

Title: Stirring the pot. Influence of changes in methodology of the Human Development Index on reporting by the press.

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Abstract

This paper assesses changes in the Human Development Index (HDI) rank for a sample of 135 countries over 20 years. The countries selected have had a presence in every HDI table published in the Human Development Reports since 1990. A measure of change in rank between subsequent years was developed so as to allow for differences in the number of countries included in the tables. Results suggest that changes in HDI methodology lead to increased turbulence in country ranking. Also, that there are significant differences between countries in their shifts in HDI table ranking, with five countries in particular (Romania, Jamaica, Botswana, Iran and Belize) experiencing substantially greater turbulence in rank than others. Results suggest that periods of enhanced turbulence in HDI ranking may lead to increased reporting in the world's press. The paper makes a case for a new way of thinking of indicators – in terms of a 'natural selection' process that operates over time. In the opinion of the author this approach would help create a greater understanding as to what makes some indicators and indices successful while others are not so and indeed would help with a better understanding of what is meant by the term 'success' with regard to such tools.

Introduction

The Human Development Index (HDI) has been reported in the United Nations Development Programme's (UNDP) Human Development Reports (HDRs) since 1990; a period spanning a total of 23 years at the time of writing (Böhringer and Jochem, 2007; Wilson et al., 2007).

While there are many indicators that have a much longer history than the HDI, the Gross Domestic Product (GDP) being an example from the field of economics, the HDI has survived as a well-reported index. Its origin in the 1980s was in part driven by a desire on behalf of the UNDP to move the development discourse away from what it saw as an emphasis on economic development and towards a more multi-faceted approach. The suite of economic indicators based on GDP and its relatives was regarded as the crystallisation of this focus on economic development, and UNDP felt it needed an index to stand alongside the GDP family but which captured a richer sense of human development (Kelly, 1991; Anand and Sen, 1994; Moldan, 1997; Ogwang, 2000). This dichotomy between economic and human development was very much a child of the time. Many countries were progressing through a painful process of structural adjustment in the 1980s, with a strong focus on balancing the books in terms of government expenditures and incomes as well as promotion of free trade and removal of subsidies and tariffs. The assumption was that such a liberalisation would ultimately be beneficial for the countries concerned as trade and the private sector would be boosted, thereby helping employment and indigenous sectors such as agriculture. Structural adjustment programmes were typically linked to financial support packages provided by the International Monetary Fund (IMF). Hence the economic vision of development tended to dominate and economic performance indicators were at the forefront in terms of gauging success. The HDRs were meant to provide a counter-balance to this prevailing economic vision of development, and the HDI was the headline index designed to stand alongside the economic indicators. This is not to say that the economic dimension to

development was seen by the creators of the HDRs and HDI as unimportant; only that economic development had to be seen as a means to achieve the ultimate goal of human development (Anand and Ravallion, 1993; Aturupane et al., 1994; Streeten, 1994).

Since its official 'launch' in the HDR of 1990 the HDI has remained true to its initial conceptualisation as a composite index having just three components; simplicity was regarded by the index creators as a vital requirement for transparency (Carlucci and Pisani, 1995; Rannis et al., 2006). It has an education component as this is regarded as an important capability for helping to provide people with more choice in employment and career development. The second component of the HDI is the health of the population and this is proxied by average life expectancy. The third component, perhaps ironically at first glance given the drivers behind the creation of the HDI, is GDP/capita as a proxy measure of per capita income. The assumption is that income is needed to help with the purchase of goods and services required in human development.

As well as the creation of the HDI the UNDP also sought to present it in such a way as to allow nation states to compare their performance over time and with other 'peer' countries. The assumption is that it is the relative performance (at least in HDI terms) of a country that is likely to be recognised by intended consumers (users) of the HDI rather than the absolute value of the index itself. Since the very first HDR the HDI has been presented in a so-called 'league table' format with countries having the highest values (best human development) towards the top and poorly performing countries (low values of the HDI) towards the bottom. Indeed the HDI 'league table' is the table that the reader of the HDR first comes across at the end of the report. In a sense the absolute value of the HDI becomes less important and what matters is where a country is ranked within the constellation of its perceived peers (Ogwang, 2000). A change introduced by UNDP to sub-divide the HDI table into high, medium and low human development sub-groups, or 'tables within a table', does not alter this overall

sense of comparison. It follows from this that the government of a poor performing country in the league table will feel pressure both from within and outside the country to do better and thus introduce measures to improve its HDI. One mechanism for such pressure is the media (Morse, 2011), and the UNDP have been consistent in their attempts to encourage press reporting of the HDR (and hence the HDI) via the release of 'press packs'. This assumption, whereby the HDI is picked by the press who in turn provide an influence over the public and ultimately policy makers and others, is admittedly simplistic for a variety of reasons and a critical review of the evidence for part of this chain of influence is provided by Barabas and Jerit (2009). But it does seem plausible that press reporting can have some impact (Holt and Barkemeyer, 2012; Schmidt et al., 2013) and this can even occur with press reporting outside a country's borders (Mekelberg, 2012).

Evolving the HDI

Given that the HDI has been published each year since 1990 (Table 1) it would be surprising if it had not undergone some evolution. The world has obviously changed a great deal since 1990 and many countries have changed in terms of their composition (e.g. Czechoslovakia became the Czech Republic and Slovakia and the USSR dissolved into a number of new states) as well as their ability to provide data to international agencies because of war and civil strife (e.g. Iraq). Thus the number of countries included in the HDI league table has varied since 1990 and Table 1 summarises this change. In effect a country could find itself going up or down the table as other countries were brought in or left out. The UNDP have to their credit constantly sought to improve the HDI in terms of the quality of the data upon which it is based as well as the means of calculating the index (Cherchye et al., 2008).

Indeed the HDI has undergone less change than perhaps one may expect given the

complexity of what it is trying to capture, and indeed in fairness it has to be noted that the creators of the index may not initially have given much thought to comparisons over time. The bedrock of the index has remained the three components of education, life expectancy and income, all weighted equally, and no other components have been added. An environmental dimension to the HDI has been discussed at various times and experiments have been undertaken (Neumayer, 2001, 2012), but the UNDP have stuck to their principle of keeping the HDI as simple as possible (Booyesen, 2002; Stapleton and Garrod, 2007; Nguetack-Tsague et al., 2011). The situation is, admittedly, slightly more complex than this as some of the components are themselves created by aggregating data, and there are also adjustments made to the data based upon assumptions of minimum and maximum values for standardisation as well as the nature of any transformation. Indeed one of the significant changes introduced by the UNDP in its calculation of the HDI is with the income component. This has always been based on GDP/capita, adjusted for inflation (real GDP chained to a chosen year) and purchasing power, but the UNDP have alternated between the use of logarithmic and Atkinson transformations. The rationale for this was to limit the effect of the extremely wide range in its value across countries. Both methods of transformation limit that range and the debate has centred on the degree to which this should happen. The first HDI in 1990 used the logarithmic transformation but this was replaced by the Atkinson approach between 1991 and 1998 before reverting to the logarithm in 1999. The Atkinson approach had the effect of levelling GDP/capita at a certain point and was thought to be too harsh on middle income countries.

<Table 1 near here>

Even so there is a contradiction in the sense that while a degree of flexibility over the construction of the HDI is desirable this does have an impact on comparison over time (Morse, 2013). If one of the main consumers of the HDI is thought to be non-indicator specialists in the media and policy domains, let alone the public, then it seems reasonable to suppose that they will not necessarily have the in-depth and technical knowledge to appreciate the impacts on ranking that a change in methodology can bring about. In fairness it should be said that UNDP is not unaware of this issue of comparability and for a number of HDRs they introduced 'alternative' tables of the HDI based upon a constant methodology; thereby allowing for some degree of comparability over time. However, while this attempt at transparency is acknowledged it should be noted that the headline HDI table is always presented at the beginning of the tabular listings in the HDRs and effectively is the 'highlight'.

It follows from the above rationale that enhanced reporting of the HDI tables by at least one group of consumers that the UNDP has in mind - newspaper reporters and their editors - may be related to periods of notable change in country ranking. If the rankings are relatively stable from year to year, with each country maintaining its position in the table, then there is arguably little to report and it is possible that newspaper editors may give this a relatively low profile. But if a country surges up and down the table compared to previous years then this is more likely to attract attention and one can perhaps expect a greater extent of press reporting in that year. This may be the case even if relatively small shifts in ranking occur that may represent little real change in human development (Høyland et al. 2012).

This hypothesis is a tantalising one. It suggests that relative stability in country ranking within the HDI league table may not attract much attention from the press while periods of turbulence may lead to enhanced press attention. This is, of course, a simplistic hypothesis as there are other reasons why the HDI may be reported besides any shifts up and down the

league table. For example the HDI may be employed as a shorthand measure of development in articles that seek to explore the usefulness (or not) of an overseas aid programme or perhaps reported in articles that focus on aspects of a country such as tourism. It is perhaps surprising that the use of indicators and indices, with uptake by the media being potentially an important part of that process, is a field that is still very under-explored in the literature (Morse, 2011). Nonetheless, despite the caveats given above the aim of the research reported here is to explore the turbulence in HDI country ranking and to identify whether this is greater for some countries relative to others. Is there evidence that changes in HDI methodology have a significant impact on turbulence in rank? Secondly is there a relationship between turbulence in HDI country ranking and reporting in the global press (i.e. newspapers)? Do these have a positive correlation and if so what can be learnt from this for those groups attempting to create and promote such indices? It should be noted that it is not the intention of the author to question or critique either the UNDP's methodology of the HDI or its mode of dissemination. The HDRs have been in the public domain since 1990 and there is an extensive literature on the methodology of the HDI and its underlying rationale (see for example Morse, 2013).

Materials and Methods

Given that the number of countries included each year in the HDI 'league table' varies (Table 1) and also given that there can be some variation in the name and territorial composition of the same country since 1990, it was first necessary to ensure that the nomenclature was consistent. Also, the HDI for 1990 was not included in the analysis given the somewhat experimental nature of the HDI at that time; it was, after all, the first attempt by UNDP at generating a HDI league table for wide consumption. Once this had been done an adjusted

HDI rank was calculated for each country in the HDI table for that year. The decision to adopt an adjusted rank rather than the original rank was taken to remove the influence arising from changes in the number of countries included in the HDI table over the years. In adjacent years where the number of countries can change significantly, for example from 1992 to 1993, countries have greater scope to move up and down more places than they would if the number of countries had remained constant.

The original rank of a country is first estimated, with accommodation made for ties in rank, and adjusted ranks were calculated as follows:

$$\text{Adjusted rank} = 1 + ((\text{original rank} - 1)/(\text{lowest rank} - 1))$$

The result of adjustment in this way is a series of ranks spanning 1 (top ranking country) to 2 (bottom ranking country) irrespective of the number of countries in the HDI table.

In order to accommodate changes in country presence within the HDI tables it was decided to only work with the adjusted ranks (based on the full table) for 135 countries having a presence in all 21 of the published HDI league tables since 1991. While the results described here are based on a sub-set of countries in each of the tables rather than all of them, it should be noted that even for the year with the largest number of countries listed in the HDI table (2011 with 187 entries) the sub-set comprises 72% of the total. Hence the sub-set of 135 countries represents a significant proportion of the total.

Once the adjusted rank figures had been determined this was used to estimate the change in rank (expressed in absolute terms) between subsequent years for the sample of 135 countries. Thus, for Albania between 1991 and 1992 the adjusted rank remained the same at 1.302 for both years and the change in rank was thus entered as zero. For Belgium, on the other hand, the adjusted rank changed from 1.094 in 1991 to 1.091 in 1992; an absolute change of 0.003.

Averaging the absolute change in rank across countries within a year and over years for a single country provides a measure of the turbulence in ranking between subsequent years, and these values were analysed using the General Linear Model (GLM) approach to analysis of variance (Dobson, 2002). Mean separation after the GLM was achieved via the Bonferroni Simultaneous Test (Dunn, 1961). The Bonferroni method is based upon probability inequalities and makes no distributional assumptions. It is a conservative approach to mean separation (i.e. has fewer 'false positive' Type 1 errors; Bland and Altman, 1995) and this is important given the number of comparisons being made between the years and 135 countries. One of the problems with the Bonferroni method is that it can become too conservative when a large number of comparisons are made (i.e. there can be 'false negatives'), but it was decided to error on the conservative side when comparing countries. For analysis of change in rank over time the comparisons used in the Bonferroni tests are those between adjacent periods; for example between the two periods '1991-1992' and '1992-1993' where the average change in adjusted rank was 0.0165 in '1991-1992' and 0.0185 in '1992-1993'.

To help explain some of the turbulence seen in country rankings a score (0 to 10; with 0 meaning no change) was given to the extent of methodological change between subsequent years. A score of 10 would equate to a complete change in the index in terms of the components (nature and type) included, but the observed changes to date in the HDI relate to:

(a) Assumptions over selection of minimum/maximum values for standardisation. These changes comprised the majority of those seen and in Table 2 they spanned scores of 1 to 4 depending upon how many components were affected and whether there were other changes as well, for example to the education component.

(b) Approach to transforming the GDP/capita component. This has been given a score of 5.

(c) Change in the way in which the components were combined, primarily a shift from using arithmetic mean to geometric mean. This was given a score of 8.

The use of scores for methodological change is admittedly a highly subjective process, and an outline of the main changes in HDI calculation over the years from 1991 to 2012 is shown in Table 2 with the scores on the right hand side along with a justification for the scores that were given. For example, between 1991 and 1993 there were no significant changes in the way the HDI was calculated and the scores for those periods were given as zero. Between 1993 and 1994 there were significant revisions across all three components of the HDI and this was given a score of 4. While the system of scoring employed here could be improved upon it does at least provide an estimation of periods of 'calm' in HDI methodology and transition points where the methodology was significantly re-jigged by UNDP. As far as the author is aware this scoring approach to analyse methodological changes for an index has not been attempted before. Alternatives to the use of scores for representing changes in methodology are not easy to envisage given the variety of changes that can occur even with just three components in an index. One option could be to create a measure of methodological impact based upon the reported HDI ranks relative the ranks using a consistent methodology, and this is discussed later in the paper.

<Table 2 near here>

In order to assess the reporting of the HDI in the press, use was made of the Nexis newspaper article search facility (www.nexis.co.uk/). The search was conducted over the years 1991 to 2012 using the term "Human Development Index" and sources selected were 'All news, All

languages'. At the time of the search this spanned a total of 6760 newspapers in countries from across the globe in the following languages; Arabic, Danish, Dutch, English, Finnish, French, German, Italian, Malay, Norwegian, Polish, Portuguese, Russian, Spanish, Swedish and Turkish. It should be noted that even in non-English publications the HDI is often referred to using its English name. The change in the number of returns was estimated between subsequent years by calculating the percentage; hence the values could be positive or negative.

Relationships between averages changes in HDI table rank, shifts in HDI methodology and reporting of the HDI in newspaper articles were analysed using correlation coefficients and linear regression.

Results

Table 3 provides an illustration of the impact that country size has on turbulence in rank. In Table 3a the turbulence in rank is based on the original (unadjusted) values while in Table 3b the turbulence is based on the adjusted rank. In both case the independent variables are the percentage change in the number of countries included in the HDI table and the score allocated to the change in methodology for the HDI over subsequent years. For the original rank both the change in number of countries and methodology are statistically significant. This suggests that changes in original rank are influenced to some extent by changes in the number of countries included in the HDI table and this is why adjusted ranks have been employed for the bulk of the analyses reported here; in effect the adjusted ranks remove the effect of size of the HDI table. For the change in adjusted rank the only significant

independent variable is methodology and thus it certainly seems that periods of greater turbulence in the HDI ranking of the 135 countries corresponded with periods of major change in methodology of the HDI. This is most noticeable for the period 1998 to 1999 and 2009 to 2010, but also for 1993 to 1994. The period of relative stasis in HDI methodology between 2000 and 2006 was reflected in a period of relative calm in terms of change in HDI ranking (see also Table 2), but this changed in the periods from 2006 to 2007/08 and 2007/08 to 2009. The latter span the only time a HDR was published covering two years - 2007 and 2008. Up till that time and indeed since then each HDR covered but one year, although it should be noted that the data used to construct the HDI league table for each HDR were usually collected a few (typically 2) years before the publication date. Thus strictly speaking the HDI published in any HDR really reflect the state of human development some years prior to the report although this is often not picked up in press reporting. The publication of a HDI covering two years (2007 and 2008) in one report is likely to create some turbulence because of an additional time-lag with the data. In the HDI published in 2006 most of the data came from 2004 while the HDI published in 2007/08 used data from 2006; in effect it can be regarded as being more of a 2008 HDI than a 2007 one.

<Table 3 near here>

The results of a GLM analysis on the changes in adjusted HDI rank suggest that there are indeed statistically significant differences between the 20 periods ($F = 20.55$; $df = 19, 2546$; $P < 0.001$) as well as between the 135 countries ($F = 4.02$; $df = 134, 2546$; $P < 0.001$). Results of mean separation on the 20 periods are shown in Table 4, and it can be seen that there were significant 'surges' in change over some periods, notably 1994 to 1996, 1997 to 2000 and 2006

to 2011) while at others (e.g. between 2000 and 2006) there was relative stability in terms of rank.

<Table 4 near here>

The average change in rank for the 135 countries is shown in Table 5. Countries having more stability in ranking over the 20 years are towards the top of the table while those having more turbulence in ranking are towards the bottom of the table. Here the country showing the most stability in terms of HDI table rank is Norway while the country showing the greatest degree of turbulence is Belize. The results of mean separation across countries (Table 6), admittedly employing a conservative approach so as to avoid Type 1 errors rather than Type 2, does suggest that there are some significant differences between countries towards the top of the table (those with less change in rank over the 20 periods) and those at the bottom (showing greater change in rank over the 20 years). Indeed with the Bonferroni method the bulk of the significant differences are between the five countries at the foot of the table (Romania, Jamaica, Botswana, Iran and Belize) and a number of countries towards the top. Countries towards the middle of the table are not significantly different in terms of their change in rank over the 20 years. Indeed the turbulence in rank for Belize is dramatically higher than for every other country in the table with the exception of Iran.

<Tables 5 and 6 near here>

Given that the UNDP began to include 'back' calculations of the HDI for some years prior to the publication of the HDR it is instructive to compare changes in country rank based upon the original calculation of the HDI (i.e. those used in each of the HDRs for the HDI in that publication) against the change in rank based upon a retrospective calculation of the HDI. As the retrospective (or 'back-casted') calculations are based upon a constant methodology and set of assumptions then any difference one sees in the volatility of rank is likely due to the shifts in methodology outlined in Table 2. Figure 1 presents the results for these two approaches over three periods – 1995 to 2000, 2000 to 2005 and 2005 to 2010 – that span a number of changes in HDI methodology. The bars to the left hand side are those based on a retrospective calculation of the HDI presented in the HDR 2010, while those on the right hand side of the graph are based upon the original HDIs presented in the HDRs over the same periods. In all cases the changes are based on adjusted ranks (so as to allow for variation in the number of countries included in each HDI 'league' table) and refer to the same group of 135 countries that have appeared in all of the HDRs. Clearly the average change in adjusted rank is much greater with the original values of the HDI than with the retrospective values, suggesting that shifts in methodology have indeed had a significant impact on the volatility of rank. In the case of the retrospective HDIs the volatility in HDI rank does appear to gradually diminish over the three periods, although this is not apparent in with the original values of the HDI.

The approach of assessing a methodological impact using original and retrospective measures of the HDI using a constant methodology provides an alternative approach to the use of scoring, but is limited in the sense that retrospective measures of the HDI are only provided for a few years in each HDR and not for the full time-frame. To add to the complexity, the methodology from calculating retrospective values of the HDI also change and this makes it difficult to piece together a picture of retrospective HDI ranks from successive HDRs.

<Figure 1 near here>

In terms of the relationship between the average change in adjusted rank of the HDI and the percentage change in the number of news stories mentioning the HDI at least once (based upon the Nexis database) the results are shown in Figure 2. The patterns in the figure do suggest that press reporting is related to change in mean change in HDI rank for the 135 countries, although the fit is far from being perfect. The correlation between the two sets of data is statistically significant (correlation = 0.452 df = 18 P<0.05) suggesting that periods of turbulence in HDI rank may indeed lead to a greater degree of press reporting of the HDI. This is the first time that such a relationship has been identified.

<Figure 2 near here>

Discussion

The identification of periods of relative turbulence and calm in HDI ranking is highly significant, especially as this is significantly related to changes in the HDI methodology. When the methodology changes then there is increased turbulence in country ranking (when estimated across the 135 countries in the sample), with some countries 'winning' in terms of a higher rank while others lose. The accumulated movement up and down the 'league table' is the variable assessed in this paper. However, while significant this should not be all that surprising. It has certainly been noted by many others than changes in HDI methodology will

have an impact on ranking, and UNDP personnel have often made this point when asked by government officials to explain why a specific country's rank has changed. For example, the following quote is taken from an article in the Irish Times of Monday 12th July, 1999:

“Ireland now ranks 20th of the 174 states surveyed in the Human Development Index (HDI), down from 17th last year. The UNDP says the fall derives from new ways of calculating data, as well as changes in some of Ireland’s figures for educational enrolment.”

In a recent paper Morse (2013) has pointed to variation in ‘resilience’ of country rank to different methodologies employed for the HDI, but this is the first illustration that some countries do appear to exhibit significant changes in rank compared to others. However, the explanation as to why it is that some have relative stability in rank over the 20 periods while others, especially Romania, Jamaica, Botswana, Iran and, above all, Belize have exhibited relatively large turbulence in rank is not immediately apparent although one can speculate. It is not difficult to imagine *prima facie* cases for why such countries have a degree of turbulence in their development without necessarily a need to consider the influence of methodological changes. In the case of Belize, for example, the country has often been claimed to have a relatively good level of political stability since its independence from Britain in 1981 although there have been border skirmishes with Guatemala. Oil exploration has take place since the mid 1950s but the first commercial discovery did not take place till 2005 and production is currently around the 5000 barrels/day level. This now represents a significant proportion (around 30%) of the country's GDP, but other important contributors have traditionally been agricultural products and services (primarily tourism which currently accounts for 18% of GDP). Earnings from agricultural products have fluctuated significantly as prices change and this can certainly have a major impact on what is a relatively small economy. Thus in economic terms it is not difficult to imagine that all this change would

have significant impacts for the country in terms of employment and investment, and there is a limit to what the government can do to manage the economy given that the Belize dollar is fixed to the US dollar (ratio was set at 2:1 in 1978). But just why Belize, or indeed the other countries, should have experienced such a high degree of turbulence in HDI and how methodological changes may possibly have reinforced this turbulence should be investigated in further research.

The results provided in this paper provide the first indication of a link between turbulence in HDI rank and press reporting of the HDI. The relationship is statistically significant at $P < 0.05$ and the pattern in Figure 2 is highly suggestive. Considering the numerous factors that could influence reporting of the HDI over the years of its existence, such as major conferences, civil and international conflict, periods of famine, environmental disasters, a statistical significance for the correlation coefficient is tantalising. Not all of the newspaper articles that mention the HDI will directly refer to changes in country rank, but a few examples that do are as follows. In this case they relate to the country that appears to have the biggest turbulence in terms of its HDI ranking – Belize.

“The index of Latin America and the Caribbean as a region increased but Belize is below the regional average. We also are ranked below Barbados, Bahamas and Trinidad and Tobago but ahead of others such as Guyana and Haiti. But there is a disturbing detail and, that is, that an analysis of the past five years shows that Belize is among the top ten countries that suffered the greatest drop in rank along with countries such as Haiti, Chad, Comoros and Iceland. So in the past five years we have regressed in development indicators such as income and economic growth.”

News 5, Belize (10th November, 2010)

“But what is most damning to the Barrow UDP administration is that the slide accelerated between 2008 to 2011, as the data depicts Belize sliding from a ranking of 58th out of 187 countries in 2000, to 78th out of 187 in 2010, to 93 out of 187 in 2011. If this is not an indictment of the Barrow administration leading Belize down a slippery slope, nothing else will be.”

The Belize Times (18th November, 2011); article refers to Mr Dean Barrow, the Prime Minister of Belize since 2008 and leader of the United Democratic Party (UDP)

Both of these excerpts illustrate a common approach to reporting whereby it is the change in rank that is most apparent along with the obvious temptation to compare the rank for one’s country with those of perceived ‘peers’.

The lessons from this research for indicator technicians are mixed. On the one hand it would be hard to deny that some flexibility in methodology is desirable. After all, the 21 years of the HDI used in this research spans a very long period, and over that time many lessons will be learnt about the best ways to construct the index and the extent and quality of datasets will also improve. How can an indicator/index possibly be maintained in an unchanged form over that time? There is also an obvious attraction in using a comparative format - such as league tables - to bring peer pressure to bear. However, changing methodology does have the consequence of causing turbulence with such comparisons and this can have both positive and negative consequences. On the one hand, if increased turbulence in ranking enhances press reporting then the view might be taken that any publicity is good publicity. However, this is a rather narrow vision and it could also be argued that such a link between turbulence in ranking and newspaper reporting is detrimental. After all, a government could find its country surging up the HDI league table without doing anything conscious to improve the state of human development of its citizens, and similarly a government that may have

introduced good policies designed to help with human development could find itself going down the table. The lack of consistency in methodology across years does come at a price.

The HDI is one of those rare indices that have stood the test of time. There are few indices outside the realm of economics that have lasted as long as the HDI and at the same time received so much attention from a wide variety of stakeholders. There has almost been nothing written about the 'natural selection' of indicators and indices; which ones have flourished and which ones have become extinct, and for those that have been successful how have they managed to evolve over time to help enhance their 'use' by intended consumers of the information. These processes could well be driven in a variety of ways by 'champions' of indicators and indices which see them as embodiments of a particular cause. But having a powerful champion may not necessarily be enough to ensure success, and much may perhaps depend upon the resonance of the underlying cause that the indicator/index is meant to help promote. In the case of the HDI it had both a powerful champion, the UNDP with its representatives in almost every country across the globe, and a cause, human development, that could be reinterpreted in a number of ways such as quality of life that have a wide appeal to the media, the public and indeed policy makers. This notion of a 'natural selection' process for indicators and indices would be a fascinating topic to explore in further research.

Finally, it has to be noted that the discussion above relates to wider questions about the increasing dominance of numbers in policy. Neylan (2008) in his review of the role of quantification in evidence-based policy makes the point that governments have increasingly regarded evidence in terms of statistics and a 'language of quantification'. He argues (page 17) that:

" the high degree of structure that characterises discourses relying on quantification has enabled the language of numbers to remove an appearance of imprecision and

value-ladenness from administrative processes and replace it with one of certainty and disinterestedness."

Thus quantification of something that can be highly undefined, vague, value-driven and imprecise, such as human development, can seemingly become transformed into something that is objective, standardised and accurate, with little if any taint of bias. Echoing the work of Theodore Porter, a historian of science, he also makes the point that:

"quantification becomes most important where elites are weak, where private negotiation is suspect and where trust is lacking" (page 16)

One wonders how this observation resonates with the use of the HDI.

Conclusions

This paper has illustrated the impact on a measure of change in HDI rank as a result of modifications in its methodology. Changes in methodology lead to increased turbulence in country ranking. Perhaps more surprisingly there are some significant differences between countries in their shifts in HDI table ranking, with five countries in particular (Romania, Jamaica, Botswana, Iran and Belize) experiencing substantially greater turbulence in rank than others. This is the first identification of such 'differential turbulence' and it needs further investigation. One interesting aspect of periods of enhanced turbulence in ranking is an indication that this is related to periods of increased reporting in the press. The explanation would appear to be straightforward as the press may especially be attuned to changes of rank over time and also relative to other peer countries. This is the first evidence for such an effect and it does require more research. It would be especially interesting to explore press reporting

for those countries having greatest turbulence in HDI rank relative to peer countries having more stability in rank.

The research also points to a new way of thinking of indicators and indices - in terms of a 'natural selection' process that operates over time. This would help create a greater understanding as to what makes some indicators and indices successful while others are not so. Indeed it would help with a better understanding of what is meant by the term 'success' with regard to such tools and in the author's opinion this is long overdue.

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Table 1. Number of countries included in the HDI league table published since 1991.

Note: the HDI table of 1990 has not been included.

Year of HDR publication	Number countries	Change in number of countries in HDI table relative to previous year
1991	160	Not applicable
1992	160	0
1993	173	13
1994	173	0
1995	174	1
1996	174	0
1997	175	1
1998	174	-1
1999	174	0
2000	174	0
2001	162	-12
2002	173	11
2003	175	2
2004	177	2
2005	177	0
2006	177	0
2007/2008	179	2
2009	182	3
2010	169	-13
2011	187	18
2012	186	-1

Table 2. Notable changes in the evolution of the methodology for the Human Development Index from 1991 to 2012.

Year	Health	Education	GDP/capita/annum (US\$ PPP)	Calculation of mean and	Score for change in methodology compared to previous year and rationale
1991	Life expectancy (years) Maximum (78.6 years) and minimum (42.0 years) taken from data set.	Adult literacy rate (%) and years of schooling weighted 2/3 and 1/3 respectively.	Adjusted GDP/capita obtained with the Atkinson formula. Minimum for formula set at \$4,829/capita. Maximum and minimum for adjusted GDP/capita taken from data set.	Arithmetic mean of the 3 HDI components	Not applicable – 1991 taken as the starting point
1992	As for 1991	As for 1991	As for 1991	As for 1991	0 No change
1993	As for 1992	As for 1992	As for 1992	As for 1992	0 No change
1994	As for 1993 but: Maximum and minimum set as constants rather than taken from data set: Maximum = 85 Minimum = 25	As for 1993 but: Literacy: maximum = 100% minimum = 0 Schooling maximum = 15 minimum = 0	As for 1993 but: Minimum for Atkinson formula set at \$5,120/capita. Maximum and minimum for GDP/capita set as constants rather than taken from data set: Maximum =	As for 1993	4 There were changes to minimum and maximum values across all 3 components of the HDI

			\$40,000/capita Minimum = \$200/capita		
1995	as for 1994	Adult literacy rate (%) and combined enrolment ratio (primary, secondary and tertiary; % weighted 2/3 and 1/3 respectively. Maximum= 100% Minimum = 0%.	As for 1994 but: Minimum for GDP/capita set as \$100/capita rather than \$200/capita	As for 1994	3 Some change to the education component was introduced along with a new minimum value for GDP/capita
1996	as for 1995	as for 1995	As for 1995 Minimum for Atkinson formula set at \$5,711/capita	As for 1995	1 Minor change to minimum for Atkinson formula
1997	As for 1996	As for 1996	As for 1996 Minimum for Atkinson formula set at \$5,835/capita	As for 1996	1 Minor change to minimum for Atkinson formula
1998	As for 1997	As for 1997	As for 1997 Minimum for Atkinson formula set at \$5,990/capita	As for 1997	1 Minor change to minimum for Atkinson formula
1999	as for 1998	as for 1998	Change from Atkinson formula to Logarithm (base 10) of GDP/capita (same as original method in 1990). Maximum= \$40,000 Minimum = \$100	as for 1998	5 Major change in the GDP/capita component as Atkinson formula was replaced by the use of logarithms but the other two components remain as before.

2000	As for 1999	As for 1999 except adult literacy was taken from age 15 and above	As for 1999	As for 1999	1 Minor change in education component
2001	as for 2000	as for 2000	as for 2000	as for 2000	0 No change
2002	As for 2001	As for 2001	As for 2001	As for 2001	0 No change
2003	As for 2002	As for 2002	As for 2002	As for 2002	0 No change
2004	As for 2003	As for 2003	As for 2003	As for 2003	0 No change
2005	As for 2004	As for 2004	As for 2004	As for 2004	0 No change
2006	As for 2005	As for 2005	As for 2005	As for 2005	0 No change
2007 ~ 2008	As for 2006	As for 2006	As for 2006	As for 2006	0 No change
2009	As for 2007/2008	As for 2007/2008	As for 2007/2008	As for 2007/2008	0 No change
2010	Life expectancy (years) Maximum taken from dataset Minimum set at 20	Based upon mean years of schooling and expected years of schooling (adult literacy rate no longer included) Maximum values taken from dataset and minimum set at 0	Logarithm (base e) of GDP/capita Maximum set at \$108,211/capita and minimum set at \$153/capita	Shift from the use of the arithmetic mean to the geometric mean	8 Major change in the education component and small changes in the other two. But there is also a major change in terms of how the components are pooled into the HDI.

2011	As for 2010	As for 2010	As for 2010	As for 2010	1 Minor change in maximum and minimum values for GDP/capita
2012	As for 2011	As for 2011	As for 2010	As for 2011	1 Minor change in maximum and minimum values for GDP/capita

Table 3. Regression analysis of change in rank with number of countries in the HDI ‘league’ table and score for changes in methodology.

(a) Regression based upon change in original rank.

	Coefficient (SE)	t-value and significance
Constant	3.5632 (0.6289)	5.67 ***
Percentage change in number of countries in the HDI table between years	0.3142 (0.1343)	2.34 *
Change in methodology between years	0.7346 (0.2581)	2.85 *

Adjusted $R^2 = 29\%$

F value for model = 4.9 * (residual df = 17)

(b) Regression based upon change in adjusted rank

	Coefficient (SE)	t-value and significance
Constant	0.016296 (0.001617)	10.08 ***
Percentage change in number of countries in the HDI table between years	0.0001845 (0.0003452)	0.53 ns
Change in methodology between years	0.0030014 (0.0006633)	4.53 ***

Adjusted $R^2 = 52\%$

F value for model = 11.24*** (residual df = 17)

Table 4. Average change in adjusted rank for periods.

Average change between years was calculated on the basis of the absolute change in the HDI table adjusted rank for all countries in the sample and acts as a measure of the 'turbulence' in the HDI table.

Period	Average change in adjusted rank	Statistical significance compared to previous period
1991 - 1992	0.0165	
1992 - 1993	0.0185	ns
1993 - 1994	0.0236	ns
1994 - 1995	0.0360	***
1995 - 1996	0.0222	***
1996 - 1997	0.0217	ns
1997 - 1998	0.0114	**
1998 - 1999	0.0344	***
1999 - 2000	0.0162	***
2000 - 2001	0.0170	ns
2001 - 2002	0.0125	ns
2002 - 2003	0.0185	ns
2003 - 2004	0.0147	ns
2004 - 2005	0.0180	ns
2005 - 2006	0.0102	ns
2006 - 2007/08	0.0299	***
2007/08 - 2009	0.0154	***
2009 - 2010	0.0370	***
2010 - 2011	0.0211	***
2011 - 2012	0.0122	ns

ns = not significant at 0.05

** P<0.01

*** P<0.001

Note: Mean separation achieved using Bonferroni Simultaneous Tests

Table 5. Average change in adjusted rank for countries.

Average change was calculated on the basis of the absolute change in the HDI table adjusted rank for all countries in the sample and acts as a measure of the 'turbulence' in the HDI table. Countries in this table are ranked from lowest average change in rank (less turbulence) at the top of the table to those having the highest averages (greatest turbulence) towards the bottom of the table.

Country	Average change in rank
Norway	0.0042
Niger	0.0068
Italy	0.0071
Sierra Leone	0.0081
Australia	0.0082
Sweden	0.0083
Burkina Faso	0.0085
Israel	0.0087
Canada	0.0090
Ireland	0.0091
Japan	0.0100
Hong Kong, China (SAR)	0.0101
Guinea-Bissau	0.0103
Netherlands	0.0104
Belgium	0.0108
Greece	0.0119
Chad	0.0120
Denmark	0.0122
Germany	0.0124
Mexico	0.0126
Honduras	0.0127
Switzerland	0.0127
Ethiopia	0.0128
United States	0.0128
Malawi	0.0129
Mozambique	0.0130
Papua New Guinea	0.0130
Korea (Republic of)	0.0130
Cyprus	0.0131
Burundi	0.0133
Indonesia	0.0134
Malaysia	0.0134
Finland	0.0135
United Kingdom	0.0135
India	0.0136
Austria	0.0137
Lao People's Democratic Republic	0.0140
Myanmar	0.0141
France	0.0146
Côte d'Ivoire	0.0147
New Zealand	0.0148

Uruguay	0.0150
Gambia	0.0150
Spain	0.0151
Barbados	0.0152
Dominican Republic	0.0153
Mali	0.0154
Argentina	0.0158
Portugal	0.0161
Zambia	0.0161
Uganda	0.0164
Pakistan	0.0166
Cambodia	0.0167
El Salvador	0.0168
Guinea	0.0168
Bolivia (Plurinational State of)	0.0169
Congo (Democratic Republic of the)	0.0169
Nepal	0.0171
Viet Nam	0.0171
Madagascar	0.0171
Chile	0.0173
Bangladesh	0.0174
Djibouti	0.0175
Comoros	0.0176
Central African Republic	0.0177
Guatemala	0.0177
Trinidad and Tobago	0.0178
Nigeria	0.0179
Hungary	0.0179
Congo	0.0192
Lesotho	0.0193
Morocco	0.0195
Senegal	0.0196
Brunei Darussalam	0.0197
Yemen	0.0198
Ghana	0.0198
Singapore	0.0199
Cameroon	0.0202
Poland	0.0205
Cape Verde	0.0206
Guyana	0.0206
Togo	0.0209
Peru	0.0211
Malta	0.0212
Mauritania	0.0212
Bahamas	0.0213
Panama	0.0215
Costa Rica	0.0215
Gabon	0.0216
Mauritius	0.0217
Kenya	0.0218

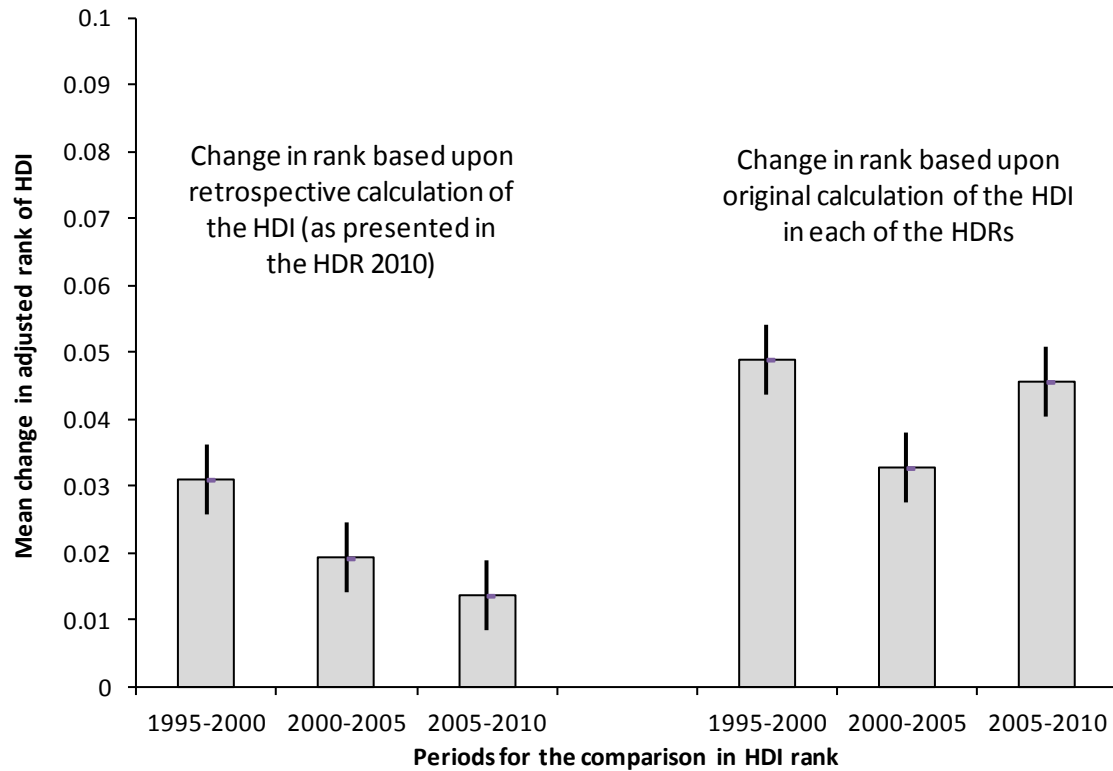
Haiti	0.0218
Iceland	0.0219
Bulgaria	0.0219
Bahrain	0.0227
Benin	0.0229
Luxembourg	0.0229
Sri Lanka	0.0230
Paraguay	0.0231
Tanzania (United Republic of)	0.0237
Nicaragua	0.0244
Philippines	0.0246
Egypt	0.0258
Sudan	0.0264
Swaziland	0.0272
Libyan Arab Jamahiriya	0.0273
Tunisia	0.0274
Mongolia	0.0275
Qatar	0.0275
Thailand	0.0276
Colombia	0.0287
Brazil	0.0288
Venezuela (Bolivarian Republic of)	0.0289
South Africa	0.0291
Suriname	0.0300
Equatorial Guinea	0.0311
Jordan	0.0316
United Arab Emirates	0.0320
Angola	0.0320
Saudi Arabia	0.0327
Maldives	0.0332
Kuwait	0.0336
Namibia	0.0337
China	0.0338
Syrian Arab Republic	0.0344
Ecuador	0.0349
Albania	0.0352
Fiji	0.0361
Turkey	0.0362
Algeria	0.0367
Romania	0.0391
Jamaica	0.0393
Botswana	0.0402
Iran	0.0421
Belize	0.0718

Table 6. Major significant differences ($P < 0.05$) between the bottom five countries having the largest average change in rank with those having the smallest average change in rank.

Country	Difference between those countries having the smallest average change in adjusted HDI rank
Romania	Ireland and below
Jamaica	Ireland and below
Botswana	Hong Kong and below
Iran	Belgium and below
Belize	All countries except Iran

Note: Mean separation was achieved using Bonferroni Simultaneous Tests

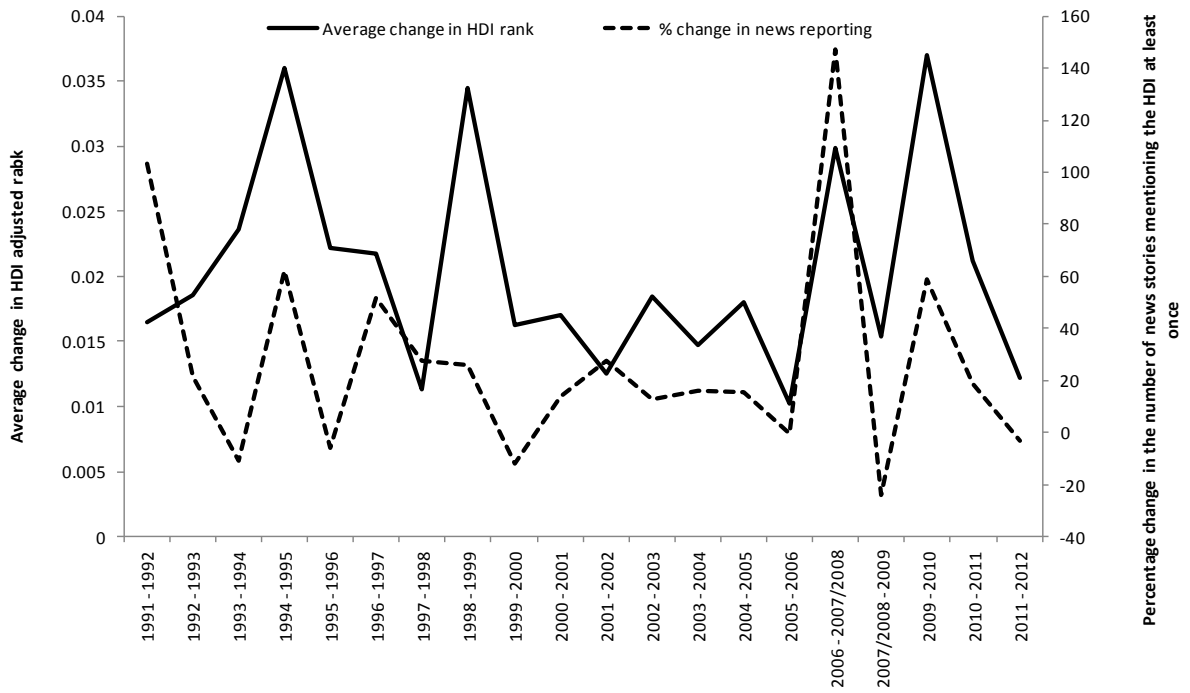
Figure 1. Comparison of change in adjusted HDI rank based upon the original calculation of the index versus a retrospective methodology employed in the HDR 2010.



Bars are 95% confidence intervals.

Difference between the two approaches to calculating the HDI is statistically significant at $P < 0.001$ ($F = 97.37$; $df = 1, 621$).

Figure 2. Average change in rank of the adjusted HDI plotted alongside the percentage change in the number of news stories mentioning the HDI at least once.



Correlation = 0.452 df = 18 P<0.05