A Solution to the HDI’s Inability to Measure Intertemporal Development

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**Abstract:**

The United Nation’s Human Development Index (HDI) has been a widely used measure of development for over two decades now. The HDI is a measure of how developed a nation is. However it does not measure the change in development levels, and therefore the improvements that nations make over time. This thesis seeks to modify the HDI measure to address this shortcoming. The thesis will first analyze the HDI to see what it does well and poorly. It will then propose a solution to the problem of measuring development over time, introducing two measures, the Dynamic HDI, and the Adjusted Dynamic HDI.

“The HDI is conceptually weak and empirically unsound, involving serious problems of noncomparability over time and space, measurement errors, and biases” – T.N. Srinivasan

**SECTION 1: Introduction**

The Human Development Index (HDI) was created in 1990 as an alternative to GDP per capita when measuring the development of nations. Proponents of the HDI have claimed that it provides a much more holistic view of development than its counterpart. However, there are many economists who believe that the HDI is an extremely flawed measurement that contributes little to the field. One of these opponents, T.N. Srinivasan, brings up the most flawed aspect of the index, non-comparability over time.[[1]](#footnote-1)

The notion of how one measures development, and compares different countries can be thought of as: (1) the living standards of different nations at a given point of time or (2) improvement of living standards with a nation over a period of time. The first allows us to see which nations perform better, and which perform worse according to a set of indicators that are believed to represent the quality of life in that nation. The second focuses on an individual nation and sees how it has improved in those indicators over time. This idea is centered around the belief that development should be based on improvement, not the sum of a series of historical events. Both measures help us get a sense of the level of development of a country. However, a big problem with the HDI is that it focuses on the first measure and ignores the second. It does not capture an important aspect of development, how nations are improving over time. This thesis attempts to add that aspect of development to the HDI to make it a more holistic index. The rest of this thesis is organized in the following manner. In Section 2, I document the history of the HDI to gain a better understanding of the thought process that went into its creation and the goals the UN had in mind when creating it. In Section 3, I will break down the original calculation of the HDI and the calculation used today. Noting similarities and differences in the construction, the paper will make clear which problems in the original HDI have been solved by the newer edition and which problems persist today.

In Section 4 I will explain a series of critiques that have been leveled against the index. It will explain the arguments against the HDI and the problems that exist in using it as a tool to measure development. The HDI’s inability to measure development over time will be elaborated on in Section 5, where I will also propose two new indices. The Dynamic HDI will attempt to solve the problem of individual development by focusing on the nations themselves instead of their relative performance on a global scale. The Adjusted Dynamic HDI will focus on the same problems as the Dynamic HDI, while also trying to take into account the difficulty of development experienced by each nation. Included in this section will be the findings from the indices and what they represent.

**SECTION 2: History of the Human Development Index**

The earliest economic indicator of the level of development of a nation was the per capita Gross Domestic Product. Per capita income was seen as the best way to measure how developed the economy of a nation was. The indicator was later modified to reflect purchasing power, giving rise to per capita income with purchasing power parity. Measuring GDP per capita, and its growth, allowed economists to measure the two aspects of development discussed in the introduction: relative development and development over time. Economists could calculate these by looking at the value of GDP per capita for given nations and also calculating the percentage change in a nation’s GDP per capita over a period of time.

However, there were a series of problems with using GDP per capita as a measure of development. The first was that it failed to take into account income inequality. A nation could have had a rapidly increasing GDP per capita, but all of the gains in wealth could be going directly to the wealthy members of society. The United Nations noted in 1969 that “the fact that development either leaves behind, or in some ways even creates, large areas of poverty, stagnation, marginality, and actual exclusion from economic and social progress is too obvious and too urgent to be overlooked” (UNECOSOC 1969). The prevailing thought was that if the poor were not achieving a higher standard of living, the nation was not developing.

The problem was that GDP per capita is by definition a mean, making it terrible at measuring dispersion. Other figures could have been added on to GDP per capita to try and express things like income inequality, but it was believed that this would still lead to an indicator which did not have great value. Jahan (2000) describes the problem in the 2000 Human Development Report as one where, “economic performance by itself cannot be the objective of development, (and) neither can per capita income be a measure of it”. He goes on to say that many of the things which end up raising a nation’s GDP per capita can be detrimental to the quality of life of its citizens, like factories that cause pollution and illness. At the same time, aspects of life that make a country developed and create better life for its people, like the ability to take vacations and spend more time with family, cannot be measured by GDP per capita. As Sen (1998) puts it, “The GNP captures only those means of well-being that happen to be transacted in the market, and this leaves out benefits and costs that do not have a price-tag attached to them”. There needed to be an alternative to GDP per capita that would take into account the quality of the lives citizens were living instead of purely focusing on average wealth gains.

Amartya Sen developed a frame of analysis that focused on what he called the capabilities and functionings of the members of a society. The functionings of a group of people are their “ability to do certain things and to achieve certain types of beings (such as being well nourished, being free from avoidable morbidity, being able to move about as desired and so on)” (Sen 1998). Capabilities are defined as, “the set of alternative function n-tuples, any one of which the person can choose” (Sen 1998). In simpler terms, capabilities are the total set of things which a person could possibly do. Functionings are the subset of those which a person is able to actually achieve. Development occurs when these two sets are increased. Increases in income can lead to development, but only if the added income allows people to do more than they were previously able to do. It is also possible for nations to develop without increases in income if they are able to increase the functioning set of their citizens in some other way.

Economists, led by Sen, who believed that GDP per capita was not a good measure needed to find a way to calculate these changes in functionings and capabilities for people around the world. It was from this need that the Human Development Index was born. The brainchild of Mahbub ul Haq, the first HDI was included in the 1990 UN Human Development Report. The HDI, using a variety of indicators, is a way to measure the development of a nation without having to rely on just growth and GDP per capita. The HDI takes into account education and health, along with income, to create an aggregate index that measures a nation’s development over a series of indicators. We can see the benefits of this method by using examining the table below which has been taken from the 1990 UN Human Development Report (UNHDR 1990).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Country** | **GNP per Capita (US$)** | **Life Expectancy (years)** | **Adult Literacy (%)** | **Infant Mortality** | **HDI Rank** |
| *Modest GNP per capita with high human development* | | | | | |
| Sri Lanka | 400 | 71 | 87 | 32 | 48 |
| Jamaica | 940 | 74 | 82 | 18 | 44 |
| Costa Rica | 1,610 | 75 | 93 | 18 | 28 |
| *High GNP per capita with modest human development* | | | | | |
| Brazil | 2,020 | 65 | 78 | 62 | 51 |
| Oman | 5,810 | 57 | 30 | 40 | 83 |
| Saudi Arabia | 6,200 | 64 | 55 | 70 | 67 |

This table clearly shows that even though Brazil, Oman, and Saudi Arabia have a higher GNP per capita than Sri Lanka, Jamaica, and Costa Rica, they are still far behind in many indicators that represent good development. It is clear evidence that GNP per capita does not tell the whole story, requiring an index based on other variables. Built to be this other measure, Ul Haq described the thought process behind the HDI. “We need a measure of the same level of vulgarity as GNP – just one number – but a measure that is not as blind to social aspects of human lives as GNP is” (UNHDR 1999).

It is the “vulgarity” of the number that is especially important to consider. If we have enough data, we can deeply analyze the development of any country. But it is very difficult to rank nations in an easily accessible way if we use that process. The HDI is trying to create a single number measurement, like GDP per capita, which can be used to compare the development of countries to each other and also represents the quality of life of the citizens of a nation more accurately. The HDI is not meant to be a tell all statistic. It is simply meant to be a statistic that is just as easy to use as GDP per capita, performs the same task, and does that task better.

Looking back at the two types of development, we will see that the HDI is successful at evaluating the first one, but overlooks the second.

**SECTION 3: Measuring the HDI**

While starting to measure heath, education, and income indicators was a positive step in development economics, the United Nations still needed to come up with an aggregation method that would combine these separate indicators in the single “vulgar” measure envisioned by ul Haq. This aggregation method needed to take a series of indicators that used different units (years, percentages, dollars), and somehow combine them into one number that would convey the level of development of a nation. The UN accomplished this by normalizing the scores of each indicator on a scale of with an upper boundary of 1 and a lower boundary of 0. The original calculation for the HDI in the 1990 UNHDR is given in Appendix A.

The score for each section of the HDI (health, education, and living standards) is made up of one or more indicators that are tracked by the United Nations. The score for health is calculated using life expectancy data. Since this data is given in years, it must be modified so that it can be aggregated with the scores from education and living standards. This is where the normalization of scores is so useful. The UN creates a range for the variable by making what it calls “goalposts” (UNHDR 2013). These goalposts mark the highest and lowest possible scores for a nation. The lower boundary for health was 20 years, meaning that the most undeveloped nation in world would still be able to achieve a life expectancy of 20. The upper boundary was the highest life expectancy any country had achieved in any given year. This guaranteed that every nation fell in this range.

Once the goalposts are established, a simple equation is used to determine the health score for each nation. The HDI takes how much the life expectancy for the given country exceeds the lower goalpost, and divides it by the size of the range between the two goalposts. Doing this creates a percentage that tells us how much of the gap between the two goalposts the nation has achieved. For example, a score of .500 would represent that a nation was half way between the goalposts.

The original calculation for education score used a different process because of the units of the indicators used. The score is calculated using the Adult Literacy Rate and the Combined Gross Enrollment Rate, the enrollment rate of students in primary, secondary, and tertiary schools. The lower goalpost for each of these indicators was 0% and the upper goalpost was 100%. In order to calculate the education score, the UN takes a weighted average of the two indicators. The Adult Literacy Rate is given a weight of 2/3 while the Combined Gross Enrollment Rate is given a weight of 1/3.

The last portion of the indicator was referred to as the living standards section, but was essentially just a calculation of income. The calculation for this score is the same as the calculation for the health and education score, except for one minor change. Instead of using GDP per capita as the indicator, the HDI uses the natural logarithm of GDP per capita. This is done because the UN assumes that there are diminishing returns to development from increases in income. The thinking is that the marginal benefit of a $1 increase in income for the poor is worth much more than the marginal benefit of that $1 increase for a rich person. Taking the natural log of GDP per capita allows the incorporation of these diminishing returns in the equation. The goalposts are set so that a GDP per capita of $100 is the lower boundary and the highest GDP per capita for any country is the high boundary.

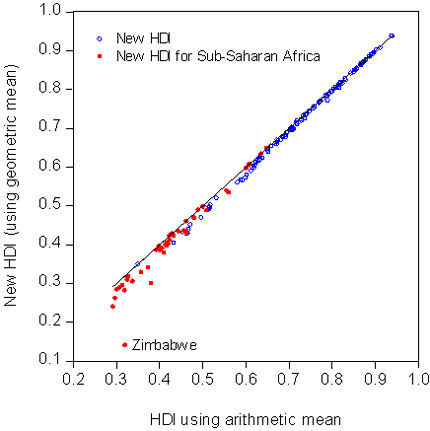
After the scores are determined for health, education, and income, they need to be aggregated into one number that measures the level of development of a nation. This is done by taking the arithmetic mean of the three scores, also known as the average. Since all the numbers are between 0 and 1, the average will be between 0 and 1. This allows the HDI to achieve its goal of being an index with a low score of 0, if a country is the worst possible in all sections, and a high score of 1, if a country is the best possible in all areas.

There are a few problems with this process of calculating the HDI.[[2]](#footnote-2) The first is the use of the arithmetic mean as the method of aggregating the 3 individual section scores. An arithmetic mean may overstate the level of development for nations with high scores in one or two sections but low scores in the other ones. For example, a nation that has very good education and living standards scores, let’s say a .9, but a very poor health score, a .1, would still be rated a .63. This shows medium to high level of development according to the UN. However, no one would ever consider a nation that had an average life expectancy of less than 30 to be very developed. The arithmetic average allows high sections to compensate for low section in this manner. The HDI was developed to measure the well roundedness of a nation’s development so that measures of development would not be reliant on one indicator. The arithmetic means work counter to this goal.

Next, the HDI is very poor at measuring the growth of individual nations. Since the scores of a nation in a given section are based on goalposts that include the highest achieving nation, a nation’s HDI is partially based on the development of others. This means that even if a nation develops in a given year, it will have the same HDI score and rank as long as other nations have developed equally well. Improvements in the quality of life for citizens in these nations are being overlooked because they are not relatively better off than citizens of other nations. This does not fit the first definition of development, relative welfare, but clearly falls under the second, changes in absolute levels of welfare.

Over the next two decades the HDI was altered in minor ways. The first major change came in 2010 when the UN conducted a major overhaul of the Index. These changes were made to try and solve the problems that existed in the old HDI and to try and create a more accurate index. The new calculation is given in Appendix B.

The new HDI does two things to try and fix the old HDI. The first change it makes is in the method of aggregation. Instead of using the arithmetic mean, the new HDI uses the geometric mean. This is calculated by taking the three individual scores, finding their product, and then taking the cube root. It is finding the score that would give the same product as the original scores from each section, if it were the score for each section.

The geometric mean solves the aggregation problem because of how it deals with a high variance in the individual scores of a nation. If a nation has 2 high scores but 1 low score, a nation will not receive a very high HDI score. Using the (.1, .9, .9) example from before, we get a score of .43 which is a drop of about 25%. It creates a much more holistic measure, where nation must show results in the indicators across all 3 sections in order to receive a high HDI score.

Mathematically, the geometric mean makes sense at the aggregation method for the HDI. However, a simple calculation that compares the 2010 HDI using a geometric aggregation and an arithmetic one shows that there is almost no change in the rankings of nations (Ravallion 2010). The only change shown is that African nations end up looking slightly worse using a geometric aggregation, as can be seen in the graph below.

The black line in the graph represents a one-to-one ratio of the arithmetic mean to the geometric mean. It can be seen that nearly every nation ends up doing worse in the calculation using the geometric compared to the arithmetic mean. This makes sense, since the problem with the arithmetic mean was that it tended to inaccurately overstate the level of development of certain nations. Yet the nations that have the largest absolute drop in score are also nations that have the lowest scores. This is important because of what it means in relation to the two measures of development. The change did not do anything according to the first criteria since most of the nations are still ranked where they used to be. It had a large affect according to the second criteria. Now if we use the HDI score as the measure of a nation’s development, African nations look much worse. This isn’t to say that as a score it is somehow less accurate than it was before, because the benefits of the new method have been shown above. This is just another example of how the HDI is very poor at showing and measuring development over time for a single nation.

The second change made to the HDI involves the education section. Instead of using the adult literacy and combined gross enrollment rates, the HDI switches to mean years of schooling for adults and expected years of schooling for children. The change in the variables is not too important. While it can be debated which variables represent the level of education in a nation better, we can assume that the two sets of variables will have a high positive correlation. A nation whose citizens have been in school longer should have higher rates of literacy and enrollment. The change which deeply affects the HDI is how these variables are aggregated into the education score. The new HDI is far better because it normalizes the calculation of the education score. Before, the percentages were combined and turned into a score that could range from 0 to 1.

The HDI does this by first normalizing the Mean Years of Schooling (MYS) and Expected Years of Schooling (EYS). The values of these variables are divided by 13.2 and 20.6 respectively to create the Mean Years of Schooling Index (MYSI) and the Expected Years of Schooling Index (EYSI). These values were chosen because they were the highest levels any nation had achieved on either indicator. By normalizing the variables, we get two normalized indices. The HDI then combines these by taking the geometric mean of the MYSI and EYSI.

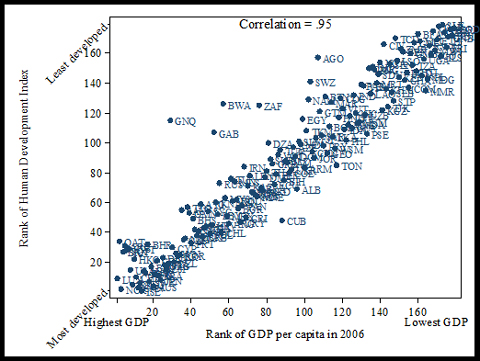
If that was where the UN stopped, it would already be a drastic improvement. However, it does more. Realizing the benefits of normalization, the UN then normalizes this score by dividing it by .951 the highest score any nation has achieved. This means that the education score is now also normalized for the greatest national achievement and truly represents a percentage of the total possible development a nation could have received. With these two changes, the HDI has become a much more accurate and consistent indicator of national development than it was when released in 1990.

Unfortunately, the new version of the HDI is just as bad as the previous incarnation at showing how an individual nation is developing. I will focus more this point later in the thesis while also exploring ways in which the HDI can be adapted so that it doesn’t ignore this important aspect of development.

This outlines the construction of the HDI, an index created to be a better measure of development than GDP per capita while still maintaining the benefit of a single number score. Even though the HDI seems to be far more focused on the quality of life aspects of development, there are problems with how it acts that have caused economists to question if it is a useful tool in the analysis of developing nations.

**SECTION 4: Critique of the HDI**

One of the first problems with the HDI is that its results are extremely similar to those of GDP per capita (Wolfers 2009). This is problematic because the HDI was supposed to be a much more holistic alternative to GDP per capita for the measurement of national development. Since both methods end up with a single score, we can rank all the countries in the world from most to least developed. Justin Wolfers did this in 2009 and produced the table below that shows where each nation lands on both measures.



There is a strong, positive linear relationship with what looks like a slope of 1. Wolfers’ data also shows a correlation of .95. This analysis shows that according to the first measure of development, relative development, the HDI and GDP per capita are both equally accurate at telling us about the development of nations. Not only is that HDI not very different from the indicator it claims replace, but the HDI is also a very long work around to arrive at a result already present in a easily accessible indicator.

This does not necessarily mean that that HDI is no better than GDP per capita. One of the benefits of using the HDI is that it allows us to reach a series of other developmental conclusions that we cannot get from just looking at GDP per capita. The most important of these is the ability to use marginal rates of substitution to calculate the values of each indicator involved in the equation. The marginal rate of substitution is calculated by taking the ratio of the derivatives of different variables. It ends up telling us the relative value of different variables in the calculation of the HDI score. The number that we get as the result of the marginal rate of substitution calculation tells us how much we would have to increase one variable to keep the HDI constant, if there is a drop of 1 in another variable. For example, a MRS of 100 between life expectancy and GDP per capita would mean that if we decrease life expectancy by 1 year and increased GDP per capita by $100, we would end up with the same HDI score. The inference that can be made here is that one year of life is worth $100, since swapping them yields the same result in terms of development.

Ravallion (2010) calculated the marginal rates of substitution between life expectancy and GDP per capita for every nation in the world. He finds a great disparity in the rate for different nations. The nation with the lowest marginal rate of substitution is Zimbabwe which sits at $.52. On the high side, Qatar has a MRS of a little less than $9,000. It seems strange that one nation would have a value 18,000 times higher than another. Many, including Ravallion finds it hard to believe that the quality of life in Qatar is that much than it is in Zimbabwe. It makes sense that a year of life in a wealthy nation like Qatar would be valued more than a year of life in a poor country like Zimbabwe.

It should be noted that the valuation of a year of life in Zimbabwe is very low, even compared to other poor countries. The next worst off country is Liberia, for whom Ravallion calculated a value of $5.51. While this is almost 11 times larger than the value for Zimbabwe, it still dwarfs in comparison to the richer nations and feels like a difficult figure to accept. Without polling citizens of these nations as to how much extra they would take each year to sacrifice a year of life, there is no way to know the legitimacy of these figures. However, they do cast doubt upon the usefulness of the figures in the HDI.

The inability of the HDI to create valuable measures of substitution undermines the effectiveness of using it as a measure of development and a method of comparison. Because nations have scarce resources to devote towards development, understanding the relationship between the different indicators is crucial to effectively allocating those resources. If a dollar can either increase life expectancy by .01, or GDP per capita by 1, a country needs to know which area would be better to invest that dollar in. Ideally this would be where the marginal rates of substitution had the most impact, but the HDI is unable to deliver usable results.

The last major problem with the HDI is something that was previously brought up. The HDI is extremely poor at measuring the development of individual nations. Since the scores for individual nations are calculated by putting a nations indicator values on a scale, the scores for each nation are partially based on how other nations have developed. This is problematic because of how it relates to year to year development.

A country may be improving on a yearly basis, but this will not show in the rankings or in a nation’s individual score unless it grows faster than the nations at the top of the different indicators. For this reason, development may be being understated in some of the lower ranking countries. They may be so far behind that even though they are improving, it is not enough to keep pace with the nations that have been around for longer and had more time to develop. Because nations have been around for different periods of time and start each year at different points, we miss being able to measure how they do in individual years. Even though the United States or Norway may have been the most developed nation at the beginning of a year shouldn’t mean that development during that year should be measured against them.

Niger is a great example of the issues that measuring nations against moving goalposts causes. Throughout the history of the HDI, from 1990 to 2013, Niger has consistently been at the bottom of the index. This would make it seem that the country hasn’t developed at all. Yet, it is important to remember that the HDI is a relative index. The table below shows Niger’s scores in each of the individual indices that comprise the HDI

|  |  |  |
| --- | --- | --- |
| Indicator | 1990 | 2012 |
| Life Expectancy | 45 years | 55 years |
| Literacy | 14% | 29% |
| GNP per Capita | $260 | $650 |

Even though Niger is still a severely underdeveloped nation, it is clear that there have been significant development in the past two decades. It is impossible to see this by looking at the HDI, where Niger is still last. This is the key problem that needs to be fixed if the HDI is going to expand as a measure. The HDI is understating the importance of the second criteria of development, and perhaps even completely eliminating it from the discussion.

The literature has done a good job of critiquing the HDI and finding the places where it needs to be improved. However, it has done a poor job of critiquing the individual development aspects of the HDI and how they relate to growth within nations. The rest of my thesis will focus on this deficiency and offer a couple of ways in which it can be remedied.

**SECTION 5: Dealing with Development over Time; the Dynamic HDI**

To deal with the issue of measuring intertemporal development and capture the relative performance of countries over time, I propose a new index called the Dynamic HDI. Its goal is to create an index which maintains the capabilities approach that is the goal of the HDI, while also showing how much nations have developed instead of where they currently sit. In this section, I will explain the rationale behind the index, show how it is calculated, and then elaborate on some of the implications of this new measure.

The largest problem with the HDI is that it ranks nations based on where they are in terms of total development relative to other nations. This is great for showing us which nations are the most developed or have the highest standard of living. However, it is a very poor ways of showing how nations are developing. Since these are the two important aspects of development, it doesn’t make sense to ignore either one. The problem is that it is very difficult to combine the two into one “vulgar” number. You can either show how developed a nation is in relation to others or how much it is developing, but not both. This means that any single number representation of a nation’s development will be leaving out extremely important information.

For this reason, the UN may need to be a little less vulgar when coming up with their development index. Vulgarity is only beneficial up until the point when it detracts from the intended transfer of knowledge. The UN has gone a little too far and taken important information out of the development conversation. It is time that information was put back in. For this reason, I advocate for a development index that contains two numbers, not one. It could be documented as (X,Y) where X is the HDI ranking and Y is the Dynamic HDI ranking. By doing this, an observer would be able to see how developed a nation is and also how well it is improving. It will take almost the exact same amount of time to read and comprehend, but will include twice the information that the current HDI gives. Because of some of the issues raised while working on measuring intertemporal development, I will be proposing two new measures. The first, the Dynamic HDI is intended to measure the pure percentage growth in each of the indicators being studied. The second, the Adjusted Dynamic HDI, measures this growth, but also factors in how difficult it was that the given nation to achieve that growth.

**The Dynamic HDI:**

The Dynamic HDI is designed to measure the improvement of different nations over time. To achieve this it calculates the percentage change in a nation’s indicators instead of the value itself. This percentage change is more valuable because it shows how the nation is improving rather than just its current level of development. By taking this percentage change and utilizing the normalization process of the HDI, the Dynamic HDI creates an index that measures the progress of nations as they improve the standard of living of their citizens. The calculations for the Dynamic HDI are given below.

The Dynamic HDI is aggregated in a way similar to the original HDI. An arithmetic average of the scores from the three sections is taken to come up with the overall Dynamic HDI score. The index uses an arithmetic average instead of a geometric average because of what it is measuring. If a nation get a score of 0 in an individual section, that doesn’t mean it isn’t improving, just that it isn’t improving in all areas. A geometric mean would cause the Dynamic HDI to be equal to 0, saying that the nation shows the least improvement of any nation. Since the index wants to show improvement, regardless of what area it comes in, it takes the arithmetic average. This allows a good score in one area to offset a poor score in another area for a nation with decent growth.

The calculation of the scores in each of the different sections is very different from the calculations in the HDI. Since the Dynamic HDI uses growth instead of absolute numbers, it requires a different series of calculations in order to arrive at an index that can be measured on a scale of 0 to 1. Before the calculation can be done, the period of the index has to be defined. Unlike the HDI, the Dynamic HDI utilizes data from a series of consecutive years to calculate the changes in the indices.

Using the health section as an example of the calculation, the Dynamic HDI first calculates the percentage changes in life expectancy for all the periods for each country. If the calculation were being done with data from 2005 to 2010, which this paper uses, the changes would be calculated from 2009-2010, ’08-’10, ’07-’10, and so forth. After this, each of these percent changes will be normalized based on the highest and lowest changes for that period. For example, if a nation experienced a 2% increase, the highest increase was 3%, and the lowest was 0%, it would gain a normalized score of .667 for that period. This normalization process occurs for each time period using the same goalpost method as the HDI. If five years are used, the country with have 5 different scores.

After this normalization has been done for each period, these normalized scores need to be aggregated to gain one Dynamic Health Score (DHS). This is done by taking a weighted average of these normalized scores. Since the index wants to value newer results over older ones, it weights the shorter periods more than the longer ones. When deciding the weights, the Dynamic HDI uses the principle of discounting. We can write out this discounting like this, using DHS1 as the Dynamic Health Score for the 1-Year period and so on:

If we then choose to define w as , we end up with:

However, all the weights need to add up to 1 so that the Dynamic HDI remains an index from 0 to 1. Therefore, to calculate the weights for the general equation solve the equation:

For n = 5, the value of w turns out to be a little less than .51. I chose to use n=5 for my analysis because in my analysis is equal to about .034. If I used n = 6 the value of would be around .017 or less than 2%. These additional weights would not contribute much to the results. For this reason, I chose to use 5 periods of growth, which required 6 years of data. The same process is used to calculate the scores for Education and GDP per capita. When these 3 scores have been found, taking the arithmetic mean yields the Dynamic HDI.

Now that the Dynamic HDI has been outlined and explained, it should be compared to the HDI in terms of results. The largest problem with the HDI was that it did a poor job of measuring the development of individual nations. A look at the results of the Dynamic HDI validates this view by telling us the nations which are improving the best. I calculated the Dynamic HDI using data from 2005 to 2010 available on the United Nations Development Programme’s website.[[3]](#footnote-3)

The top 5 countries in the Dynamic HDI rankings, in order, with their HDI scores in parenthesis are:

1. Zimbabwe (172)
2. Ethiopia (173)
3. Malawi (174)
4. Liberia (170)
5. Tanzania (152)

In addition, 17 of the top 20 nations in the rankings are from Africa. This evidence goes to show that even though African nations performed very poorly on the HDI, all African nations in the top 20 of the Dynamic HDI ranked lower than 150th in the HDI, many are developing faster than any other nations in the world. Zimbabwe, a nation that has long been in the news for political turmoil and poor governance, is improving the best. A preliminary analysis suggests that the Dynamic HDI presents a very different picture from the HDI on how well different nations are developing.

Plotting the HDI ranking against the Dynamic HDI ranking also gives us an important result. We can see that there is a strong negative relationship between the HDI rank of a nation and the Dynamic HDI rank of that nation. The main takeaway is that developing nations, on average, are improving faster than those we would consider to be developed. This is especially true for Africa, which is where most of the nations in the bottom right hand corner of the graph are from.

There are also a few outliers. The two points right above 50 on the HDI axis are Belarus at (50, 39)[[4]](#footnote-4) and Uruguay (51, 47). Both of these nations are performing extremely well and not conforming to the global trend. They are both well-developed but are still improving at rates equivalent to the quick pace of the African nations.

In the top right corner there are three large outliers: Kyrgyzstan (125,156), Comoros (169, 124), and Madagascar (151, 152). These are the nations that, for some reason, are both poorly developed and not improving. The problem could be a series of things, but it might be better to focus less on countries like Zimbabwe and more on these nations.

The implications of the Dynamic HDI are wide ranging. It shows us how large the field of development is and how it cannot be characterized in a single number. The fastest developing nations in the world are the same nations that have some of the lowest HDI scores. We can’t characterize these nations as poorly developing. This takes us all back to the two sides of development. The first involves the absolute level of development of a nation. The second involves the rate of change in a nation’s level of development over time. Both of these methods are valuable since the HDI is great at telling the first, while the Dynamic HDI excels at telling the second.

Yet, there is one concern in the methodology of the Dynamic HDI. It comes when we are calculating the improvement in nations over a period of time. The Dynamic HDI calculates the percentage increase of a nation’s scores in each of the indicators. This means that a nation that had a life expectancy of 30 and improved by 1 year will have the same score as a nation which had a life expectancy of 60 and improved by 2.

The problem is that this method completely ignores the difficulty of achieving the gains which have occurred. As a country starts to live longer, gains of 1 year in life expectancy should become harder to achieve. We know that there is a biological limit on the length of a human life and growth cannot be sustained forever. According to this information, a year gain in both of the countries previously mentioned would be much more difficult for the nation that has a life expectancy of 60. Yet, in this index they grow twice and much and still only receive the same score.

This does not make the Dynamic HDI a poor index. But it is important to understand what it is measuring. The Dynamic HDI measures the growth in all countries in the world. This is great for understanding what nation are growing the fastest, but it ignores the difficulty of improving/growing from a higher initial level of development. Rather than simply look at the percentage growth it makes sense to calculate the improvement a nation makes in relation to the potential improvement that it can make. That is what the Adjusted Dynamic HDI does.

**The Adjusted Dynamic HDI:**

The Adjusted Dynamic HDI solves the problem of the difficulty of the achieved development by looking at development as the catching up done by a lower developed nation. The Adjusted Dynamic HDI is calculated using the most of the same process as the Dynamic HDI. However, there is one extremely important change. Instead of calculating the growth of an indicator within a nation, it calculates the difference between the highest score of any nation and the nation’s score and then sees what percentage of that gap was filled. This means that nations with higher indicator scores will end up with smaller gaps and therefore have to achieve a smaller absolute gain to achieve the same ADHDI score as nations with lower indicator scores.

To better understand the difference in how the two indices measure development, assume that there is a country ABC. In the table below, there are statistics for this fictional country along with statistics for other countries that are key to the example. Highest is the most developed nation, Lowest is the least developed nation, and Big Growth is a nation that experienced a large increase in life expectancy.

|  |  |  |
| --- | --- | --- |
| **Country** | **2010 Life Expectancy (LE)** | **2011 Life Expectancy** |
| ABC | 50 | 55 |
| Highest | 80 | 85 |
| Lowest | 20 | 25 |
| Big Growth | 30 | 40 |

Using the Dynamic HDI, the relative score for 2011 would be calculated by dividing the growth rate of country ABC by the differences between the largest and smallest growth rate as shown in the next table. All the statistics used in this table come from the table above.

|  |  |  |
| --- | --- | --- |
| **Country** | **’10-’11 Growth Rate** | **1-Yr Relative LE Score** |
| ABC | ((55 – 50)/50) \* 100 = **10%** | (10 - 6.25)/(33.33 - 6.25) = **.1385** |
| Highest | ((85 – 80)/80) \* 100 = **6.25%** | (6.25 - 6.25)/(33.33 - 6.25) = **0** |
| Lowest | ((25 – 20)/20) \* 100 = **25%** | (25 - 6.25)/(33.33 - 6.25) = **.6924** |
| Big Growth | ((40 – 30)/30) \* 100 = **33.33%** | (33.33 - 6.25)/(33.33 - 6.25) = **1** |

The Dynamic HDI calculates the percentage growth for each nation and then compares them to each other to determine the relative scores. In this example, each of the first 3 nations increased their life expectancies by 5 years. Because the Dynamic HDI is calculated using growth rates, the nations that were less developed ended up with better scores. This is why the scatterplot of nation’s HDI and Dynamic HDI rankings has a strong negative relationship. Poorer nations are given an advantage by not having to increase too much in order to achieve high rates of growth. The more developed nations cannot increase their own indicators levels fast enough to keep up with poorly developed nation.

In contrast, the table below shows the calculation for the Adjusted Dynamic HDI.

|  |  |  |  |
| --- | --- | --- | --- |
| **Country** | **2010 Gap** | **’10-’11 Increase** | **1-Yr Rel. LE Score** |
| ABC | 80 – 50 = **30** | 55 – 50 = **5** | 5/30 = **.1667** |
| Highest | 80 – 80 = **0** | 85 – 80 = **5** | **1**[[5]](#footnote-5) |
| Lowest | 80 – 20 = **60** | 25 – 20 = **5** | 5/60 = **.0833** |
| Growth | 80 – 30 = **50** | 40 – 30 = **10** | 10/50 = **.20** |

In the Adjusted Dynamic HDI, the scores of the nations are based on what percentage of the gap between the nation and the highest achieving nation is filled. Since ABC had an average life expectancy of 50 years and the highest country had an average life expectancy of 80 years, the gap for ABC is 30 years. ABC showed an increase of 5 years in life expectancy, so their 1-Year Relative Score for life expectancy is equal to the increase divided by the gap, or about .1667. This can be used to calculate the relative scores for all nations. When calculating the relative scores for the longer periods, the same process is used except a longer period is used to determine the gain.

The only nation that this process does not work well for is the nation that has the highest score in any indicator. Since it is at the top, it has a gap of 0 and following the equation will involve dividing by 0. In these cases, I set any gain to be equal to 1, and no gain to be equal to a relative score of zero. It made sense to do this because any gain, even a small gain, by the top nation was development which no other country had accomplished. However, if the country did not improve at all, it made little sense to give it a good score. This is a simplifying assumption for calculation purposes that has very little impact on most of the rankings, but does contribute a ranking boost to the nations that are able to continue developing and lead in an indicator.

Once these relative values are calculated for the five periods being used (1-Year, 2-Year, and so on), the same process used to calculate the Dynamic HDI is used to aggregate the individual scores. Weights are given to each score, based on the discounting explained in the Dynamic HDI section, such that the shorter periods are weighted more heavily. This makes the changes in recent years far more valuable when determining a nation’s score. After the weights are assigned, a weighted average is taken to determine the nation’s Adjusted Dynamic HDI Score.

The minor change to take the difficulty of development into account yields very different results when compared to the Dynamic HDI. The full results for the Adjusted Dynamic HDI are included in the Appendices at the end of the paper. Below are the top 5 Adjusted Dynamic HDI nations, with their HDI and Dynamic HDI score respectively in parenthesis:

1. Japan (10, 130)
2. Australia (2, 135)
3. Hong Kong (13, 75)
4. Switzerland (9, 102)
5. South Korea (12, 82)

A scatterplot showing the two indices gives us a similar indicator. You cannot predict the ranking of a nation in one index based on its ranking in the other. A 45 degree line drawn shows what the relationship would look like if each nation had the same score in both indices. Data points above the line represent nations who scored better on the Adjusted Index, while points below the line represent nations that performed better on the Dynamic HDI.

We can see from the data and the graph below that there is not great relationship between the two. At least theoretically, it seems like the Adjusted Dynamic HDI would be a better measure of how successfully a nation is doing in regards to development. By taking into account how difficult it is to improve, the Adjusted Dynamic HDI levels the intertemporal playing field. Even though it is more difficult for more developed nations to improve, they are given a shorter yardstick on which to measure themselves and can then make up the gap. Nations which find it tougher to improve end up with smaller denominators when using this method. This makes comparisons of improvement across nations more meaningful.

The introduction of the DHDI/ADHDI introduces a second number to capture the development status of countries. In sticking to Mahbub ul Haq’s call for a single “vulgar” number, the HDI sacrificed too much. It is important to capture the aspect of development that focuses on change. A score that reads (23, 94) is just as easy to understand as a score that reads 23, except that we know have the added benefit of knowing how the nation has done in the last 5 years. An extra number gives us almost twice the information and provides a far more usable statistic.

It is true that the proposal for reporting two measures, the HDI and the DHDI/ADHDI, will eliminate the possibility of ranking countries in terms of best to worst in development. I argue that this is a good change. Success in changing the lives of real people across the world should not be the equivalent of a soccer league where we need to develop a table and declare a winner. The HDI should be a tool for development and a way to broaden knowledge, not a tool used for bragging rights.

**SECTION 6: Conclusion**

In economics, the field of development is vast. As technology becomes more and more accessible, we are able to track more and more indicators. This has given economists more data to work with than they have ever had. Because of this, developing the proper methods to analyze and reduce this data into meaningful figures has become more important than ever.

The HDI is one of these figures that people look to because it is easy to digest and tells a good story. The problem is that this story is incomplete. For almost two and half decades the HDI has represented development as the final product of centuries of events. This leaves out what nations are doing today to improve themselves.

The Dynamic HDI solves this issue by focusing on the last 5 years of a nation’s history to determine how well it is improving. It then ranks nations to show which nations and regions are being most successful in improving the standard of living of the lives of their citizens. Ideally, this measure would complement the HDI to paint as good a picture of national development. With two numbers, rather than just one, we will have a measuring which captures both the static and dynamic aspects of development.

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**Appendix A: Original HDI Calculation**

Where:

* LE = Life Expectancy
* ALI = Adult Literacy Rate
* CGER = Combined Gross Enrollment Rate
* GDP = Gross Domestic Product

**Appendix B: New HDI Calculation**

Where:

* LE = Life Expectancy
* MYS = Mean Years of Schooling for Adults
* EYS = Expected Years of Schooling for Children
* GDPpc = Gross Domestic Product per Capita

**Appendix C: Dynamic HDI Calculation for Year *x* with a *z* Year Rolling Average**

**HEALTH:**

* = Normalized % Change in Life Expectancy
* = Weight of nth Year RHS
* = Minimum Percentage Change in Life Expectancy for Any Nation over Last n Years.
* = Maximum Percentage Change in Life Expectancy for Any Nation over Last n Years.

**EDUCATION:**

* = Normalized % Change in Mean Years of Schooling
* = Weight of nth Year MYS
* = Minimum Percentage Change in Mean Years of Schooling for Any Nation over Last n Years.
* = Maximum Percentage Change in Mean Years of Schooling for Any Nation over Last n Years.
* = Normalized % Change in Expected Years of Schooling
* = Weight of nth Year EYS
* = Minimum Percentage Change in Expected Years of Schooling for Any Nation over Last n Years.
* = Maximum Percentage Change in Expected Years of Schooling for Any Nation over Last n Years.

**INCOME:**

* = Normalized % Change in Income
* = Weight of nth Year RHS
* = Minimum Percentage Change in Natural Log of GDP Per Capita for Any Nation over Last n Years.
* = Maximum Percentage Change in Natural Log of GDP Per Capita for Any Nation over Last n Years.

**Appendix D: Adjusted Dynamic HDI Calculation for Year *x* with a *z* Year Rolling Average**

**HEALTH:**

* = Normalized % Change in Life Expectancy
* = Weight of nth Year RHS
* = Maximum Life Expectancy of Any Nation in Year n

**EDUCATION:**

* = Adjusted % Change in Mean Years of Schooling
* = Weight of nth Year MYS
* = Maximum MYS for Any Nation in Year n
* = Adjusted % Change in Expected Years of Schooling
* = Weight of nth Year EYS
* = Maximum EYS for Any Nation in Year n

**INCOME:**

* = Adjusted % Change in Income
* = Weight of nth Year RHS
* = Maximum ln(GDP per Capita) for Any Nation in Year n

**Appendix E: Countries by HDI Rank**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **HDI Rank** | **Country** | **DyHDI** | **DyHDI Rank** | **ADyHDI** | **ADyHDI Rank** |
| **1** | Norway | 0.2123 | 149 | 0.1771 | 53 |
| **2** | Australia | 0.2286 | 135 | 0.3397 | 2 |
| **3** | United States | 0.2241 | 143 | 0.1817 | 36 |
| **4** | Netherlands | 0.2432 | 120 | 0.2021 | 9 |
| **5** | Germany | 0.2376 | 125 | 0.1939 | 16 |
| **6** | New Zealand | 0.2348 | 129 | 0.1317 | 163 |
| **7** | Ireland | 0.1988 | 156 | 0.2105 | 7 |
| **8** | Sweden | 0.2265 | 141 | 0.1920 | 18 |
| **9** | Switzerland | 0.2637 | 102 | 0.2227 | 4 |
| **10** | Japan | 0.2348 | 130 | 0.5026 | 1 |
| **11** | Canada | 0.2089 | 152 | 0.1764 | 58 |
| **12** | Korea (Republic of) | 0.2882 | 82 | 0.2162 | 5 |
| **13** | Hong Kong, China (SAR) | 0.2959 | 75 | 0.2998 | 3 |
| **13** | Iceland | 0.1761 | 161 | 0.1889 | 23 |
| **15** | Denmark | 0.2178 | 146 | 0.1762 | 59 |
| **16** | Israel | 0.2447 | 119 | 0.2042 | 8 |
| **17** | Belgium | 0.2331 | 131 | 0.1833 | 30 |
| **18** | Austria | 0.2547 | 111 | 0.1993 | 11 |
| **20** | France | 0.2408 | 123 | 0.2001 | 10 |
| **21** | Slovenia | 0.2315 | 134 | 0.1862 | 25 |
| **21** | Finland | 0.2266 | 140 | 0.1737 | 72 |
| **23** | Spain | 0.2467 | 114 | 0.2106 | 6 |
| **25** | Italy | 0.2155 | 147 | 0.1923 | 17 |
| **26** | United Kingdom | 0.2200 | 144 | 0.1802 | 39 |
| **26** | Luxembourg | 0.1961 | 157 | 0.1728 | 77 |
| **28** | Czech Republic | 0.1743 | 162 | 0.0776 | 164 |
| **29** | Greece | 0.1856 | 159 | 0.1617 | 152 |
| **30** | Brunei Darussalam | 0.2112 | 150 | 0.1653 | 133 |
| **31** | Cyprus | 0.2780 | 90 | 0.1972 | 14 |
| **32** | Malta | 0.2360 | 128 | 0.1902 | 21 |
| **33** | Estonia | 0.2084 | 153 | 0.1669 | 123 |
| **35** | Slovakia | 0.2466 | 115 | 0.1721 | 82 |
| **36** | Qatar | 0.2453 | 117 | 0.1745 | 65 |
| **37** | Hungary | 0.2268 | 139 | 0.1710 | 86 |
| **38** | Barbados | 0.2453 | 118 | 0.1912 | 19 |
| **39** | Poland | 0.2788 | 89 | 0.1745 | 64 |
| **40** | Chile | 0.2656 | 100 | 0.1764 | 57 |
| **41** | Lithuania | 0.1995 | 155 | 0.1586 | 156 |
| **41** | United Arab Emirates | 0.1216 | 164 | 0.1374 | 162 |
| **43** | Portugal | 0.2604 | 106 | 0.1908 | 20 |
| **44** | Latvia | 0.2002 | 154 | 0.1652 | 134 |
| **45** | Argentina | 0.3049 | 67 | 0.1837 | 28 |
| **46** | Seychelles | 0.2611 | 104 | 0.1706 | 91 |
| **47** | Croatia | 0.2280 | 137 | 0.1744 | 66 |
| **48** | Bahrain | 0.1413 | 163 | 0.1579 | 157 |
| **50** | Belarus | 0.3610 | 34 | 0.1986 | 12 |
| **51** | Uruguay | 0.3228 | 53 | 0.1806 | 37 |
| **52** | Montenegro | 0.2321 | 133 | 0.1777 | 44 |
| **53** | Palau | 0.1789 | 160 | 0.1626 | 149 |
| **54** | Kuwait | 0.1896 | 158 | 0.1546 | 160 |
| **55** | Russian Federation | 0.2825 | 87 | 0.1748 | 63 |
| **56** | Romania | 0.2413 | 122 | 0.1730 | 73 |
| **57** | Saudi Arabia | 0.2746 | 94 | 0.1851 | 27 |
| **57** | Bulgaria | 0.2643 | 101 | 0.1777 | 47 |
| **59** | Panama | 0.2965 | 73 | 0.1728 | 76 |
| **59** | Cuba | 0.2626 | 103 | 0.1450 | 161 |
| **61** | Mexico | 0.2592 | 108 | 0.1789 | 41 |
| **62** | Costa Rica | 0.2883 | 81 | 0.1952 | 15 |
| **64** | Libya | 0.2814 | 88 | 0.1727 | 78 |
| **64** | Malaysia | 0.2770 | 91 | 0.1730 | 75 |
| **67** | Trinidad and Tobago | 0.2363 | 127 | 0.1645 | 140 |
| **69** | Kazakhstan | 0.3052 | 65 | 0.1690 | 102 |
| **70** | Albania | 0.2687 | 98 | 0.1709 | 87 |
| **71** | Venezuela | 0.2727 | 96 | 0.1875 | 24 |
| **72** | Lebanon | 0.3032 | 68 | 0.1743 | 68 |
| **72** | Georgia | 0.2463 | 116 | 0.1670 | 120 |
| **72** | Dominica | 0.2427 | 121 | 0.1622 | 151 |
| **76** | Iran | 0.3366 | 43 | 0.1975 | 13 |
| **77** | Peru | 0.3372 | 42 | 0.1772 | 51 |
| **78** | Macedonia | 0.2568 | 109 | 0.1742 | 71 |
| **78** | Ukraine | 0.2283 | 136 | 0.1706 | 92 |
| **80** | Mauritius | 0.2860 | 84 | 0.1689 | 104 |
| **85** | Brazil | 0.3209 | 54 | 0.1743 | 69 |
| **85** | Jamaica | 0.2522 | 112 | 0.1791 | 40 |
| **87** | Armenia | 0.2144 | 148 | 0.1666 | 124 |
| **89** | Ecuador | 0.2843 | 86 | 0.1825 | 32 |
| **90** | Turkey | 0.2964 | 74 | 0.1788 | 42 |
| **91** | Colombia | 0.2881 | 83 | 0.1758 | 62 |
| **92** | Sri Lanka | 0.3050 | 66 | 0.1693 | 98 |
| **93** | Algeria | 0.2701 | 97 | 0.1777 | 46 |
| **94** | Tunisia | 0.2934 | 78 | 0.1703 | 93 |
| **95** | Tonga | 0.2189 | 145 | 0.1650 | 136 |
| **96** | Dominican Republic | 0.3256 | 50 | 0.1721 | 81 |
| **96** | Samoa | 0.2509 | 113 | 0.1653 | 130 |
| **96** | Belize | 0.2259 | 142 | 0.1698 | 96 |
| **96** | Fiji | 0.2096 | 151 | 0.1692 | 100 |
| **100** | Jordan | 0.2369 | 126 | 0.1577 | 158 |
| **101** | China | 0.3767 | 29 | 0.1771 | 52 |
| **103** | Thailand | 0.2922 | 79 | 0.1688 | 107 |
| **104** | Maldives | 0.3309 | 45 | 0.1805 | 38 |
| **105** | Suriname | 0.2682 | 99 | 0.1647 | 139 |
| **106** | Gabon | 0.3107 | 61 | 0.1681 | 113 |
| **107** | El Salvador | 0.2606 | 105 | 0.1692 | 101 |
| **108** | Bolivia | 0.3056 | 64 | 0.1680 | 114 |
| **108** | Mongolia | 0.2851 | 85 | 0.1832 | 31 |
| **111** | Paraguay | 0.3299 | 47 | 0.1742 | 70 |
| **112** | Egypt | 0.3251 | 51 | 0.1761 | 60 |
| **113** | Moldova | 0.2917 | 80 | 0.1660 | 127 |
| **114** | Uzbekistan | 0.3151 | 58 | 0.1632 | 146 |
| **114** | Philippines | 0.3006 | 71 | 0.1685 | 109 |
| **116** | Syrian Arab Republic | 0.2593 | 107 | 0.1773 | 50 |
| **118** | Guyana | 0.3303 | 46 | 0.1661 | 126 |
| **119** | Botswana | 0.3277 | 48 | 0.1688 | 106 |
| **120** | Honduras | 0.2969 | 72 | 0.1819 | 35 |
| **121** | Indonesia | 0.3774 | 28 | 0.1820 | 34 |
| **121** | South Africa | 0.2940 | 76 | 0.1634 | 145 |
| **125** | Tajikistan | 0.3513 | 39 | 0.1653 | 131 |
| **125** | Kyrgyzstan | 0.2269 | 138 | 0.1608 | 155 |
| **127** | Viet Nam | 0.3506 | 40 | 0.1776 | 48 |
| **128** | Namibia | 0.3410 | 41 | 0.1683 | 111 |
| **129** | Nicaragua | 0.2938 | 77 | 0.1724 | 80 |
| **130** | Morocco | 0.3230 | 52 | 0.1702 | 94 |
| **131** | Iraq | 0.2762 | 92 | 0.1643 | 141 |
| **133** | Guatemala | 0.2753 | 93 | 0.1675 | 118 |
| **134** | Timor-Leste | 0.5144 | 6 | 0.1821 | 33 |
| **135** | Ghana | 0.4365 | 13 | 0.1777 | 45 |
| **136** | India | 0.3944 | 23 | 0.1713 | 83 |
| **136** | Equatorial Guinea | 0.3020 | 69 | 0.1576 | 159 |
| **138** | Laos | 0.4033 | 21 | 0.1760 | 61 |
| **138** | Cambodia | 0.3531 | 38 | 0.1681 | 112 |
| **141** | Swaziland | 0.3262 | 49 | 0.1653 | 132 |
| **142** | Congo | 0.3777 | 27 | 0.1657 | 129 |
| **143** | Solomon Islands | 0.2552 | 110 | 0.1669 | 122 |
| **144** | Sao Tome and Principe | 0.3178 | 57 | 0.1675 | 117 |
| **145** | Kenya | 0.4069 | 20 | 0.1766 | 56 |
| **146** | Bangladesh | 0.3748 | 31 | 0.1690 | 103 |
| **146** | Pakistan | 0.3178 | 56 | 0.1673 | 119 |
| **148** | Angola | 0.4461 | 9 | 0.1854 | 26 |
| **149** | Myanmar | 0.4723 | 7 | 0.1730 | 74 |
| **150** | Cameroon | 0.3597 | 37 | 0.1769 | 54 |
| **151** | Madagascar | 0.2321 | 132 | 0.1684 | 110 |
| **152** | Tanzania | 0.5149 | 5 | 0.1895 | 22 |
| **153** | Nigeria | 0.3601 | 35 | 0.1637 | 144 |
| **154** | Senegal | 0.3318 | 44 | 0.1693 | 99 |
| **155** | Mauritania | 0.2734 | 95 | 0.1640 | 143 |
| **157** | Nepal | 0.3727 | 32 | 0.1706 | 90 |
| **158** | Lesotho | 0.4186 | 19 | 0.1657 | 128 |
| **159** | Togo | 0.3066 | 63 | 0.1628 | 147 |
| **160** | Yemen | 0.3847 | 25 | 0.1688 | 105 |
| **161** | Uganda | 0.4359 | 15 | 0.1711 | 85 |
| **163** | Zambia | 0.4652 | 8 | 0.1708 | 88 |
| **164** | Djibouti | 0.3108 | 60 | 0.1650 | 135 |
| **165** | Gambia | 0.4457 | 10 | 0.1783 | 43 |
| **166** | Benin | 0.3185 | 55 | 0.1627 | 148 |
| **167** | Rwanda | 0.4272 | 16 | 0.1727 | 79 |
| **168** | Côte d'Ivoire | 0.3892 | 24 | 0.1670 | 121 |
| **169** | Comoros | 0.2393 | 124 | 0.1611 | 154 |
| **170** | Malawi | 0.5251 | 4 | 0.1774 | 49 |
| **171** | Sudan | 0.3012 | 70 | 0.1626 | 150 |
| **172** | Zimbabwe | 0.5942 | 1 | 0.1743 | 67 |
| **173** | Ethiopia | 0.5792 | 2 | 0.1766 | 55 |
| **174** | Liberia | 0.5446 | 3 | 0.1700 | 95 |
| **175** | Afghanistan | 0.4455 | 11 | 0.1698 | 97 |
| **176** | Guinea-Bissau | 0.3068 | 62 | 0.1612 | 153 |
| **177** | Sierra Leone | 0.4236 | 17 | 0.1643 | 142 |
| **178** | Burundi | 0.4362 | 14 | 0.1837 | 29 |
| **178** | Guinea | 0.3133 | 59 | 0.1647 | 138 |
| **180** | Central African Republic | 0.4412 | 12 | 0.1712 | 84 |
| **182** | Mali | 0.4009 | 22 | 0.1676 | 116 |
| **183** | Burkina Faso | 0.3711 | 33 | 0.1706 | 89 |
| **184** | Chad | 0.3599 | 36 | 0.1666 | 125 |
| **185** | Mozambique | 0.4191 | 18 | 0.1648 | 137 |
| **186** | Niger | 0.3823 | 26 | 0.1678 | 115 |
| **186** | Congo | 0.3755 | 30 | 0.1686 | 108 |

**Appendix F: Countries by Alphabetical Order**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **HDI Rank** | **Country** | **DyHDI** | **DyHDI Rank** | **ADyHDI** | **ADyHDI Rank** |
| 175 | **Afghanistan** | 0.4455 | 11 | 0.1698 | 97 |
| 70 | **Albania** | 0.2687 | 98 | 0.1709 | 87 |
| 93 | **Algeria** | 0.2701 | 97 | 0.1777 | 46 |
| 148 | **Angola** | 0.4461 | 9 | 0.1854 | 26 |
| 45 | **Argentina** | 0.3049 | 67 | 0.1837 | 28 |
| 87 | **Armenia** | 0.2144 | 148 | 0.1666 | 124 |
| 2 | **Australia** | 0.2286 | 135 | 0.3397 | 2 |
| 18 | **Austria** | 0.2547 | 111 | 0.1993 | 11 |
| 48 | **Bahrain** | 0.1413 | 163 | 0.1579 | 157 |
| 146 | **Bangladesh** | 0.3748 | 31 | 0.1690 | 103 |
| 38 | **Barbados** | 0.2453 | 118 | 0.1912 | 19 |
| 50 | **Belarus** | 0.3610 | 34 | 0.1986 | 12 |
| 17 | **Belgium** | 0.2331 | 131 | 0.1833 | 30 |
| 96 | **Belize** | 0.2259 | 142 | 0.1698 | 96 |
| 166 | **Benin** | 0.3185 | 55 | 0.1627 | 148 |
| 108 | **Bolivia** | 0.3056 | 64 | 0.1680 | 114 |
| 119 | **Botswana** | 0.3277 | 48 | 0.1688 | 106 |
| 85 | **Brazil** | 0.3209 | 54 | 0.1743 | 69 |
| 30 | **Brunei Darussalam** | 0.2112 | 150 | 0.1653 | 133 |
| 57 | **Bulgaria** | 0.2643 | 101 | 0.1777 | 47 |
| 183 | **Burkina Faso** | 0.3711 | 33 | 0.1706 | 89 |
| 178 | **Burundi** | 0.4362 | 14 | 0.1837 | 29 |
| 138 | **Cambodia** | 0.3531 | 38 | 0.1681 | 112 |
| 150 | **Cameroon** | 0.3597 | 37 | 0.1769 | 54 |
| 11 | **Canada** | 0.2089 | 152 | 0.1764 | 58 |
| 180 | **Central African Republic** | 0.4412 | 12 | 0.1712 | 84 |
| 184 | **Chad** | 0.3599 | 36 | 0.1666 | 125 |
| 40 | **Chile** | 0.2656 | 100 | 0.1764 | 57 |
| 101 | **China** | 0.3767 | 29 | 0.1771 | 52 |
| 91 | **Colombia** | 0.2881 | 83 | 0.1758 | 62 |
| 169 | **Comoros** | 0.2393 | 124 | 0.1611 | 154 |
| 142 | **Congo** | 0.3777 | 27 | 0.1657 | 129 |
| 186 | **Congo** | 0.3755 | 30 | 0.1686 | 108 |
| 62 | **Costa Rica** | 0.2883 | 81 | 0.1952 | 15 |
| 168 | **Côte d'Ivoire** | 0.3892 | 24 | 0.1670 | 121 |
| 47 | **Croatia** | 0.2280 | 137 | 0.1744 | 66 |
| 59 | **Cuba** | 0.2626 | 103 | 0.1450 | 161 |
| 31 | **Cyprus** | 0.2780 | 90 | 0.1972 | 14 |
| 28 | **Czech Republic** | 0.1743 | 162 | 0.0776 | 164 |
| 15 | **Denmark** | 0.2178 | 146 | 0.1762 | 59 |
| 164 | **Djibouti** | 0.3108 | 60 | 0.1650 | 135 |
| 72 | **Dominica** | 0.2427 | 121 | 0.1622 | 151 |
| 96 | **Dominican Republic** | 0.3256 | 50 | 0.1721 | 81 |
| 89 | **Ecuador** | 0.2843 | 86 | 0.1825 | 32 |
| 112 | **Egypt** | 0.3251 | 51 | 0.1761 | 60 |
| 107 | **El Salvador** | 0.2606 | 105 | 0.1692 | 101 |
| 136 | **Equatorial Guinea** | 0.3020 | 69 | 0.1576 | 159 |
| 33 | **Estonia** | 0.2084 | 153 | 0.1669 | 123 |
| 173 | **Ethiopia** | 0.5792 | 2 | 0.1766 | 55 |
| 96 | **Fiji** | 0.2096 | 151 | 0.1692 | 100 |
| 21 | **Finland** | 0.2266 | 140 | 0.1737 | 72 |
| 20 | **France** | 0.2408 | 123 | 0.2001 | 10 |
| 106 | **Gabon** | 0.3107 | 61 | 0.1681 | 113 |
| 165 | **Gambia** | 0.4457 | 10 | 0.1783 | 43 |
| 72 | **Georgia** | 0.2463 | 116 | 0.1670 | 120 |
| 5 | **Germany** | 0.2376 | 125 | 0.1939 | 16 |
| 135 | **Ghana** | 0.4365 | 13 | 0.1777 | 45 |
| 29 | **Greece** | 0.1856 | 159 | 0.1617 | 152 |
| 133 | **Guatemala** | 0.2753 | 93 | 0.1675 | 118 |
| 178 | **Guinea** | 0.3133 | 59 | 0.1647 | 138 |
| 176 | **Guinea-Bissau** | 0.3068 | 62 | 0.1612 | 153 |
| 118 | **Guyana** | 0.3303 | 46 | 0.1661 | 126 |
| 120 | **Honduras** | 0.2969 | 72 | 0.1819 | 35 |
| 13 | **Hong Kong, China (SAR)** | 0.2959 | 75 | 0.2998 | 3 |
| 37 | **Hungary** | 0.2268 | 139 | 0.1710 | 86 |
| 13 | **Iceland** | 0.1761 | 161 | 0.1889 | 23 |
| 136 | **India** | 0.3944 | 23 | 0.1713 | 83 |
| 121 | **Indonesia** | 0.3774 | 28 | 0.1820 | 34 |
| 76 | **Iran** | 0.3366 | 43 | 0.1975 | 13 |
| 131 | **Iraq** | 0.2762 | 92 | 0.1643 | 141 |
| 7 | **Ireland** | 0.1988 | 156 | 0.2105 | 7 |
| 16 | **Israel** | 0.2447 | 119 | 0.2042 | 8 |
| 25 | **Italy** | 0.2155 | 147 | 0.1923 | 17 |
| 85 | **Jamaica** | 0.2522 | 112 | 0.1791 | 40 |
| 10 | **Japan** | 0.2348 | 130 | 0.5026 | 1 |
| 100 | **Jordan** | 0.2369 | 126 | 0.1577 | 158 |
| 69 | **Kazakhstan** | 0.3052 | 65 | 0.1690 | 102 |
| 145 | **Kenya** | 0.4069 | 20 | 0.1766 | 56 |
| 12 | **Korea (Republic of)** | 0.2882 | 82 | 0.2162 | 5 |
| 54 | **Kuwait** | 0.1896 | 158 | 0.1546 | 160 |
| 125 | **Kyrgyzstan** | 0.2269 | 138 | 0.1608 | 155 |
| 138 | **Laos** | 0.4033 | 21 | 0.1760 | 61 |
| 44 | **Latvia** | 0.2002 | 154 | 0.1652 | 134 |
| 72 | **Lebanon** | 0.3032 | 68 | 0.1743 | 68 |
| 158 | **Lesotho** | 0.4186 | 19 | 0.1657 | 128 |
| 174 | **Liberia** | 0.5446 | 3 | 0.1700 | 95 |
| 64 | **Libya** | 0.2814 | 88 | 0.1727 | 78 |
| 41 | **Lithuania** | 0.1995 | 155 | 0.1586 | 156 |
| 26 | **Luxembourg** | 0.1961 | 157 | 0.1728 | 77 |
| 78 | **Macedonia** | 0.2568 | 109 | 0.1742 | 71 |
| 151 | **Madagascar** | 0.2321 | 132 | 0.1684 | 110 |
| 170 | **Malawi** | 0.5251 | 4 | 0.1774 | 49 |
| 64 | **Malaysia** | 0.2770 | 91 | 0.1730 | 75 |
| 104 | **Maldives** | 0.3309 | 45 | 0.1805 | 38 |
| 182 | **Mali** | 0.4009 | 22 | 0.1676 | 116 |
| 32 | **Malta** | 0.2360 | 128 | 0.1902 | 21 |
| 155 | **Mauritania** | 0.2734 | 95 | 0.1640 | 143 |
| 80 | **Mauritius** | 0.2860 | 84 | 0.1689 | 104 |
| 61 | **Mexico** | 0.2592 | 108 | 0.1789 | 41 |
| 113 | **Moldova** | 0.2917 | 80 | 0.1660 | 127 |
| 108 | **Mongolia** | 0.2851 | 85 | 0.1832 | 31 |
| 52 | **Montenegro** | 0.2321 | 133 | 0.1777 | 44 |
| 130 | **Morocco** | 0.3230 | 52 | 0.1702 | 94 |
| 185 | **Mozambique** | 0.4191 | 18 | 0.1648 | 137 |
| 149 | **Myanmar** | 0.4723 | 7 | 0.1730 | 74 |
| 128 | **Namibia** | 0.3410 | 41 | 0.1683 | 111 |
| 157 | **Nepal** | 0.3727 | 32 | 0.1706 | 90 |
| 4 | **Netherlands** | 0.2432 | 120 | 0.2021 | 9 |
| 6 | **New Zealand** | 0.2348 | 129 | 0.1317 | 163 |
| 129 | **Nicaragua** | 0.2938 | 77 | 0.1724 | 80 |
| 186 | **Niger** | 0.3823 | 26 | 0.1678 | 115 |
| 153 | **Nigeria** | 0.3601 | 35 | 0.1637 | 144 |
| 1 | **Norway** | 0.2123 | 149 | 0.1771 | 53 |
| 146 | **Pakistan** | 0.3178 | 56 | 0.1673 | 119 |
| 53 | **Palau** | 0.1789 | 160 | 0.1626 | 149 |
| 59 | **Panama** | 0.2965 | 73 | 0.1728 | 76 |
| 111 | **Paraguay** | 0.3299 | 47 | 0.1742 | 70 |
| 77 | **Peru** | 0.3372 | 42 | 0.1772 | 51 |
| 114 | **Philippines** | 0.3006 | 71 | 0.1685 | 109 |
| 39 | **Poland** | 0.2788 | 89 | 0.1745 | 64 |
| 43 | **Portugal** | 0.2604 | 106 | 0.1908 | 20 |
| 36 | **Qatar** | 0.2453 | 117 | 0.1745 | 65 |
| 56 | **Romania** | 0.2413 | 122 | 0.1730 | 73 |
| 55 | **Russian Federation** | 0.2825 | 87 | 0.1748 | 63 |
| 167 | **Rwanda** | 0.4272 | 16 | 0.1727 | 79 |
| 96 | **Samoa** | 0.2509 | 113 | 0.1653 | 130 |
| 144 | **Sao Tome and Principe** | 0.3178 | 57 | 0.1675 | 117 |
| 57 | **Saudi Arabia** | 0.2746 | 94 | 0.1851 | 27 |
| 154 | **Senegal** | 0.3318 | 44 | 0.1693 | 99 |
| 46 | **Seychelles** | 0.2611 | 104 | 0.1706 | 91 |
| 177 | **Sierra Leone** | 0.4236 | 17 | 0.1643 | 142 |
| 35 | **Slovakia** | 0.2466 | 115 | 0.1721 | 82 |
| 21 | **Slovenia** | 0.2315 | 134 | 0.1862 | 25 |
| 143 | **Solomon Islands** | 0.2552 | 110 | 0.1669 | 122 |
| 121 | **South Africa** | 0.2940 | 76 | 0.1634 | 145 |
| 23 | **Spain** | 0.2467 | 114 | 0.2106 | 6 |
| 92 | **Sri Lanka** | 0.3050 | 66 | 0.1693 | 98 |
| 171 | **Sudan** | 0.3012 | 70 | 0.1626 | 150 |
| 105 | **Suriname** | 0.2682 | 99 | 0.1647 | 139 |
| 141 | **Swaziland** | 0.3262 | 49 | 0.1653 | 132 |
| 8 | **Sweden** | 0.2265 | 141 | 0.1920 | 18 |
| 9 | **Switzerland** | 0.2637 | 102 | 0.2227 | 4 |
| 116 | **Syrian Arab Republic** | 0.2593 | 107 | 0.1773 | 50 |
| 125 | **Tajikistan** | 0.3513 | 39 | 0.1653 | 131 |
| 152 | **Tanzania** | 0.5149 | 5 | 0.1895 | 22 |
| 103 | **Thailand** | 0.2922 | 79 | 0.1688 | 107 |
| 134 | **Timor-Leste** | 0.5144 | 6 | 0.1821 | 33 |
| 159 | **Togo** | 0.3066 | 63 | 0.1628 | 147 |
| 95 | **Tonga** | 0.2189 | 145 | 0.1650 | 136 |
| 67 | **Trinidad and Tobago** | 0.2363 | 127 | 0.1645 | 140 |
| 94 | **Tunisia** | 0.2934 | 78 | 0.1703 | 93 |
| 90 | **Turkey** | 0.2964 | 74 | 0.1788 | 42 |
| 161 | **Uganda** | 0.4359 | 15 | 0.1711 | 85 |
| 78 | **Ukraine** | 0.2283 | 136 | 0.1706 | 92 |
| 41 | **United Arab Emirates** | 0.1216 | 164 | 0.1374 | 162 |
| 26 | **United Kingdom** | 0.2200 | 144 | 0.1802 | 39 |
| 3 | **United States** | 0.2241 | 143 | 0.1817 | 36 |
| 51 | **Uruguay** | 0.3228 | 53 | 0.1806 | 37 |
| 114 | **Uzbekistan** | 0.3151 | 58 | 0.1632 | 146 |
| 71 | **Venezuela** | 0.2727 | 96 | 0.1875 | 24 |
| 127 | **Viet Nam** | 0.3506 | 40 | 0.1776 | 48 |
| 160 | **Yemen** | 0.3847 | 25 | 0.1688 | 105 |
| 163 | **Zambia** | 0.4652 | 8 | 0.1708 | 88 |
| 172 | **Zimbabwe** | 0.5942 | 1 | 0.1743 | 67 |

**Appendix G: Countries by DHDI Rank**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **HDI Rank** | **Country** | **DyHDI** | **DyHDI Rank** | **ADyHDI** | **ADyHDI Rank** |
| 172 | Zimbabwe | 0.5942 | **1** | 0.1743 | 67 |
| 173 | Ethiopia | 0.5792 | **2** | 0.1766 | 55 |
| 174 | Liberia | 0.5446 | **3** | 0.1700 | 95 |
| 170 | Malawi | 0.5251 | **4** | 0.1774 | 49 |
| 152 | Tanzania | 0.5149 | **5** | 0.1895 | 22 |
| 134 | Timor-Leste | 0.5144 | **6** | 0.1821 | 33 |
| 149 | Myanmar | 0.4723 | **7** | 0.1730 | 74 |
| 163 | Zambia | 0.4652 | **8** | 0.1708 | 88 |
| 148 | Angola | 0.4461 | **9** | 0.1854 | 26 |
| 165 | Gambia | 0.4457 | **10** | 0.1783 | 43 |
| 175 | Afghanistan | 0.4455 | **11** | 0.1698 | 97 |
| 180 | Central African Republic | 0.4412 | **12** | 0.1712 | 84 |
| 135 | Ghana | 0.4365 | **13** | 0.1777 | 45 |
| 178 | Burundi | 0.4362 | **14** | 0.1837 | 29 |
| 161 | Uganda | 0.4359 | **15** | 0.1711 | 85 |
| 167 | Rwanda | 0.4272 | **16** | 0.1727 | 79 |
| 177 | Sierra Leone | 0.4236 | **17** | 0.1643 | 142 |
| 185 | Mozambique | 0.4191 | **18** | 0.1648 | 137 |
| 158 | Lesotho | 0.4186 | **19** | 0.1657 | 128 |
| 145 | Kenya | 0.4069 | **20** | 0.1766 | 56 |
| 138 | Laos | 0.4033 | **21** | 0.1760 | 61 |
| 182 | Mali | 0.4009 | **22** | 0.1676 | 116 |
| 136 | India | 0.3944 | **23** | 0.1713 | 83 |
| 168 | Côte d'Ivoire | 0.3892 | **24** | 0.1670 | 121 |
| 160 | Yemen | 0.3847 | **25** | 0.1688 | 105 |
| 186 | Niger | 0.3823 | **26** | 0.1678 | 115 |
| 142 | Congo | 0.3777 | **27** | 0.1657 | 129 |
| 121 | Indonesia | 0.3774 | **28** | 0.1820 | 34 |
| 101 | China | 0.3767 | **29** | 0.1771 | 52 |
| 186 | Congo | 0.3755 | **30** | 0.1686 | 108 |
| 146 | Bangladesh | 0.3748 | **31** | 0.1690 | 103 |
| 157 | Nepal | 0.3727 | **32** | 0.1706 | 90 |
| 183 | Burkina Faso | 0.3711 | **33** | 0.1706 | 89 |
| 50 | Belarus | 0.3610 | **34** | 0.1986 | 12 |
| 153 | Nigeria | 0.3601 | **35** | 0.1637 | 144 |
| 184 | Chad | 0.3599 | **36** | 0.1666 | 125 |
| 150 | Cameroon | 0.3597 | **37** | 0.1769 | 54 |
| 138 | Cambodia | 0.3531 | **38** | 0.1681 | 112 |
| 125 | Tajikistan | 0.3513 | **39** | 0.1653 | 131 |
| 127 | Viet Nam | 0.3506 | **40** | 0.1776 | 48 |
| 128 | Namibia | 0.3410 | **41** | 0.1683 | 111 |
| 77 | Peru | 0.3372 | **42** | 0.1772 | 51 |
| 76 | Iran | 0.3366 | **43** | 0.1975 | 13 |
| 154 | Senegal | 0.3318 | **44** | 0.1693 | 99 |
| 104 | Maldives | 0.3309 | **45** | 0.1805 | 38 |
| 118 | Guyana | 0.3303 | **46** | 0.1661 | 126 |
| 111 | Paraguay | 0.3299 | **47** | 0.1742 | 70 |
| 119 | Botswana | 0.3277 | **48** | 0.1688 | 106 |
| 141 | Swaziland | 0.3262 | **49** | 0.1653 | 132 |
| 96 | Dominican Republic | 0.3256 | **50** | 0.1721 | 81 |
| 112 | Egypt | 0.3251 | **51** | 0.1761 | 60 |
| 130 | Morocco | 0.3230 | **52** | 0.1702 | 94 |
| 51 | Uruguay | 0.3228 | **53** | 0.1806 | 37 |
| 85 | Brazil | 0.3209 | **54** | 0.1743 | 69 |
| 166 | Benin | 0.3185 | **55** | 0.1627 | 148 |
| 146 | Pakistan | 0.3178 | **56** | 0.1673 | 119 |
| 144 | Sao Tome and Principe | 0.3178 | **57** | 0.1675 | 117 |
| 114 | Uzbekistan | 0.3151 | **58** | 0.1632 | 146 |
| 178 | Guinea | 0.3133 | **59** | 0.1647 | 138 |
| 164 | Djibouti | 0.3108 | **60** | 0.1650 | 135 |
| 106 | Gabon | 0.3107 | **61** | 0.1681 | 113 |
| 176 | Guinea-Bissau | 0.3068 | **62** | 0.1612 | 153 |
| 159 | Togo | 0.3066 | **63** | 0.1628 | 147 |
| 108 | Bolivia | 0.3056 | **64** | 0.1680 | 114 |
| 69 | Kazakhstan | 0.3052 | **65** | 0.1690 | 102 |
| 92 | Sri Lanka | 0.3050 | **66** | 0.1693 | 98 |
| 45 | Argentina | 0.3049 | **67** | 0.1837 | 28 |
| 72 | Lebanon | 0.3032 | **68** | 0.1743 | 68 |
| 136 | Equatorial Guinea | 0.3020 | **69** | 0.1576 | 159 |
| 171 | Sudan | 0.3012 | **70** | 0.1626 | 150 |
| 114 | Philippines | 0.3006 | **71** | 0.1685 | 109 |
| 120 | Honduras | 0.2969 | **72** | 0.1819 | 35 |
| 59 | Panama | 0.2965 | **73** | 0.1728 | 76 |
| 90 | Turkey | 0.2964 | **74** | 0.1788 | 42 |
| 13 | Hong Kong, China (SAR) | 0.2959 | **75** | 0.2998 | 3 |
| 121 | South Africa | 0.2940 | **76** | 0.1634 | 145 |
| 129 | Nicaragua | 0.2938 | **77** | 0.1724 | 80 |
| 94 | Tunisia | 0.2934 | **78** | 0.1703 | 93 |
| 103 | Thailand | 0.2922 | **79** | 0.1688 | 107 |
| 113 | Moldova | 0.2917 | **80** | 0.1660 | 127 |
| 62 | Costa Rica | 0.2883 | **81** | 0.1952 | 15 |
| 12 | Korea (Republic of) | 0.2882 | **82** | 0.2162 | 5 |
| 91 | Colombia | 0.2881 | **83** | 0.1758 | 62 |
| 80 | Mauritius | 0.2860 | **84** | 0.1689 | 104 |
| 108 | Mongolia | 0.2851 | **85** | 0.1832 | 31 |
| 89 | Ecuador | 0.2843 | **86** | 0.1825 | 32 |
| 55 | Russian Federation | 0.2825 | **87** | 0.1748 | 63 |
| 64 | Libya | 0.2814 | **88** | 0.1727 | 78 |
| 39 | Poland | 0.2788 | **89** | 0.1745 | 64 |
| 31 | Cyprus | 0.2780 | **90** | 0.1972 | 14 |
| 64 | Malaysia | 0.2770 | **91** | 0.1730 | 75 |
| 131 | Iraq | 0.2762 | **92** | 0.1643 | 141 |
| 133 | Guatemala | 0.2753 | **93** | 0.1675 | 118 |
| 57 | Saudi Arabia | 0.2746 | **94** | 0.1851 | 27 |
| 155 | Mauritania | 0.2734 | **95** | 0.1640 | 143 |
| 71 | Venezuela | 0.2727 | **96** | 0.1875 | 24 |
| 93 | Algeria | 0.2701 | **97** | 0.1777 | 46 |
| 70 | Albania | 0.2687 | **98** | 0.1709 | 87 |
| 105 | Suriname | 0.2682 | **99** | 0.1647 | 139 |
| 40 | Chile | 0.2656 | **100** | 0.1764 | 57 |
| 57 | Bulgaria | 0.2643 | **101** | 0.1777 | 47 |
| 9 | Switzerland | 0.2637 | **102** | 0.2227 | 4 |
| 59 | Cuba | 0.2626 | **103** | 0.1450 | 161 |
| 46 | Seychelles | 0.2611 | **104** | 0.1706 | 91 |
| 107 | El Salvador | 0.2606 | **105** | 0.1692 | 101 |
| 43 | Portugal | 0.2604 | **106** | 0.1908 | 20 |
| 116 | Syrian Arab Republic | 0.2593 | **107** | 0.1773 | 50 |
| 61 | Mexico | 0.2592 | **108** | 0.1789 | 41 |
| 78 | Macedonia | 0.2568 | **109** | 0.1742 | 71 |
| 143 | Solomon Islands | 0.2552 | **110** | 0.1669 | 122 |
| 18 | Austria | 0.2547 | **111** | 0.1993 | 11 |
| 85 | Jamaica | 0.2522 | **112** | 0.1791 | 40 |
| 96 | Samoa | 0.2509 | **113** | 0.1653 | 130 |
| 23 | Spain | 0.2467 | **114** | 0.2106 | 6 |
| 35 | Slovakia | 0.2466 | **115** | 0.1721 | 82 |
| 72 | Georgia | 0.2463 | **116** | 0.1670 | 120 |
| 36 | Qatar | 0.2453 | **117** | 0.1745 | 65 |
| 38 | Barbados | 0.2453 | **118** | 0.1912 | 19 |
| 16 | Israel | 0.2447 | **119** | 0.2042 | 8 |
| 4 | Netherlands | 0.2432 | **120** | 0.2021 | 9 |
| 72 | Dominica | 0.2427 | **121** | 0.1622 | 151 |
| 56 | Romania | 0.2413 | **122** | 0.1730 | 73 |
| 20 | France | 0.2408 | **123** | 0.2001 | 10 |
| 169 | Comoros | 0.2393 | **124** | 0.1611 | 154 |
| 5 | Germany | 0.2376 | **125** | 0.1939 | 16 |
| 100 | Jordan | 0.2369 | **126** | 0.1577 | 158 |
| 67 | Trinidad and Tobago | 0.2363 | **127** | 0.1645 | 140 |
| 32 | Malta | 0.2360 | **128** | 0.1902 | 21 |
| 6 | New Zealand | 0.2348 | **129** | 0.1317 | 163 |
| 10 | Japan | 0.2348 | **130** | 0.5026 | 1 |
| 17 | Belgium | 0.2331 | **131** | 0.1833 | 30 |
| 151 | Madagascar | 0.2321 | **132** | 0.1684 | 110 |
| 52 | Montenegro | 0.2321 | **133** | 0.1777 | 44 |
| 21 | Slovenia | 0.2315 | **134** | 0.1862 | 25 |
| 2 | Australia | 0.2286 | **135** | 0.3397 | 2 |
| 78 | Ukraine | 0.2283 | **136** | 0.1706 | 92 |
| 47 | Croatia | 0.2280 | **137** | 0.1744 | 66 |
| 125 | Kyrgyzstan | 0.2269 | **138** | 0.1608 | 155 |
| 37 | Hungary | 0.2268 | **139** | 0.1710 | 86 |
| 21 | Finland | 0.2266 | **140** | 0.1737 | 72 |
| 8 | Sweden | 0.2265 | **141** | 0.1920 | 18 |
| 96 | Belize | 0.2259 | **142** | 0.1698 | 96 |
| 3 | United States | 0.2241 | **143** | 0.1817 | 36 |
| 26 | United Kingdom | 0.2200 | **144** | 0.1802 | 39 |
| 95 | Tonga | 0.2189 | **145** | 0.1650 | 136 |
| 15 | Denmark | 0.2178 | **146** | 0.1762 | 59 |
| 25 | Italy | 0.2155 | **147** | 0.1923 | 17 |
| 87 | Armenia | 0.2144 | **148** | 0.1666 | 124 |
| 1 | Norway | 0.2123 | **149** | 0.1771 | 53 |
| 30 | Brunei Darussalam | 0.2112 | **150** | 0.1653 | 133 |
| 96 | Fiji | 0.2096 | **151** | 0.1692 | 100 |
| 11 | Canada | 0.2089 | **152** | 0.1764 | 58 |
| 33 | Estonia | 0.2084 | **153** | 0.1669 | 123 |
| 44 | Latvia | 0.2002 | **154** | 0.1652 | 134 |
| 41 | Lithuania | 0.1995 | **155** | 0.1586 | 156 |
| 7 | Ireland | 0.1988 | **156** | 0.2105 | 7 |
| 26 | Luxembourg | 0.1961 | **157** | 0.1728 | 77 |
| 54 | Kuwait | 0.1896 | **158** | 0.1546 | 160 |
| 29 | Greece | 0.1856 | **159** | 0.1617 | 152 |
| 53 | Palau | 0.1789 | **160** | 0.1626 | 149 |
| 13 | Iceland | 0.1761 | **161** | 0.1889 | 23 |
| 28 | Czech Republic | 0.1743 | **162** | 0.0776 | 164 |
| 48 | Bahrain | 0.1413 | **163** | 0.1579 | 157 |
| 41 | United Arab Emirates | 0.1216 | **164** | 0.1374 | 162 |

**Appendix H: Countries by ADHDI Rank**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **HDI Rank** | **Country** | **DyHDI** | **DyHDI Rank** | **ADyHDI** | **ADyHDI Rank** |
| 10 | Japan | 0.2348 | 130 | 0.5026 | **1** |
| 2 | Australia | 0.2286 | 135 | 0.3397 | **2** |
| 13 | Hong Kong, China (SAR) | 0.2959 | 75 | 0.2998 | **3** |
| 9 | Switzerland | 0.2637 | 102 | 0.2227 | **4** |
| 12 | Korea (Republic of) | 0.2882 | 82 | 0.2162 | **5** |
| 23 | Spain | 0.2467 | 114 | 0.2106 | **6** |
| 7 | Ireland | 0.1988 | 156 | 0.2105 | **7** |
| 16 | Israel | 0.2447 | 119 | 0.2042 | **8** |
| 4 | Netherlands | 0.2432 | 120 | 0.2021 | **9** |
| 20 | France | 0.2408 | 123 | 0.2001 | **10** |
| 18 | Austria | 0.2547 | 111 | 0.1993 | **11** |
| 50 | Belarus | 0.3610 | 34 | 0.1986 | **12** |
| 76 | Iran | 0.3366 | 43 | 0.1975 | **13** |
| 31 | Cyprus | 0.2780 | 90 | 0.1972 | **14** |
| 62 | Costa Rica | 0.2883 | 81 | 0.1952 | **15** |
| 5 | Germany | 0.2376 | 125 | 0.1939 | **16** |
| 25 | Italy | 0.2155 | 147 | 0.1923 | **17** |
| 8 | Sweden | 0.2265 | 141 | 0.1920 | **18** |
| 38 | Barbados | 0.2453 | 118 | 0.1912 | **19** |
| 43 | Portugal | 0.2604 | 106 | 0.1908 | **20** |
| 32 | Malta | 0.2360 | 128 | 0.1902 | **21** |
| 152 | Tanzania | 0.5149 | 5 | 0.1895 | **22** |
| 13 | Iceland | 0.1761 | 161 | 0.1889 | **23** |
| 71 | Venezuela | 0.2727 | 96 | 0.1875 | **24** |
| 21 | Slovenia | 0.2315 | 134 | 0.1862 | **25** |
| 148 | Angola | 0.4461 | 9 | 0.1854 | **26** |
| 57 | Saudi Arabia | 0.2746 | 94 | 0.1851 | **27** |
| 45 | Argentina | 0.3049 | 67 | 0.1837 | **28** |
| 178 | Burundi | 0.4362 | 14 | 0.1837 | **29** |
| 17 | Belgium | 0.2331 | 131 | 0.1833 | **30** |
| 108 | Mongolia | 0.2851 | 85 | 0.1832 | **31** |
| 89 | Ecuador | 0.2843 | 86 | 0.1825 | **32** |
| 134 | Timor-Leste | 0.5144 | 6 | 0.1821 | **33** |
| 121 | Indonesia | 0.3774 | 28 | 0.1820 | **34** |
| 120 | Honduras | 0.2969 | 72 | 0.1819 | **35** |
| 3 | United States | 0.2241 | 143 | 0.1817 | **36** |
| 51 | Uruguay | 0.3228 | 53 | 0.1806 | **37** |
| 104 | Maldives | 0.3309 | 45 | 0.1805 | **38** |
| 26 | United Kingdom | 0.2200 | 144 | 0.1802 | **39** |
| 85 | Jamaica | 0.2522 | 112 | 0.1791 | **40** |
| 61 | Mexico | 0.2592 | 108 | 0.1789 | **41** |
| 90 | Turkey | 0.2964 | 74 | 0.1788 | **42** |
| 165 | Gambia | 0.4457 | 10 | 0.1783 | **43** |
| 52 | Montenegro | 0.2321 | 133 | 0.1777 | **44** |
| 135 | Ghana | 0.4365 | 13 | 0.1777 | **45** |
| 93 | Algeria | 0.2701 | 97 | 0.1777 | **46** |
| 57 | Bulgaria | 0.2643 | 101 | 0.1777 | **47** |
| 127 | Viet Nam | 0.3506 | 40 | 0.1776 | **48** |
| 170 | Malawi | 0.5251 | 4 | 0.1774 | **49** |
| 116 | Syrian Arab Republic | 0.2593 | 107 | 0.1773 | **50** |
| 77 | Peru | 0.3372 | 42 | 0.1772 | **51** |
| 101 | China | 0.3767 | 29 | 0.1771 | **52** |
| 1 | Norway | 0.2123 | 149 | 0.1771 | **53** |
| 150 | Cameroon | 0.3597 | 37 | 0.1769 | **54** |
| 173 | Ethiopia | 0.5792 | 2 | 0.1766 | **55** |
| 145 | Kenya | 0.4069 | 20 | 0.1766 | **56** |
| 40 | Chile | 0.2656 | 100 | 0.1764 | **57** |
| 11 | Canada | 0.2089 | 152 | 0.1764 | **58** |
| 15 | Denmark | 0.2178 | 146 | 0.1762 | **59** |
| 112 | Egypt | 0.3251 | 51 | 0.1761 | **60** |
| 138 | Laos | 0.4033 | 21 | 0.1760 | **61** |
| 91 | Colombia | 0.2881 | 83 | 0.1758 | **62** |
| 55 | Russian Federation | 0.2825 | 87 | 0.1748 | **63** |
| 39 | Poland | 0.2788 | 89 | 0.1745 | **64** |
| 36 | Qatar | 0.2453 | 117 | 0.1745 | **65** |
| 47 | Croatia | 0.2280 | 137 | 0.1744 | **66** |
| 172 | Zimbabwe | 0.5942 | 1 | 0.1743 | **67** |
| 72 | Lebanon | 0.3032 | 68 | 0.1743 | **68** |
| 85 | Brazil | 0.3209 | 54 | 0.1743 | **69** |
| 111 | Paraguay | 0.3299 | 47 | 0.1742 | **70** |
| 78 | Macedonia | 0.2568 | 109 | 0.1742 | **71** |
| 21 | Finland | 0.2266 | 140 | 0.1737 | **72** |
| 56 | Romania | 0.2413 | 122 | 0.1730 | **73** |
| 149 | Myanmar | 0.4723 | 7 | 0.1730 | **74** |
| 64 | Malaysia | 0.2770 | 91 | 0.1730 | **75** |
| 59 | Panama | 0.2965 | 73 | 0.1728 | **76** |
| 26 | Luxembourg | 0.1961 | 157 | 0.1728 | **77** |
| 64 | Libya | 0.2814 | 88 | 0.1727 | **78** |
| 167 | Rwanda | 0.4272 | 16 | 0.1727 | **79** |
| 129 | Nicaragua | 0.2938 | 77 | 0.1724 | **80** |
| 96 | Dominican Republic | 0.3256 | 50 | 0.1721 | **81** |
| 35 | Slovakia | 0.2466 | 115 | 0.1721 | **82** |
| 136 | India | 0.3944 | 23 | 0.1713 | **83** |
| 180 | Central African Republic | 0.4412 | 12 | 0.1712 | **84** |
| 161 | Uganda | 0.4359 | 15 | 0.1711 | **85** |
| 37 | Hungary | 0.2268 | 139 | 0.1710 | **86** |
| 70 | Albania | 0.2687 | 98 | 0.1709 | **87** |
| 163 | Zambia | 0.4652 | 8 | 0.1708 | **88** |
| 183 | Burkina Faso | 0.3711 | 33 | 0.1706 | **89** |
| 157 | Nepal | 0.3727 | 32 | 0.1706 | **90** |
| 46 | Seychelles | 0.2611 | 104 | 0.1706 | **91** |
| 78 | Ukraine | 0.2283 | 136 | 0.1706 | **92** |
| 94 | Tunisia | 0.2934 | 78 | 0.1703 | **93** |
| 130 | Morocco | 0.3230 | 52 | 0.1702 | **94** |
| 174 | Liberia | 0.5446 | 3 | 0.1700 | **95** |
| 96 | Belize | 0.2259 | 142 | 0.1698 | **96** |
| 175 | Afghanistan | 0.4455 | 11 | 0.1698 | **97** |
| 92 | Sri Lanka | 0.3050 | 66 | 0.1693 | **98** |
| 154 | Senegal | 0.3318 | 44 | 0.1693 | **99** |
| 96 | Fiji | 0.2096 | 151 | 0.1692 | **100** |
| 107 | El Salvador | 0.2606 | 105 | 0.1692 | **101** |
| 69 | Kazakhstan | 0.3052 | 65 | 0.1690 | **102** |
| 146 | Bangladesh | 0.3748 | 31 | 0.1690 | **103** |
| 80 | Mauritius | 0.2860 | 84 | 0.1689 | **104** |
| 160 | Yemen | 0.3847 | 25 | 0.1688 | **105** |
| 119 | Botswana | 0.3277 | 48 | 0.1688 | **106** |
| 103 | Thailand | 0.2922 | 79 | 0.1688 | **107** |
| 186 | Congo | 0.3755 | 30 | 0.1686 | **108** |
| 114 | Philippines | 0.3006 | 71 | 0.1685 | **109** |
| 151 | Madagascar | 0.2321 | 132 | 0.1684 | **110** |
| 128 | Namibia | 0.3410 | 41 | 0.1683 | **111** |
| 138 | Cambodia | 0.3531 | 38 | 0.1681 | **112** |
| 106 | Gabon | 0.3107 | 61 | 0.1681 | **113** |
| 108 | Bolivia | 0.3056 | 64 | 0.1680 | **114** |
| 186 | Niger | 0.3823 | 26 | 0.1678 | **115** |
| 182 | Mali | 0.4009 | 22 | 0.1676 | **116** |
| 144 | Sao Tome and Principe | 0.3178 | 57 | 0.1675 | **117** |
| 133 | Guatemala | 0.2753 | 93 | 0.1675 | **118** |
| 146 | Pakistan | 0.3178 | 56 | 0.1673 | **119** |
| 72 | Georgia | 0.2463 | 116 | 0.1670 | **120** |
| 168 | Côte d'Ivoire | 0.3892 | 24 | 0.1670 | **121** |
| 143 | Solomon Islands | 0.2552 | 110 | 0.1669 | **122** |
| 33 | Estonia | 0.2084 | 153 | 0.1669 | **123** |
| 87 | Armenia | 0.2144 | 148 | 0.1666 | **124** |
| 184 | Chad | 0.3599 | 36 | 0.1666 | **125** |
| 118 | Guyana | 0.3303 | 46 | 0.1661 | **126** |
| 113 | Moldova | 0.2917 | 80 | 0.1660 | **127** |
| 158 | Lesotho | 0.4186 | 19 | 0.1657 | **128** |
| 142 | Congo | 0.3777 | 27 | 0.1657 | **129** |
| 96 | Samoa | 0.2509 | 113 | 0.1653 | **130** |
| 125 | Tajikistan | 0.3513 | 39 | 0.1653 | **131** |
| 141 | Swaziland | 0.3262 | 49 | 0.1653 | **132** |
| 30 | Brunei Darussalam | 0.2112 | 150 | 0.1653 | **133** |
| 44 | Latvia | 0.2002 | 154 | 0.1652 | **134** |
| 164 | Djibouti | 0.3108 | 60 | 0.1650 | **135** |
| 95 | Tonga | 0.2189 | 145 | 0.1650 | **136** |
| 185 | Mozambique | 0.4191 | 18 | 0.1648 | **137** |
| 178 | Guinea | 0.3133 | 59 | 0.1647 | **138** |
| 105 | Suriname | 0.2682 | 99 | 0.1647 | **139** |
| 67 | Trinidad and Tobago | 0.2363 | 127 | 0.1645 | **140** |
| 131 | Iraq | 0.2762 | 92 | 0.1643 | **141** |
| 177 | Sierra Leone | 0.4236 | 17 | 0.1643 | **142** |
| 155 | Mauritania | 0.2734 | 95 | 0.1640 | **143** |
| 153 | Nigeria | 0.3601 | 35 | 0.1637 | **144** |
| 121 | South Africa | 0.2940 | 76 | 0.1634 | **145** |
| 114 | Uzbekistan | 0.3151 | 58 | 0.1632 | **146** |
| 159 | Togo | 0.3066 | 63 | 0.1628 | **147** |
| 166 | Benin | 0.3185 | 55 | 0.1627 | **148** |
| 53 | Palau | 0.1789 | 160 | 0.1626 | **149** |
| 171 | Sudan | 0.3012 | 70 | 0.1626 | **150** |
| 72 | Dominica | 0.2427 | 121 | 0.1622 | **151** |
| 29 | Greece | 0.1856 | 159 | 0.1617 | **152** |
| 176 | Guinea-Bissau | 0.3068 | 62 | 0.1612 | **153** |
| 169 | Comoros | 0.2393 | 124 | 0.1611 | **154** |
| 125 | Kyrgyzstan | 0.2269 | 138 | 0.1608 | **155** |
| 41 | Lithuania | 0.1995 | 155 | 0.1586 | **156** |
| 48 | Bahrain | 0.1413 | 163 | 0.1579 | **157** |
| 100 | Jordan | 0.2369 | 126 | 0.1577 | **158** |
| 136 | Equatorial Guinea | 0.3020 | 69 | 0.1576 | **159** |
| 54 | Kuwait | 0.1896 | 158 | 0.1546 | **160** |
| 59 | Cuba | 0.2626 | 103 | 0.1450 | **161** |
| 41 | United Arab Emirates | 0.1216 | 164 | 0.1374 | **162** |
| 6 | New Zealand | 0.2348 | 129 | 0.1317 | **163** |
| 28 | Czech Republic | 0.1743 | 162 | 0.0776 | **164** |

1. Srinivasan, T.N. (1994) [↑](#footnote-ref-1)
2. See Kovacevic (2010); Ravallion (2010); Noorbakhsh (1998); Sagar and Najam (1998); [↑](#footnote-ref-2)
3. http://hdr.undp.org/en/data [↑](#footnote-ref-3)
4. (HDI Rank, Dynamic HDI Rank) [↑](#footnote-ref-4)
5. Equal to 1 since Highest has the highest life expectancy in 2010 and their life expectancy increased from 2010 to 2011 [↑](#footnote-ref-5)