bolivia (Plurinational State of)	0.9454	0.2923	0.8996	0.6288
Bosnia and Herzegovina	0.9858	0.4619	0.9157	0.7471
Botswana	0.9277	0.5357	0.8838	0.7601
Brazil	0.9782	0.4941	0.8792	0.7518
Brunei Darussalam	0.9782	0.9806	0.9087	0.9552
Bulgaria	0.9736	0.6050	0.9694	0.8296
Burkina Faso	0.8377	0.0869	0.4218	0.3132
Burundi	0.8377	0.0344	0.5834	0.2562
Cabo Verde	0.9588	0.2806	0.7543	0.5877
Cambodia	0.9306	0.1710	0.6730	0.4749
Cameroon	0.8079	0.1582	0.7782	0.4633

Canada	0.9990	0.8838	0.9902	0.9562
Central African Republic	0.7258	0.0405	0.5242	0.2488
Chad	0.7422	0.0875	0.4173	0.3003
Chile	0.9943	0.6450	0.9607	0.8509
China	0.9833	0.5393	0.8632	0.7707
Colombia	0.9850	0.4668	0.8871	0.7416
Comoros	0.8728	0.1202	0.6751	0.4137
Congo (Republic of the)	0.8751	0.2553	0.7592	0.5535
Congo (Democratic Republic of the)	0.8274	0.0417	0.7133	0.2908
Costa Rica	0.9946	0.5106	0.9086	0.7727
Côte d'Ivoire	0.7879	0.1707	0.6393	0.4414
Croatia	0.9895	0.6629	0.9664	0.8590
Cuba	0.9907	0.3241	0.9641	0.6764
Cyprus	0.9963	0.7951	0.9714	0.9164
Czechia	0.9922	0.7787	0.9924	0.9153
Denmark	0.9963	0.9133	0.9971	0.9681
Djibouti	0.9004	0.1712	0.4679	0.4162
Dominica	0.9888	0.3685	0.8432	0.6747
Dominican Republic	0.9669	0.5169	0.8664	0.7566
Ecuador	0.9837	0.3944	0.9123	0.7073
Egypt	0.9506	0.4113	0.8268	0.6863
El Salvador	0.9611	0.2965	0.7861	0.6073
Equatorial Guinea	0.8012	0.5717	0.6443	0.6658
Estonia	0.9904	0.7647	0.9898	0.9085
Eswatini (Kingdom of)	0.8144	0.3719	0.7619	0.6134
Ethiopia	0.8961	0.0906	0.4829	0.3397
Fiji	0.9077	0.3644	0.9507	0.6800
Finland	0.9981	0.8712	0.9959	0.9532
France	0.9992	0.8620	0.9714	0.9423
Gabon	0.8961	0.5324	0.8580	0.7425
Gambia	0.8439	0.0765	0.5596	0.3305

Georgia	0.9648	0.3781	0.9839	0.7106
Germany	0.9972	0.9038	0.9951	0.9643
Ghana	0.8693	0.1909	0.7844	0.5068
Greece	0.9988	0.6920	0.9656	0.8739
Guatemala	0.9683	0.3100	0.7298	0.6028
Guinea	0.8377	0.1104	0.4877	0.3560
Guyana	0.9325	0.3178	0.8298	0.6265
Haiti	0.8681	0.0850	0.6453	0.3624
Honduras	0.9748	0.1970	0.7214	0.5174
Hong Kong, China (SAR)	1.0000	0.9519	0.9858	0.9790
Hungary	0.9833	0.7240	0.9740	0.8851
Iceland	0.9995	0.9072	0.9966	0.9668
India	0.9287	0.2916	0.7773	0.5949
Indonesia	0.9480	0.4253	0.8480	0.6993
Iran (Islamic Republic of)	0.9824	0.5785	0.9365	0.8104
Iraq	0.9391	0.5233	0.7767	0.7254
Ireland	0.9988	0.9384	0.9962	0.9774
Israel	0.9995	0.8009	0.9891	0.9251
Italy	0.9998	0.8252	0.9549	0.9236
Jamaica	0.9703	0.3279	0.9053	0.6604
Japan	1.0000	0.8642	0.9820	0.9467
Jordan	0.9703	0.3384	0.8931	0.6644
Kazakhstan	0.9618	0.6483	0.9749	0.8471
Kenya	0.8972	0.1479	0.7492	0.4633
Kiribati	0.9158	0.1838	0.8181	0.5164
Korea (Republic of)	0.9995	0.8307	0.9873	0.9359
Kuwait	0.9765	0.9743	0.8397	0.9279
Kyrgyzstan	0.9463	0.1593	0.9341	0.5203
Lao People's Democratic Republic	0.9108	0.2737	0.6866	0.5552
Latvia	0.9754	0.7121	0.9886	0.8822
Lesotho	0.7381	0.1562	0.7243	0.4371

Liberia	0.8681	0.0539	0.6149	0.3065
Libya	0.9580	0.4368	0.8318	0.7034
Liechtenstein	0.9956	0.9968	0.9748	0.9890
Lithuania	0.9782	0.7575	0.9921	0.9025
Luxembourg	0.9988	0.9647	0.9653	0.9761
Madagascar	0.9014	0.0722	0.7063	0.3583
Malawi	0.8693	0.0600	0.6542	0.3243
Malaysia	0.9798	0.7251	0.9223	0.8686
Maldives	0.9904	0.4585	0.7847	0.7089
Mali	0.8079	0.0991	0.4210	0.3231
Malta	0.9991	0.8125	0.9730	0.9244
Mauritania	0.8796	0.1770	0.5720	0.4466
Mauritius	0.9736	0.6575	0.9248	0.8396
Mexico	0.9742	0.5686	0.8923	0.7906
Micronesia (Federated States of)	0.9128	0.1752	0.8030	0.5045
Moldova (Republic of)	0.9506	0.2917	0.9033	0.6304
Mongolia	0.9316	0.4124	0.9340	0.7106
Morocco	0.9824	0.3134	0.7506	0.6137
Mozambique	0.8249	0.0597	0.5554	0.3013
Myanmar	0.9035	0.2538	0.6525	0.5309
Namibia	0.8645	0.3813	0.8008	0.6415
Nepal	0.9391	0.1346	0.7020	0.4460
Netherlands	0.9988	0.9181	0.9924	0.9690
New Zealand	0.9988	0.8156	0.9972	0.9331
Nicaragua	0.9697	0.2172	0.7872	0.5494
Niger	0.8475	0.0474	0.3576	0.2431
North Macedonia	0.9782	0.4663	0.9104	0.7461
Norway	0.9990	0.9696	0.9956	0.9880
Oman	0.9870	0.8332	0.9293	0.9142
Pakistan	0.9056	0.2323	0.6014	0.5021
Palau	0.9655	0.5511	0.9834	0.8058

Panama	0.9895	0.6191	0.9107	0.8232
Papua New Guinea	0.8751	0.1746	0.6230	0.4566
Paraguay	0.9683	0.4377	0.8569	0.7135
Peru	0.9824	0.4529	0.9021	0.7376
Philippines	0.9445	0.3772	0.8865	0.6810
Poland	0.9901	0.7305	0.9882	0.8941
Portugal	0.9985	0.7346	0.9300	0.8803
Qatar	0.9946	1.0000	0.8826	0.9575
Romania	0.9793	0.6763	0.9510	0.8572
Russian Federation	0.9556	0.6939	0.9789	0.8658
Rwanda	0.9218	0.0989	0.6499	0.3898
Saint Lucia	0.9803	0.4326	0.8829	0.7208
Saint Vincent and the Grenadines	0.9556	0.4384	0.8808	0.7173
Samoa	0.9618	0.2582	0.9100	0.6091
Sao Tome and Principe	0.9363	0.1467	0.7825	0.4754
Saudi Arabia	0.9742	0.9154	0.9465	0.9451
Senegal	0.9118	0.1567	0.5099	0.4177
Serbia	0.9788	0.5201	0.9611	0.7880
Seychelles	0.9626	0.6945	0.9378	0.8559
Sierra Leone	0.7462	0.0711	0.5771	0.3128
Singapore	0.9998	0.9872	0.9787	0.9885
Slovakia	0.9862	0.7682	0.9727	0.9032
Slovenia	0.9972	0.7848	0.9918	0.9190
Solomon Islands	0.9588	0.1020	0.6728	0.4037
South Africa	0.8705	0.4386	0.9258	0.7071
Spain	0.9998	0.8150	0.9515	0.9186
Sri Lanka	0.9837	0.4349	0.9480	0.7402
Sudan	0.8840	0.1855	0.4963	0.4334
Sweden	0.9994	0.9092	0.9955	0.9671
Switzerland	0.9998	0.9497	0.9910	0.9799
Syrian Arab Republic	0.9506	0.1336	0.6073	0.4256

Tajikistan	0.9427	0.1662	0.8834	0.5173
Tanzania (United Republic of)	0.8829	0.1371	0.6201	0.4218
Thailand	0.9842	0.5394	0.8680	0.7724
Timor-Leste	0.9277	0.3149	0.6868	0.5854
Togo	0.8326	0.0815	0.7165	0.3650
Tonga	0.9418	0.2545	0.9543	0.6115
Trinidad and Tobago	0.9633	0.7418	0.9282	0.8721
Tunisia	0.9824	0.4095	0.8541	0.7004
Turkey	0.9862	0.6919	0.8829	0.8446
Uganda	0.8597	0.0892	0.7307	0.3826
Ukraine	0.9523	0.3299	0.9661	0.6720
United Arab Emirates	0.9877	0.9676	0.9395	0.9647
United Kingdom	0.9972	0.8539	0.9953	0.9463
United States	0.9913	0.9400	0.9916	0.9740
Uruguay	0.9877	0.6013	0.9153	0.8161
Uzbekistan	0.9489	0.2788	0.9126	0.6227
Venezuela (Bolivarian Republic of)	0.9531	0.3632	0.9107	0.6806
Vietnam	0.9760	0.2702	0.8504	0.6076
Yemen	0.8950	0.0737	0.5050	0.3217
Zambia	0.8657	0.1704	0.7964	0.4898
Zimbabwe	0.8377	0.1307	0.7936	0.4429
Overall	0.9430	0.4700	0.8370	0.6890

Source: Authors' computation (UNDP, 2019b).