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Abstract

This paper introduces a new and comprehensive Human Development Index (HDI) trends dataset for 135 countries and 40 years of annual data. We apply this dataset to answer several empirical questions related to the evolution of human development over the last 40 years. The data reveal overall global improvements, yet significant variability across all regions. While we confirm the existence of continued divergence in per capita income, we find the inverse for HDI. We find no statistically significant correlation between growth and non-income HDI improvements over a forty year period. We also examine some basic correlates that are associated with countries performance in HDI.

Keywords: Human Development, Human Development Index, convergence, economic growth.

JEL classification: O1, O4, O47, O5

1. Introduction

Comparative assessments of development experiences over time tend to be based on growth rates of per capita income.[1] Though the multidimensional nature of development experiences is well-known and has been accepted by most development economists for quite some time, per capita income growth is still the standard for ascertaining what countries have made the most progress over time in development.

This is partly due to the fact that many of the questions that we ask about development are one-dimensional in nature: What countries are progressing faster? Are some countries catching up with others? What are the most developed countries today? Are they the same ones as twenty or forty years ago? In fact, one could argue that the idea of development itself is one-dimensional, implying as it does some summary assessment of progress in many dimensions of the quality of life. And per capita income is the variable to which most economists revert when they look for a one-dimensional answer to this question.

At least since the publication of the first *Human Development Report* in 1990, UNDP's Human Development Index is perhaps the best known alternative multidimensional measure of development.[2] In the words of a recent *New York Times* article, "only one measure has succeeded in challenging the hegemony of growth-centric thinking. This is known as the Human Development Index."[3] Thus it seems worth asking to what extent the conclusions of the

[1] For example see the following: Commission on Growth and Development (2008), "The Growth Report: Strategies for Sustained Growth and Inclusive Development", Barro and Sala-i-Martin (2003), "Economic Growth", and The World Bank (1993), "The East Asian Miracle: economic growth and public policy".

[2] Other indices designed to capture aggregate well being are Sen's Welfare Index, Bhutan's Gross National Happiness index, and the Canadian Index of Well-Being, among many others.

[3] Gertner, Jon (May 13, 2010). The Rise and Fall of the G.D.P. *New York Times*. http://www.nytimes.com/2010/05/16/magazine/16GDP-t.html?pagewanted=all

traditional literature based on economic growth hold up if we view them through the lens of the human development index.

One obstacle to carrying out such a comparative assessment had been the scarcity of comparable HDI data over time. This paper presents a new comparable database containing annual data on the Human Development Index and its components for 135 countries covering the years between 1970 and 2010. The new data sheds light on some old and new development questions. In particular, we discuss the existence of convergence in development, the correlation between income and non-income measures of development in levels and changes, and the correlates of underperformance in human development.

This paper forms part of the background research carried out for the 2010 *Human Development Report*. One of the decisions taken in that report was to alter the HDI functional form and to replace the set of indicators used to measure progress. While the changes in functional form were motivated by what were seen by the authors as valid criticisms of the previous form (such as the linear functional form's acceptance of perfect substitutability across dimensions), the changes in indicators were motivated by the greater adequacy of new variables for measuring future progress.

Since this paper is concerned with analysis of long-term historical trends, we decided to incorporate the changes in the functional form for the purposes of our analysis but to maintain the indicators used in the old HDI. This responds not only to the greater data availability of the old indicators – which is an important consideration – but also to the fact that these indicators appear to be better suited to examining past progress. For example, we may wish to replace literacy by mean years of schooling in current and future assessments because of the great

progress observed in the former, but if we want to understand past progress we would likely want our indicator to capture the observed progress in literacy. Therefore, the main database used in our analysis is one which we call a *hybrid HDI* – an HDI that uses the old indicators together with the functional form that will be introduced in the 2010 report.

This paper explains the construction of this database and shows how we can use it to answer a number of concerning issues such as historical performance in human development, convergence among countries, and causes of success and underperformance. The rest of the paper is as follows: section 2 describes the dataset and explains the key methodological decisions, section 3 discusses the trends of Human Development and presents the discussion of potential correlates explaining performance in Human Development, and Section 4 provides concluding remarks.

2. The construction of the HDI trend dataset

2.1. The hybrid HDI database

The Human Development Index (HDI) is a measure of three sets of capabilities: to live long, healthy lives, to be educated and knowledgeable, and to enjoy a decent standard of living. To enable comparison, the indicators are normalized—that is, put on a scale from 0 to 1.

Since its inception, the HDI has been revised several times to address major criticisms (Raworth and Stewart, 2002). In the 2010 Human Development Report (HDR2010), several improvements to the construction of the HDI are introduced. The HDR2010 presents new indicators to the HDI: Expected Years of Schooling and School Life expectancy in place of Gross Enrolment and Adult Literacy and Gross National Income in place of Gross Domestic Product. Reasons for these changes involve the fact that some—such as literacy—have become less useful precisely because of the progress observed. Only recently has sufficient data become available to allow us use of

these new indicators in the HDI. However for the purposes of historical assessment, it makes more sense to use the original indicators (life expectancy, literacy, gross enrolment and per capita GDP) as they are more broadly available in terms of both in time and in country coverage and remain meaningful for this type of long run analysis.

In this paper, we generate a dataset that is a combination of the original HDI and the new, forming a *hybrid* HDI—the original indicators and the new functional form—in what we call the HDI trends dataset. This database enhances initial work done by Gray and Purser (2010), by expanding the country coverage and data frequency and also by introducing methodological refinements.

Debates that led to a change in the HDI dealt with two issues. The first issue concerned the functional form. The previous construction of the HDI aggregated the three dimensions using the arithmetic mean, which allowed for perfect substitutability: a country could "compensate" for poor performance in one or two dimensions with stellar performance in a different dimension. The new formula switched to a geometric mean, and thus does not allow for perfect substitutability and penalizes unbalanced development.

The second issue concerned the indicators used. The previous HDI used GDP per capita as its measure of income. The increasingly globalized nature of trade has increased differences between the income of a country's residents and a country's domestic production. Due to the growth of international aid and remittances, the disparity between a country's GNI and its GDP has greatly increased for some developing countries. To the extent that we are interested in a measure of a country's capacity to produce goods – for example for assessing the productivity of its economy – we would prefer to use GDP. But the HDI attends to capture the idea of

“command over resources” as a capability. This would seem to argue for income based measures, thus motivating the change to GNI per capita.

The trend data for the Human Development Report 2010 begins with 1980 and covers only 95 countries, as only these have data for 1980 and 2010. The HDI trends dataset that we present in this paper, in contrast, includes more countries and years. This dataset contains annual data, covering 135 countries from 1970 to 2010, allowing an analysis of performance in human development and its components for 92 percent of the world’s population.

Sixty UN member states are not covered by our sample. These countries do not have data for all of the HDI components, of which 16 are in sub-Saharan Africa, 12 in Latin America and the Caribbean, and 15 in East Asia and the Pacific. On average, they are somewhat less developed than countries in the sample: life expectancy is three years shorter, literacy is similar but gross enrolment is 6 percentage points lower, and per capita income is $2,785 lower. This does not mean that all countries excluded from the hybrid HDI sample are poor: eight (including Germany and Singapore) are classified today as developed according to the new HDI presented in the HDR 2010. Their annual economic growth and changes in health were slightly higher than in the rest of the sample, while changes in gross enrolment and literacy were similar. Obviously, this evidence is only partial because the data are incomplete, but it suggests that the omission of these countries does not systematically bias the picture of progress that emerges from our analysis.

2.2. The indicators of the hybrid HDI

2.2.1. Life Expectancy

The life expectancy at birth estimates are taken from a dataset constructed by the Population Division of the United Nations Department of Economic and Social Affairs (UN-DESA) in the latest version of the World Population Prospects. The population estimates and projections are produced every two years using data from national vital registration systems, population censuses and surveys. They are based on life tables for each individual country that are composed of a set of values of a hypothetical group of infants born at the same time and subject to the specific mortality rates of any given year. The data are available from 1950 – 2010 as estimates (until 2009) and projections (starting with 2010). Since the data set does not have any gaps in time, we use the exact values published by the UN-DESA without any permutation of the data.

2.2.2. Adult Literacy rate

Our literacy indicator measures the percentage of the population fifteen years and older that is able to read. The data used is predominately from the United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics (UIS) and combines direct national estimates with recent estimates based on its global age-specific literacy projections model. For some countries, this data is complemented with data for 1970 and 1975 from various editions of UN Demographic Yearbooks (1993, 1988, 1983 and 1979 editions). We additionally use data, made public on the UIS website archive of literacy rate estimations and forecasts for 138 countries in five-year intervals from 1970 to 2015.

2.2.3. Gross Enrolment Ratio (GER)

The measure of GER is a combined measure of primary, secondary and tertiary education for both sexes. Similar to Literacy, GER data is produced by UNESCO-UIS and its primary source are reports from national governments. The ratios are calculated by dividing the number of students enrolled in all three levels of education by the total population of the theoretical age group corresponding to these levels. The population data is taken from the World Population Prospects 1950 – 2050 by UN-DESA.

2.2.4. Gross Domestic Product (GDP)

The GDP series we created is in constant international dollars, controlling for purchasing power parity (PPP) with a 2008 base year. The master data for GDP is provided by the World Bank and released in its World Development Indicators (WDI) database (May 2010). The original data from WDI had a 2005 base year, which we converted to 2008, by applying the ratio between current GDP of the year 2008 to constant GDP of 2008 in 2005 prices. Due to the lack of complete data going back to 1970 (the WDI starts in 1980) and going up until 2010, the dataset was supplemented by corresponding GDP per capita PPP data from the Penn World Tables 6.3 and the World Economic Outlook (WEO) database of the International Monetary Fund (IMF) of the April 2010 version.

2.3. Former Soviet Union, former Yugoslavia and former Czechoslovakia

Former communist countries have undergone multiple political and territorial changes. For our HDI trends dataset, we collected and computed data as if the three former communist countries, the Soviet Union, Yugoslavia and Czechoslovakia, were the independent States they are at present throughout our period of analysis (which includes the transitional and pre-independence

time). As of today, 15 countries have emerged out of the Former Soviet Union (FSU); six emerged out of former Yugoslavia[4] and two out of Czechoslovakia. Out of the total of 23 former eastern Bloc countries, we were able to compute data for 19 countries; 14 out of 15 from the Ex-Soviet Union,[5] three out of the six from former Yugoslavia and both countries that were unified as Czechoslovakia.

Life Expectancy data, as reported by UN-DESA is based on similar conceptual assumptions about the integrity of former Eastern Bloc countries and is complete without gaps for every country and every year in our analysis. Similarly, the Globalization-Health Nexus Database (GHND)[6] reports their real GDP per capita data for most of these countries pre separation. The gaps of the quinquennial GDP data were filled by linear interpolation. Since there was no publicly available dataset on the remaining educational indicators, adult literacy or gross enrolment, the series were complemented by data extracted from population and household censuses and statistical yearbooks of the regions that are now independent countries.[7] We incorporated the data from these 23 countries by calculating the annual growth rate of the data and then recursively applying it to the master series, which ends in the early 1990's.

[4] This does not include Kosovo. At present, Kosovo is not a member State of the United Nations.

[5] Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Russian Federation, Tajikistan, Ukraine and Uzbekistan are these 14 countries. Only for Turkmenistan the HDI could not be calculated.

[6] For the GHND dataset and its documentation see http://www.dse.unifi.it/sviluppo/database_eng.html (last accessed in June 2010).

[7] Timothy Heleniak (2010), "Human Development Indicators – USSR, Yugoslavia, Czechoslovakia, 1970 – 1990." Data, data description and explanatory note are available upon request. In addition to the former communist states of the Eastern Bloc, there are a number of other countries such as India, Pakistan, Bangladesh, Zimbabwe and others that have not been in existence in their present state, or have not maintained their territorial integrity since 1970. Notwithstanding, for the countries in our dataset that underwent territorial and/or political changes, public data was available from the sources described in section 2.2. Our data is composed based on the most recent territorial and political status.

2.4. Creating the hybrid HDI index

The hybrid HDI index applies the same functional form as introduced in the HDR for the calculation of the official HDI in 2010. Before the health, education, and income indicators are geometrically aggregated; individual subindices for each dimension were calculated. Minimum and maximum values (see goalposts in table 1) were set in order to transform the indicators into indices between 0 and 1. The maximum values were set to be the actual observed maximum values of each dimension of the time series spanned by our data. The minimum values are set at 20 years for life expectancy, at 0 years for both education variables and at $163 for per capita gross national product (GDP). These minima represent estimates of the minimum levels a society needs to survive in each of these dimensions. The life expectancy minimum is based on long-run historical evidence from Maddison (2010) and Riley (2005). The reasoning behind a 0 goalpost in education is that societies can subsist without formal education. A basic level of income is necessary to ensure survival: $163 is the lowest value attained by any country during our 40 year examination period (in Liberia in 1995), which corresponds to less than 45 cents a day, just over a third of the World Bank's $1.25 a day poverty line.

Table 1. Goalposts for the hybrid HDI

Dimension	Observed Maximum	Minimum
Life Expectancy	83.2	20
	(Japan, 2010)	
Gross Enrolment Ratio	115.82	0
	(Australia, 2002)	
Adult Literacy	99	0
	(several countries during several years)	
Combined Education Index	1	0
	(Australia, 2002)	
Per capita income (PPP $)	106,769.7	163.3
	(United Arab Emirates, 1977)	(Liberia, 1995)

Source: HDI trends dataset.

Having defined the minimum and maximum values, the subindices are calculated as follows:

Dimension index = (actual value – minimum value) / (maximum value – minimum value) (1)

For education, equation 1 is applied to each of the two subcomponents, then a geometric mean of the resulting indices is created and finally, equation 1 is reapplied to the geometric mean of the indices, using 0 as the minimum and the highest geometric mean of the resulting indices for the time period under consideration as the maximum. This is equivalent to applying equation 1 directly to the geometric mean of the two subcomponents. Because each dimension index is a proxy for capabilities in the corresponding dimension, the transformation function from income to capabilities is likely to be concave (Anand and Sen 2000). Thus, for income the natural logarithm of the actual minimum and maximum values is used.

2.5. Aggregating the sub-indices to produce the hybrid HDI

Precisely as in the official HDI of the 2010 HDR, the hybrid HDI is computed as the geometric mean of the three dimension indices. The hybrid HDI thus applies the same aggregation formula as the new HDI to the set of indicators and sources used in previous Reports (since 1995) in order to allow a more extensive analysis over time.

Hybrid HDI = Lifeindex^$^{(1/3)}$ * Educationindex^$^{(1/3)}$ * Incomeindex^$^{(1/3)}$ (2)

The geometric mean aggregation presented in equation 2 embodies imperfect substitutability across all HDI dimensions. It thus addresses one of the most serious criticisms of the linear aggregation formula, which allowed for perfect substitution across dimensions.[8] Some degree of

[8] See Raworth and Stewart (2002) for a major survey.

substitutability however is inherent in the definition of any index that increases continuously with the values of its components.

Adopting the geometric mean produces lower index values, with the largest changes occurring in countries with uneven development across dimensions, for example Equatorial Guinea and Sudan, where the achievements are lop-sided towards incomes. The new formula limits the amount by which advances in one dimension can make up for others. Thus it captures the idea that health, education and income are all essential contributors to people's well-being. An opposite example is Zimbabwe, which is the poorest country in the world in terms of income. Previously, Zimbabwe could "compensate" for its poor income and health performances with its relatively better education performance and thus did not fall to the bottom of the index. The new formula, however limits the amount by which it can do this, so the country takes a much greater hit overall from its poor health and income performance.

How different are the official HDI values from the HDR 2010 compared to the hybrid HDI? In general, the two are highly correlated with Pearson and Spearman correlation coefficients of 0.99. Out of the 10 bottom ranked official HDI countries in 2010, 9 are the same as for the hybrid HDI. For the top-ten ranked countries, 7 are the same in the rankings of each variable. Relative to the official HDI in the HDR 2010, the hybrid HDI has much smaller values, with the exception of Norway, New Zealand and the Czech Republic, all of which are in the very high human development category (see figure 1). Both index versions were most similar in the high human development category and most discrepant for low human development. The official HDI has data for 169 countries and the hybrid HDI provides data for 135 countries. However, not all of the 135 hybrid HDI sample countries are also in the official HDI. Lebanon, Oman and Samoa

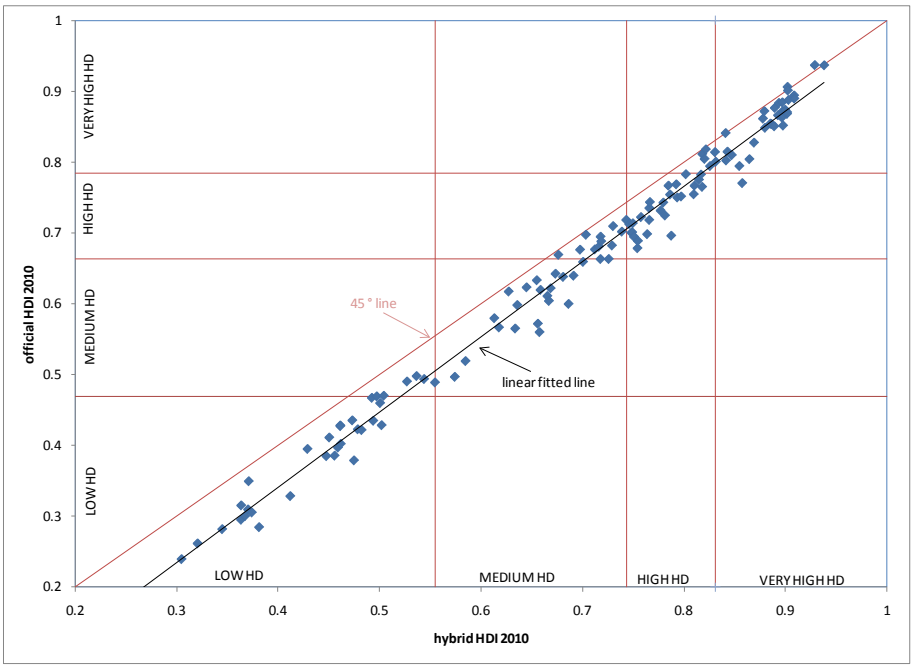
are missing in the official dataset. Out of the 132 overlapping countries, 97 either do not change in rank, or change only up to +/- five ranks.[9]

As detailed in the appendix, some variables were interpolated or extrapolated in order to ensure maximum coverage. This leads to the question of whether our results are sensitive to the choice of methods for filling missing values. We experimented with a number of different extrapolation techniques – see table A.1 in the appendix – of our indicators, and found that neither the ranking of countries in 2010, nor the ranking of performances over time, nor the main trend findings, presented in the following sections changed significantly.[10] These robustness tests show that for the analysis of trends, the general results are independent of the type of indicators (the old or new HDI indicators) that are used.

[9] We introduce a number of figures and analyses in this paper using the HDI Trends Dataset. As a robustness check, we have reproduced the figures using the official HDI dataset for HDR2010. These figures are in the Appendix. For further details and discussion on the impacts of the methodological refinements, and the differences of the HDI of HDR2010 with HDR2009, see Choi et al (2010).

[10] The correlation between the changes from 1980 to 2010 for the countries present in both HDIs is 0.91. What's more, the correlation of growth rates is 0.96, and the correlation between the deviation from fit is 0.97. All of these correlations are statistically significant at the 1% level.

Figure 1 – Comparison of official and hybrid HDI 2010



Source: HDI trends dataset and own calculations.

3. Trends analysis

We begin this section by discussing the evolution of the hybrid HDI and its components, presented in table 2. The general picture emerging from an analysis of the HDI trends dataset suggests significant overall progress (see table 2). The world average rose from 0.57 in 1990 to 0.67 in 2010. This progress represents the continuation of a long-run trend: in 1970, the world's HDI (i.e., the population-weighted country average) stood at 0.48. The increase in its value reflects expansions of about a fourth in the health and education indicators and doubling of income per capita.[11] These aggregate global measures are strongly influenced by the two most populous countries—China and India. Even so, figures unweighted by population (and thus

[11] All dollar figures, unless otherwise noted, refer to purchasing power parity adjusted constant dollars in 2008 prices.

reflecting average country performance) show similar progress.[12] Progress in human development, as measured by the HDI, has occurred across almost all countries and regions: of the 135 countries and territories with data back to 1970, all but three have a higher level of human development today than they did then—the exceptions are the Democratic Republic of the Congo, Zambia and Zimbabwe.

Progress in education has been overall significant and widespread. Since 1970 the gross enrolment rate has risen by 26 percent and literacy has risen by 39 percent on average in the world. World averages wash out the intricacies of the national reality. While it is true that the great majority of countries experience stark improvements in education, ten saw a falling in gross enrolment rates[13].

Life expectancy has also increased across the world. It has raised most in the Arab States, by more than 18 years since 1970—just over a third of the initial value. In sub-Saharan Africa, life expectancy is more than 8 years longer than in 1970. And in the bottom quarter of countries in the 1970 HDI distribution, increases in longevity were more than twice as rapid as those of the top quarter. As with education, however, the story is not completely one of progress – there are also setbacks observed in eight countries from our sample.[14]

The average GDP per capita today is $10,645, almost 1.5 times its level 20 years ago and almost twice its level 40 years ago. All regions have seen significant increases, though patterns vary. Despite the positive overall economic growth, 19 countries—14 percent of our sample - have seen their GDP per capita decrease. The magnitude of average income growth depends on

[12] We concentrate on averages weighted by population, unless otherwise noted.

[13] Albania, Azerbaijan, China, Georgia, Kyrgyzstan, the Republic of Moldova, Tajikistan, Trinidad and Tobago, Uzbekistan, Zambia.

[14] The eight countries are: Belarus, Congo, Lesotho, Russian Federation, Swaziland, Ukraine, Zambia and Zimbabwe.

whether the income figures are population-weighted or unweighted—that is, whether one thinks of the income of the average person or the average country. This is also true at the regional level. For example, because of China's size and rapid growth, the income of the average person in the East-Asia Pacific region has grown 1,183 percent since 1970—but that of the average country in that region rose by a much more moderate 280 percent (which is still higher than any other region). Likewise, the income of the average person in sub-Saharan Africa increased only 20 percent, but that of the average African country, 96 percent.[15]

[15] This reflects the weak overall growth records of the Democratic Republic of Congo, Nigeria and Ethiopia, where 311 million people live in 2010.

Table 2: Trends in the HDI and components by region and HDI groups, 135 countries, 1970–2010

	hybrid HDI						*LE*						*GDP*					
						% change						*% change*						*% change*
Regional groups	*1970*	*1980*	*1990*	*2000*	*2010*	*(70 - 10)*	*1970*	*1980*	*1990*	*2000*	*2010*	*(70 - 10)*	*1970*	*1980*	*1990*	*2000*	*2010*	*(70 - 10)*
Developed	0.75	0.80	0.83	0.87	0.89	18	71	74	76	78	80	13	16,438	21,308	26,942	32,945	37,185	126
OECD	0.76	0.80	0.83	0.87	0.89	18	71	74	76	78	80	13	16,525	21,275	26,977	32,997	37,105	125
non OECD	0.69	0.75	0.79	0.83	0.86	24	70	73	75	78	80	14	11,025	23,046	25,314	30,894	40,043	263
Developing	0.40	0.47	0.52	0.58	0.64	57	56	60	63	65	68	21	2,067	2,780	3,101	3,649	5,873	184
Sub-Saharan Africa	0.28	0.34	0.36	0.37	0.43	53	44	48	49	49	52	19	1,221	1,267	1,143	1,118	1,466	20
South Asia	0.33	0.38	0.44	0.50	0.57	72	49	54	58	62	65	33	1,294	1,224	1,551	2,060	3,398	162
Central and Eastern Europe and the CIS	0.66	0.69	0.72	0.70	0.75	13	67	67	68	67	69	3	5,390	8,110	9,910	7,456	11,866	120
Latin America and the Caribbean	0.58	0.65	0.69	0.73	0.77	32	60	64	68	72	74	24	5,894	8,402	7,794	9,092	11,092	88
Arab States	0.40	0.48	0.55	0.61	0.66	65	51	57	63	67	70	37	5,195	7,248	5,956	6,544	8,603	66
East Asia and the Pacific	0.36	0.45	0.52	0.63	0.71	96	59	64	67	71	73	23	507	822	1,440	2,931	6,504	1,183
HDI groups (2010 HDI quartiles)																		
low	0.28	0.32	0.35	0.38	0.44	61	44	47	50	52	55	27	1,078	1,078	997	1,028	1,434	33
medium	0.36	0.43	0.49	0.58	0.65	83	56	61	64	67	69	25	709	972	1,485	2,505	5,010	606
high	0.62	0.67	0.70	0.72	0.77	24	63	65	68	70	73	15	6,503	9,116	9,344	9,238	12,610	94
very high	0.75	0.80	0.83	0.87	0.89	18	71	74	76	78	80	13	16,438	21,308	26,942	32,945	37,185	126
HDI groups (1970 Hybrid HDI quartiles)																		
low	0.33	0.39	0.45	0.53	0.60	82	54	59	61	64	66	22	655	823	1,235	2,122	4,323	560
medium	0.46	0.54	0.60	0.65	0.69	51	53	59	64	68	71	34	3,491	4,784	4,791	5,572	7,334	110
high	0.64	0.69	0.72	0.74	0.79	24	65	68	70	72	75	15	5,753	8,595	9,408	10,762	14,486	152
very high	0.76	0.79	0.82	0.85	0.88	16	71	73	75	76	79	11	15,590	20,304	25,512	30,006	34,585	122
World Average	0.48	0.53	0.57	0.62	0.68	41	59	63	65	67	70	18	5,131	6,361	7,245	8,368	10,645	107

	GER						Lit					
						% change						% change
Regional groups	*1970*	*1980*	*1990*	*2000*	*2010*	*(70 - 10)*	*1970*	*1980*	*1990*	*2000*	*2010*	*(70 - 10)*
Developed	69.49	75.75	80.98	89.36	92.44	33	96.96	97.67	98.24	98.61	98.83	2
OECD	69.61	75.98	81.17	89.64	92.80	33	97.15	97.86	98.41	98.74	98.90	2
non OECD	61.83	63.88	72.31	78.37	79.46	29	85.14	87.73	90.67	93.47	96.11	13
Developing	51.74	53.32	53.55	60.68	66.21	28	50.05	58.01	66.84	75.51	80.66	61
Sub-Saharan Africa	25.59	37.17	37.73	43.01	53.51	109	23.03	33.71	45.53	55.59	65.24	183
South Asia	36.07	39.20	45.99	50.39	59.24	64	30.95	37.17	45.21	56.96	66.01	113
Central and Eastern Europe and the CIS	69.61	70.87	76.76	78.05	81.77	17	90.81	92.87	95.07	96.31	97.04	7
Latin America and the Caribbean	52.21	64.59	71.23	80.15	82.96	59	72.47	79.27	84.06	88.78	92.10	27
Arab States	34.17	43.79	52.64	61.86	64.47	89	29.65	40.38	52.20	63.93	73.71	149
East Asia and the Pacific	64.63	60.64	52.88	65.00	69.08	7	53.26	65.54	79.27	90.34	93.83	76
HDI groups (2010 HDI quartiles)												
low	25.98	33.94	36.13	42.52	51.54	98	22.38	31.52	42.21	52.76	62.63	180
medium	53.82	52.78	51.01	59.32	65.32	21	45.77	55.27	65.81	76.42	81.78	79
high	59.64	66.28	72.48	78.66	82.05	38	77.26	81.63	85.87	89.82	92.86	20
very high	69.49	75.75	80.98	89.36	92.44	33	96.96	97.67	98.24	98.61	98.83	2
HDI groups (1970 Hybrid HDI quartiles)												
low	49.43	48.19	45.79	54.03	60.81	23	38.64	48.14	58.50	69.62	75.72	96
medium	47.96	57.77	64.31	71.87	74.35	55	57.73	66.63	76.73	83.11	88.32	53
high	62.80	68.76	73.28	78.35	85.34	36	86.08	89.78	92.26	94.54	95.94	11
very high	70.58	76.29	81.82	88.54	91.22	29	97.71	98.13	98.48	98.80	98.93	1
World Average	55.53	57.66	58.32	65.30	70.21	26	60.06	65.67	72.29	79.24	83.43	39

Note: Variables defined as per 2010 HDR. Numbers in the table are population-weighted. Variables are measured as follows: income is in US$ constant 2008 PPP prices, life expectancy is in years, and gross enrolment and literacy are in percentages. The sample covers 135 countries, and thus the world.
Source: HDI trends dataset and own calculations.

Cursorily assessing the population weighted data presented in table 2 gives the misleading impression that, as a whole, the developing countries have outpaced the developed countries in terms of growth, as illustrated by average growth rates of 184 versus 126 percent. The conclusion that developing countries are converging towards developed countries based on this evidence however is highly dependent on the performance of a few highly populated countries (for a detailed treatment of the convergence hypothesis, see section 3.2). While some developing countries have in fact closed the gap to the developed countries, others have not. T The unweighted per capita income aggregates, in which the impact of populous countries, such as most importantly China and India, is diminished, show the converse of the weighted figures: income differences across countries were significant and actually growing. Between 1970 and 2010, per capita incomes of developed countries increased 175 percent, compared with 136 percent of developing countries. Various measures of inequality reflect this divergence. For example, the average income of a country in the top quarter of the world income distribution was 23 times that of a country in the bottom quarter in 1970. By 2010, that ratio approached 29.[16]

3.1. Top Performers

Which countries have performed best in improving their people's HDI over the last four decades? Answering is not as simple as it might sound, because it depends on the standard used to judge change.[17] One can measure progress in human development in a variety of ways. The simplest measure is to take the absolute change over time in the HDI. However, this overly

[16] For further reading on examining income convergence and global income inequality, see Barro and Sala-i-Martin, (1992), Milanovic (2003), and Sala-i-Martin (2002).

[17] Similarly, Easterly 2009 shows that choices about how to measure and set MDG targets significantly affect which countries and regions are progressing most and which are failing.

favors less developed countries, because they have more room to advance. An alternative is to use the growth rate of the HDI, but this gives even more weight to growth from low initial levels.

A third technique of measuring progress is using the shortfall reduction method, which measures the fall in the gap between a country's initial level and the variable's upper limit. This method, discussed in the first Human Development Report, reflects national efforts to close development gaps but implicitly assumes that a certain percentage reduction is equally feasible at different initial levels of development, which does not always make sense. Going from a literacy rate of 98 to 99 percent is a 50 percent reduction of the shortfall from the maximum of 100, but so is an increase from 20 to 60 percent, which implies a much larger achievement. In practice, shortfall rankings tend to favour developed countries.

We propose another alternative for measuring a country's performance in HDI, which is to look at a country's deviation from its expected performance given its initial HDI and the performance of countries at a similar starting point—the deviation from fit. This measure uses the residual from a regression of log changes in the HDI on the initial log HDI level to measure a country's distance from the group average. This "distance from the group average" method measures how well a country does relative to other countries starting out at the same point. This method addresses several of the main shortcomings of the other three methods. Namely, it is not by construction biased either in favour or against poor countries.

Why the choice of method matters can be illustrated by comparing the top and bottom 10 movers in our country sample. The four methods—absolute change, percentage change, shortfall reduction and deviation from fit—coincide broadly in identifying the bottom movers, which include Democratic Republic of Congo, Georgia, Republic of Moldova, Tajikistan, Ukraine,

Zambia, and Zimbabwe, all bottom ten performers in all 4 methods. Liberia performs in the bottom ten for three out of four of the methods. But the lists of top performers differ. Eight of the top 10 performers under the shortfall reduction method are developed countries, but there is only one developed country in the top 10 for the absolute change and deviation from fit, South Korea, and none for percentage change. Oman is the only country to be in the top 10 for all for methods with China, Lao PDR, Nepal, Saudi Arabia, and South Korea being in 3 out of 4 of the top ten lists.

Table 3: Methods of Measuring Progress—Top Ten and Bottom Ten Performers

Rank	Deviation from Fit	Absolute Change	Growth Rate	Shortfall Reduction
1	Oman	Oman	Burkina Faso	South Korea
2	China	China	Nepal	Australia
3	Nepal	Saudi Arabia	Ethiopia	Oman
4	Indonesia	Indonesia	Oman	Norway
5	Saudi Arabia	South Korea	Mali	Ireland
6	Lao PDR	Tunisia	Niger	Saudi Arabia
7	Tunisia	Algeria	China	Hong Kong, China
8	South Korea	Nepal	Mozambique	U.A.E.
9	Algeria	Lao PDR	Lao PDR	Spain
10	Morocco	Morocco	Benin	Finland
…				
126	Ukraine	Liberia	Jamaica	Côte d'Ivoire
127	Côte d'Ivoire	Trinidad & Tobago	Trinidad & Tobago	C.A.R.
128	Georgia	Russian Federation	Russian Federation	Ukraine
129	Moldova	Tajikistan	Tajikistan	Georgia
130	Tajikistan	Moldova	Moldova	Moldova
131	C.A.R.	Ukraine	Georgia	Liberia
132	Liberia	Georgia	Ukraine	Tajikistan
133	Zambia	Zambia	Zambia	Zambia
134	DR Congo	DR Congo	DR Congo	DR Congo
135	Zimbabwe	Zimbabwe	Zimbabwe	Zimbabwe

Source: HDI trends dataset and own calculations.

We chose the deviation-of-fit as our method to assess progress over time in the remaining analyses since it is capable of comparing the advancement trajectory of a country relative to countries it started out with at the beginning. This is particularly useful since, as we will see later, there has been convergence in HDI. Therefore, countries with different starting points are expected to grow at different rates.

A striking feature of the data is the relatively little overlap between top performers in growth and top performers in the non-income dimensions of human development. Among the top 10 performers (see table 4), most of them (7) are top achievers in the non-income dimensions, while three are top achievers in the income dimension. Only South Korea and Indonesia are is a top achievers in both dimensions.. This ranking differs greatly from the top 13 performers in the Spence Commission, which measured sustained growth of at least 7 percent over at least a 25 year period. Our top ten performers are more geographically diverse, including only four of the success stories touted by the Commission on Growth and Development.

Table 4: Top and bottom movers in HDI, nonincome HDI and GDP, 1970-2010

Rank	HDI	Nonincome HDI	Income
1	Oman	Oman	China
2	China	Nepal	Botswana
3	Nepal	Saudi Arabia	South Korea
4	Indonesia	Libya	Hong Kong, China
5	Saudi Arabia	Algeria	Malaysia
6	Lao PDR	Tunisia	Indonesia
7	Tunisia	Iran	Malta
8	South Korea	Ethiopia	Viet Nam
9	Algeria	South Korea	Mauritius
10	Morocco	Indonesia	India
…			
126	Ukraine	Afghanistan	C.A.R.
127	Côte d'Ivoire	Côte d'Ivoire	Côte d'Ivoire
128	Georgia	Cameroon	Zambia
129	Moldova	C.A.R.	Madagascar
130	Tajikistan	DR Congo	Niger
131	C.A.R.	Congo	Kuwait
132	Liberia	Lesotho	Libya
133	Zambia	Swaziland	Djibouti
134	DR Congo	Zimbabwe	DR Congo
135	Zimbabwe	Zambia	Liberia

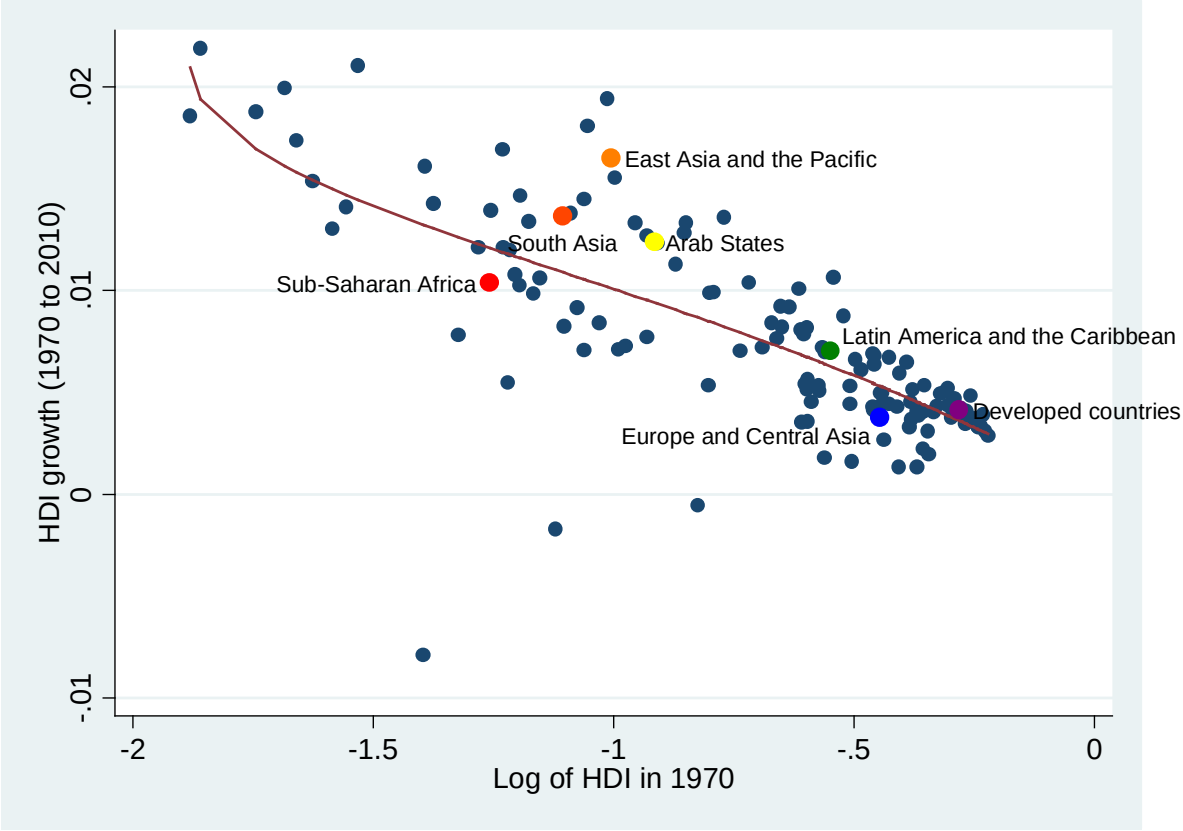
Note: The nonincome HDI comprises the health and education indices, equally geometrically weighted. Improvements in HDI and nonincome HDI are measured with the deviation from fit and improvements in income are measured by the annual percentage growth rate in per capita GDP.
Source: HDI trends dataset and own calculations.

In Figure 2 we assess the pace with which regions advance towards human development.[18] Out of the seven regions, only the developed countries have experienced HDI progress as would have been expected forty years ago. Two regions, Sub-Saharan Africa and Europe and Central Asia have performed below expectations and improved their HDI less than could have been expected from the outset. This is despite the good performance of some sub-Saharan countries – Ethiopia, Botswana, and Benin– which come in respectively at 11th, 12th, and 18th places. Four regions on

[18] When we discuss regional values, we are referring to regional averages weighted by population. The regions used are the six UNDP regions and a seventh group of developed countries, defined by those with "Very High Human Development" in the HDR2010.

the other hand have exceeded expectations, most notably East Asia and the Pacific. The Arab States and South Asia are also on a continued growth process, exceeding expectations, and also Latin America and the Caribbean performed marginally better than expected.

Figure 2: HDI performance relative to expectations forty years ago and cohort performance



Source: HDI trends dataset and own calculations.

3.2. Convergence in Human Development

Generally, whether the gap between developed and developing countries has narrowed, and the extent of which, if at all, is answered by looking at some measure of convergence, which shows how far apart countries are from each other and whether less developed countries are advancing more rapidly than rich ones. A vast body of literature in growth empirics distinguishes between

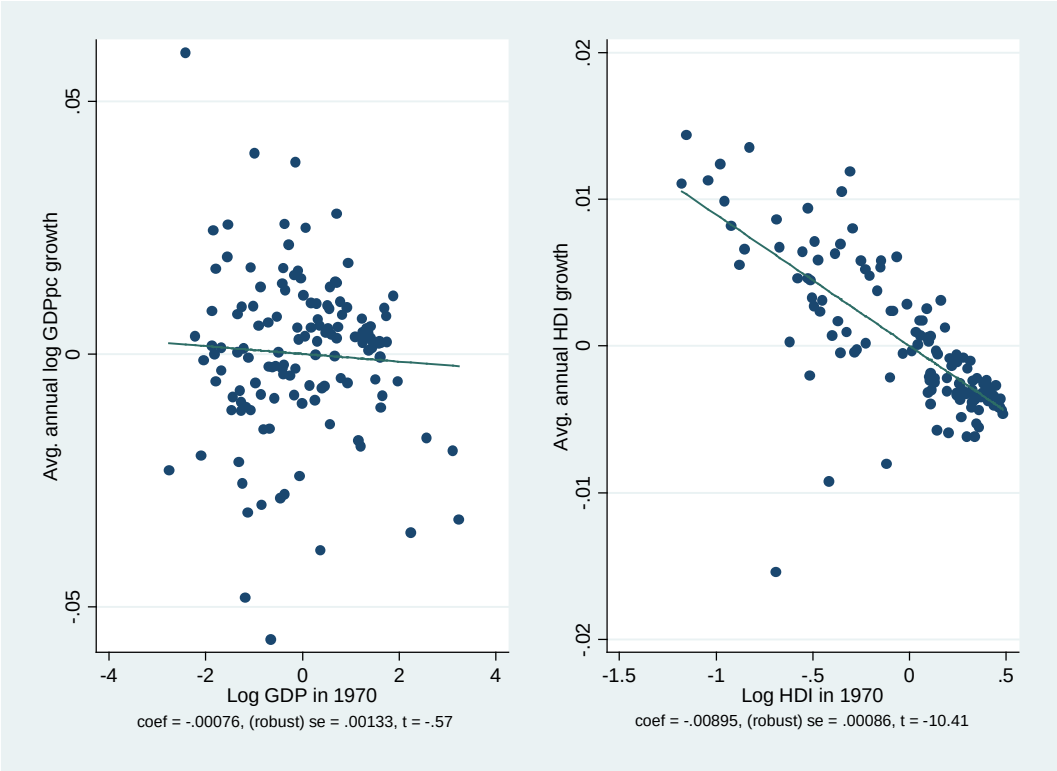
two kinds of convergence (see Barro and Sala-i-Martin, 1992). The two competing definitions are *beta convergence*, where the association between income growth and the initial level of income is negative (see e.g. Mankiew et al., 1992; Sala-i-Martin, 1996; and Evans and Karras, 1997) and *sigma convergence*, where the dispersion across economies falls as time advances (see eg. Higgins et al., 2006).

Using GDP to investigate cross country convergences has led to the finding that gaps are in fact not closing (eg. Pritchett 1997; UN-DESA 2006; and Ocampo, Vos and Sundaram 2007).[19] In our analysis we also find no signs of beta convergence in income (see figure 3 and table 5) and find that income dispersion is in fact increasing over time (see table 6).

The HDI reveals a different story from the GDP as it shows that overall, poor countries are catching up with rich countries (figure 3). Beta convergence tests (see Barro and Sala-i-Martin 2003), which compare rates of change of different indicators with initial values, detected convergence in the aggregate HDI and nonincome dimensions as well as for all its composite variables, with the exception of income.

[19] For example Pritchett 1997; United Nations Department of Economic and Social Affairs 2006; Ocampo, Vos and Sundaram 2007.

Figure 3: Convergence of HDI components, 1970-2010



Source: HDI trends dataset and own calculations.
Note: Estimations are robust OLS regressions.

Table 5: Beta convergence test: Impact of initial value on performance, 1970-2010

	HDI	niHDI	GDP
constant	0.0058	0.0097	0.0225
coefficient	-0.0033	-0.0085	-0.0008
p - value (coeff.)	0	0	0.568
obs	135	135	135
R - squared	0.1141	0.4955	0.0033

Source: HDI trends dataset and own calculations.
Note: Figures presented reflect the outcome of an OLS regression where the initial values of the HDI and components are on the right hand side and the improvements in these dimensions on the left hand side.

One might naturally suspect that convergence is a logical result of the HDI being bounded at one, or by the indicators—like life expectancy or literacy—that have natural upper bounds.[20] The argument can be made that most developed countries were already close to the upper bound of the HDI and thus had less room to grow in the HDI. However, it is important to note that even though the HDI is bounded above by 1, this does not mean that progress near this bound is limited, because the HDI upper bound is in fact the result of a normalization which has no effect on rates of change. Thus, mathematically the HDI formula does not impose a tendency towards automatic convergence.

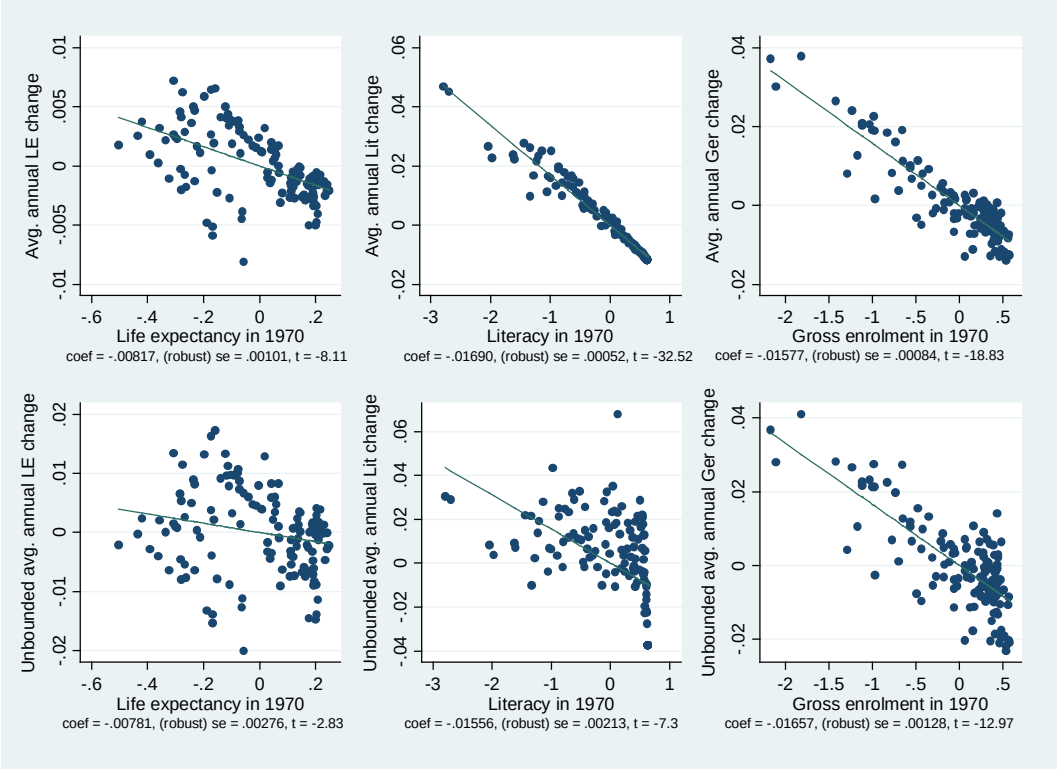
This is distinct from the issue of whether the variables used in the HDI have natural bounds. It is evident that some of them do. To evaluate whether this generates the convergence, we unbounded the variables through a logit transformation $lx = \ln\left(\frac{x}{\bar{x}-x}\right)$, where x is the variable in question and $\bar{x}$ denotes its upper bound, and confirmed the convergence results. Beta convergence tests associated with the logit transform of literacy and gross enrolments reject the hypothesis of no convergence with p-values of less than 1 percent for all three variables (see figure 4). Thus, while the natural upper bounds nonetheless contribute to convergence, we can preclude that they are the drivers behind our results corroborating the existence of convergence. Moreover, even if statistical tests would have confirmed that upper bounds on these variables in fact generate convergence, the substantive result—that education and health outcomes are becoming more alike in poor and rich countries—still holds true.

Despite the observed convergence, there has been great variability in HDI performance. A fourth of the countries in our data set experienced HDI growth of more than 65 percent from

[20] Whether such a limit exists for longevity is debatable. Oeppen and Vaupel 2002 show that female life expectancy in the top ranked country has advanced at a steady annual pace of 3 additional months per year over the past 160 years, with no deceleration in technical progress in expanding the length of life.

1970 to 2010 while another fourth grew less than 20 percent. While three countries experienced negative growth over this forty year period, ten have seen negative growth rates since 1990.[21] This variability is true even for countries starting with very similar HDIs in 1970 experienced very different growth in human development. Half of the variation in HDI progress is unexplained by countries' starting level in 1970. This result suggests the relevance of country specific factors such as institutions, geography, and polices as important for understanding performance.

Figure 4: Convergence of HDI components, 1970-2010



Source: HDI trends dataset and own calculations.
Note: Estimations are robust OLS regressions.

In summary, beta convergence analysis has shown a statistically significant decline in the relationship between initial levels and log changes not only for the aggregate indices, but also for composite measures, except income.

[21] These countries are the Congo, the Democratic Republic of the Congo, Georgia, Kyrgyzstan, Moldova, Swaziland, Tajikistan, Ukraine, Zambia, and Zimbabwe.

Turning to the concept of sigma convergence, table 6 shows how most differences in people's well-being have gradually shrunk between developing and developed countries, confirming the general picture painted by the beta convergence analysis. Health and education outcomes have converged, but income per capita levels have again diverged.

Table 6: Standard deviation of HDI components, 1970–2010

year	GDP	Life	Literacy	GER
1970	1.17	0.20	0.71	0.57
1980	1.24	0.18	0.57	0.47
1990	1.26	0.17	0.45	0.41
2000	1.34	0.17	0.35	0.34
2010	1.33	0.16	0.28	0.27

Note: Numbers presented are the standard deviation of the logarithms of the variables.
Source: HDI trends dataset and own calculations.

3.3. Lack of correlation between economic growth and human development

It is well-known that there exists a strong correlation between the level of per capita income on the one hand and the HDI and its components on the other. [22] To some, this suggests the existence of a stable structural relationship linking both variables.[23] Even if one does not read causality into this relationship, one could still conclude from such a structural relationship that a strategy to further health and education would be likely to fail if it does not also generate high growth.

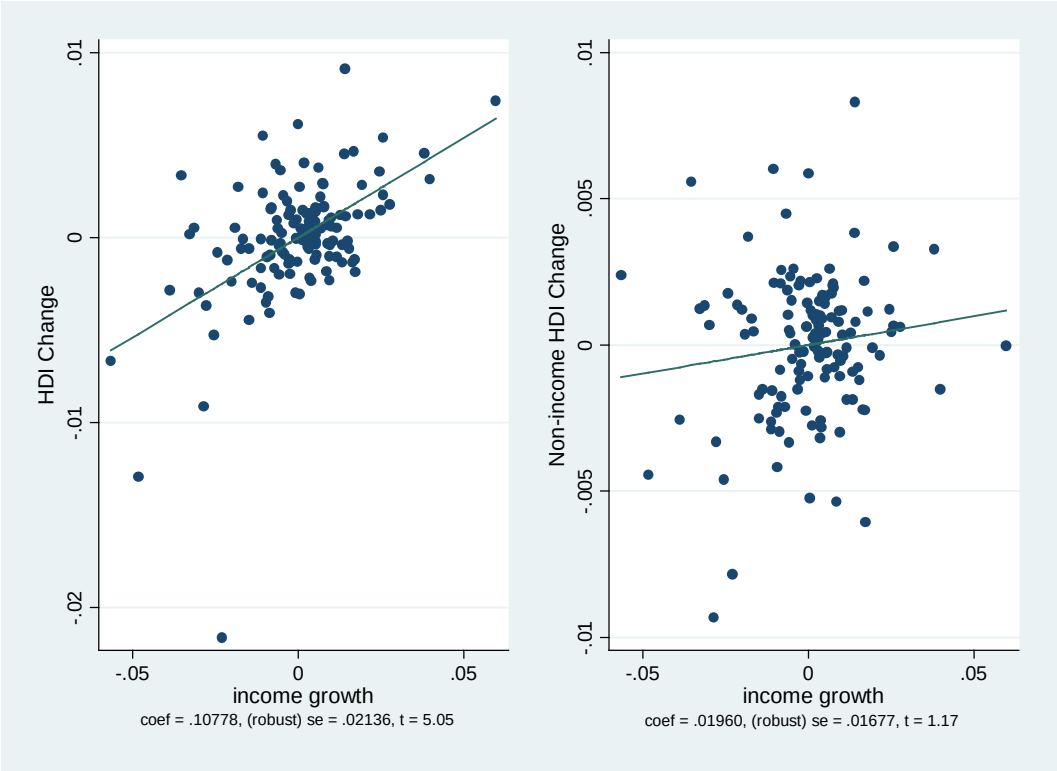
[22] The correlation is positive and statistically significant at the 1% level for GDP and literacy, GER, life expectancy. The correlations are 0.38, 0.46, and 0.57, respectively.

[23] See also: Ravallion, M. 1996. "How Well Can Method Substitute for Data? Five Experiments in Poverty Analysis." *The World Bank Research Observer* 11(2): 199-221; Srinivasan, T. N. 1994. "Human Development: A New Paradigm or Reinvention of the Wheel?" The American Economic Review 84(2): 238-43.; Justin Wolfers post on the Freakonomics Blog: http://freakonomics.blogs.nytimes.com/2009/05/22/what-does-the-human-development-index-measure/; and Francisco Rodriguez's response: http://freakonomics.blogs.nytimes.com/2009/06/01/another-perspective-on-the-human-development-index/.

However, looking at the correlation in levels is only one way of ascertaining whether there is a structural relationship between two variables. If the structural relationship existed, one would also expect to see a correlation in changes over time. Yet this does not happen with the human development data.

First, it is important to distinguish two questions. By construction, a third of the changes in the HDI come from economic growth, so not surprisingly there will be a correlation between improvements in the HDI and economic growth. A more interesting exercise is to compare growth rates with changes in the nonincome dimensions of human development. For this exercise, we use an index calculated with only the equally weighted health and education variables of the HDI, which we term "nonincome HDI." (figure 5). This correlation is remarkably weak and statistically insignificant. In fact, the correlation between changes in the nonincome HDI and economic growth is negative (-0.30) and is statistically significant at one percent. However, this measure may be biased by the fact that less developed countries tend to have faster rates of improvement in the HDI. Thus in figure 5 we use the deviation-from-fit measure to account for different HDI starting points. The corresponding correlation is 0.13 and is not statistically significant.

Figure 5: Economic growth and HDI, 1970–2010



Note: Graphs show results from deviation-of-fit analysis of changes; income is per capita GDP. Estimations are robust OLS regressions.
Source: HDI trends database and own calculations.

A commonly held hypothesis is that growth is necessary but not sufficient for improvements in health and education and that the lack of sufficiency explains the low correlation. One way to understand whether this is the case is by looking at countries with very poor growth experiences: for example, countries that have contracted over the past four decades. If growth was an indispensable precondition for progress in health and education, we would not see countries undergoing declines in GDP progressing in health and education. But countries with negative growth on average also saw substantial improvements in literacy, growth enrolments and life expectancy. Togo, Iran and Venezuela experienced income declines, yet their life expectancy grew by an average of 14 years and their gross school enrolments by an average of 31 percentage points since 1970. For the 18 countries that saw a fall in GDP, their average life expectancy rose

11 years, their gross enrolment rose 22 percentage points, and their literacy rate increased 45 percentage points. In fact, Libya had the fourth best performance in non-income HDI while having the fourth worst performance in GDP out of all countries from 1970 to 2010.

Thus, we have a puzzle: two alternative measures of a structural relationship give different results: the correlation in levels is consistent with the existence of a structural relationship; the correlation in changes is not.

Georgiadis, Pineda and Rodriguez (2010) attempt to reconcile this puzzle for the case of life expectancy. They argue that the relationship between growth and changes in life expectancy has broken down for low and some medium HDI countries. They argue that the development process has changed over time and that the processes through which people became healthier and more educated forty years ago are no longer the key processes at the present moment. Further, they argue that the relationship at higher HDI levels is much weaker than previously thought and with more countries boosting their progress and reaching higher echelons of human development, the association to income growth is less strong. Their analysis is based on a calibration exercise that shows that the breakdown and flattening out of the relationship is the only hypothesis consistent with several stylized facts.[24]

One important caveat should be noted. Any observed correlation between growth and changes in human development does not imply causation in a specific direction—even if growth always

[24] They contrast the ability of different data generating processes (DGPs) for life expectancy to replicate the patterns observed in the actual data. In particular, they initially focus on two polar DGPs: One in which per capita income is the sole determinant of life expectancy (the stable Preston curve), and another one in which the evolution of life expectancy is entirely independent of per capita income (the breakdown of the Preston curve). As none of these polar DGPs is able to replicate the patterns observed in the actual data, they investigate a third DGP in which per capita income is of no importance for the determination of life expectancy in countries far away from the health technology frontier, but may be of some (even though very small) importance for countries close to the health technology frontier.

went with improvements in health and education, one would not know whether this meant that growth was leading to broader improvements in the quality of life or that the improvement in health and education made societies more productive.

3.4. Underperformance in Human Development

We examine why certain countries underperformed in promoting human development. As we saw in section 3, there is a general trend for countries to improve their HDI levels over time. But we also saw that countries starting out at different levels of human development perform differently. In this section, we present a measure of underperformance that takes both a country's performance over time and its starting point into account.

We define underperformance as follows. We take 1970 as our base year. The distribution of the HDI in 1970 is split into quartiles, creating four groups to be added as explanatory variables. These, along with a time trend,[25] form the determinants of the predicted path of human development for each country given by the evolution of the logistic transformation of its HDI. Note that this exercise is similar to the definition of deviation –from-fit, in that it compares a country to its starting point, but also imposes some more structure on the projected trajectory. Next, if we find that a country's growth in HDI is one standard deviation below the predicted path, measured among all other countries that also performed below the predicted path, we say that country has underperformed.[26] The following equation illustrates this process.

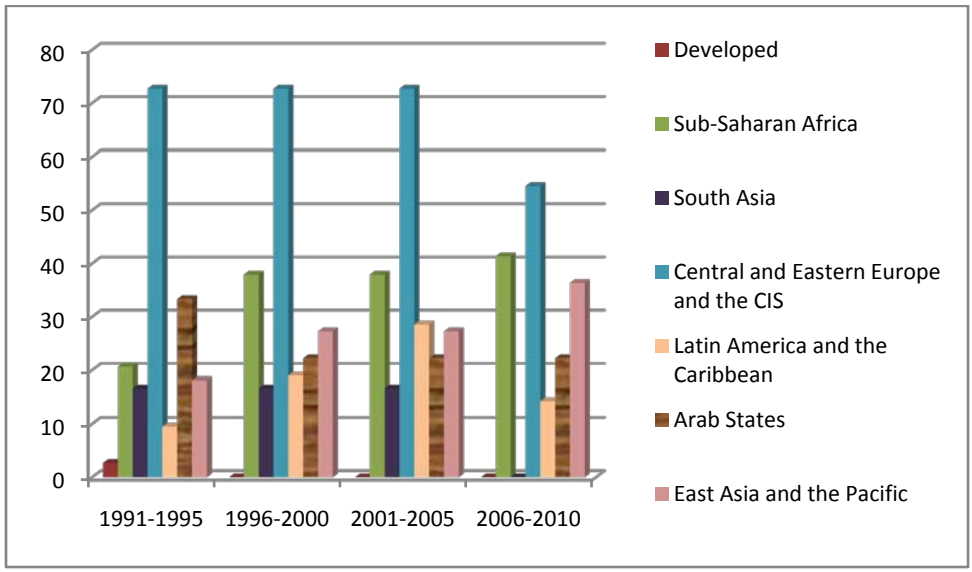
$$logitHDI_t = \beta_0 + \beta_1 * year + \beta_2 * Q1_{1970} + \beta_3 * Q2_{1970} + \beta_4 * Q3_{1970} + \beta_5 * Q4_{1970} + \epsilon_t$$

[25] This approach similar to the one taken by Asher and Daponte (2010).
[26] This is only calculated since 1990.

where $logitHDI_t$ is defined as $ln(\frac{hdi}{1-hdi})$, Q1 is the "Low Human Development" quartile, and Q4 is the "Very High Human Development" quartile.

Which countries succeeded—and which underperformed—in promoting human development? Certain regional patterns are present. Underperformance was highest in Europe and Central Asia, with deterioration on several fronts in the first decade of transition. By 2000 more than two-thirds of countries were doing significantly worse than would be expected given their starting point. Even in 2006-2010 more than half the countries in that region have been underperforming—as have more than four in ten countries in Sub-Saharan Africa, one in three in East Asia and the Pacific, one in four in the Arab States, and one in seven in Latin America and the Caribbean. No South Asian country was underperforming in 2010.

Figure 6: Underperformance by region, by five year periods, from 1990-2010



Source: HDI trends dataset and own calculations.

Table 7: Correlates of Underperformance in Human Development

Correlates of Underperformance	underperformance	no underperformance
HDI 1970	0.54	0.53
HIV prevalence rate*	2.9	1.3
Democracies with alternation*	0.4	0.5
Health expenditure (% of GDP)*	3	3.6
Education expenditure (% of total budget)*	9.7	12.3
Total expenditure (% of GDP)	25.7	27.4
Value of natural resources exports (US$ per worker)*	0.9	1.8
ODA received (% of GNI)*	7.3	5
Male/female education attainment ratio	1.6	1.6
Years in Conflict	1.4	1.1
Total observations	46	89

Note: * denotes a significant difference between underperforming countries and the rest at the 5 percent level. The number of countries can change across indicators, depending on the sample size. Numbers represent averages, except for the case of HDI, which presents the initial value in 1970.
Source: Authors' calculations based on the HDI trends database, World Bank (2010), UN Statistics Division (2010), UCDP and PRIO (2009), and Cheibub, Gandhi, and Vreeland (2009).

Next, we correlate the measure of underperformance with different potential determinants to understand what factors could be associated with performance in HD. A basic comparison across groups shows that underperforming countries had similar initial levels of human development to those performing as or better than expected. Therefore, they diverge from the better performers because of their slower rate of progress rather than because of their initial condition. On average, they spend less on health and education and tend to be less democratic. They have higher HIV prevalence rates—a result related to the high incidence of underperformance in Southern Africa. Poor performers are on average less endowed than other countries with natural resources, suggesting that the "resource curse" may not apply to human development, a result confirmed by more systematic research.[27] Underperforming countries have a higher incidence of civil war, although this difference is not statistically significant, likely because of the heterogeneity of civil war experiences. We also find that underperforming

[27] Pineda and Rodriguez (2010).

countries receive more aid on average, a result that may appear puzzling but likely reflects the fact that aid is directed toward lagging countries.

We found that underperforming countries spent on average almost two percentage points of GDP less than other countries, though this difference was not statistically significant. What was statistically significant, however, was the percent of GDP governments spent on health and education. Underperforming countries spent 3% of GDP on health and 9.7% on education, whereas other countries spent 3.6% and 12.3% respectively. This lack of public investment can negatively affect growth in human development in a variety of known and unknown ways. Principally, when governments under-invest in their people, social unrest is more likely to occur. This unrest can come from the growing inequality in education, health, and inevitably income, which results from a lack of public investment.

Democracy, too, is positively related growth in human development. While we don't argue for causality—the data limits our ability to establish causality for any of our correlates—we find that underperforming countries on average are less likely to be a democracy.[28] Our findings also show that the HIV/AIDS epidemic has had a significant, detrimental effect on the world, specifically Sub-Saharan Africa, in all dimensions of human development. While we find a negative relationship between HDI and aid received as a percent of GNI, this finding should not be interpreted as causal. A likely cause of the relationship is due to poor and struggling countries receiving the most aid.

[28] In this definition, we restrict to what are called "democracies with alternation" to distinguish from countries where one party has kept control as long as the system of government has been in place. This is because democracies without alternation have yet to show the party in power would be willing to peacefully and democratically give up power. This builds on an index created by Cheibub, Gandhi, and Vreeland (2009).

Countries with major natural resource deposits are often thought to suffer from their overdependence on them—the so-called "Natural Resource Curse." This economic deterioration is thought to come from overvalued exchange rates, excessive rent-seeking and an under-reliance on the country's citizens for tax revenue. The existence of the curse for income has recently come under severe scrutiny.[29] In contrast, we found a statistically significant, positive relationship between the value of natural resources exported and performance in human development. Pineda and Rodriguez (2010) study this relationship in greater detail, and argue that in general natural resource endowments lead to positive performance on the HDI – in contrast to the traditional result in incomes.

No previous studies on underperformance have been conducted using the HDI as the principal measure of a country's success. However, many studies have looked at closely related areas to understand why certain countries fail or succeed in promoting economic and social progress.

4. Final Remarks and Conclusions

The HDI trends dataset we presented in this paper allows new insights into questions of long-term performances of 135 countries over the last 40 years. We found overall progress in the world as measured by the HDI, with most of the world's denizens being better off today than at any point in time in recent history. Notwithstanding, we observe significant variability in human development progress and even some country exceptions to the general upwards trend.

In addition, our analysis reveals three main results. First, top performers in HDI differ from conventional top performers based on per capita income growth. Most of the top performing HDI

[29] See Lederman and Maloney (2007).

countries achieve this status predominantly due to improvements in nonincome dimensions, albeit some also manage to significantly advance via income growth.

Second, developing countries are making great strides towards bringing their human development levels in line with developed countries; they increased their education and their health performances at a faster pace than developed countries (which did also improve). Convergence was observed for all HDI components but income - which in fact diverged further between rich and poor countries.

Third, economic growth is not significantly correlated with improvements in non-income dimensions of human development, even over a long (forty year) period. The idea that some growth is necessary for improvements in non-income human development is also at odds with a number of examples, including of countries with negative economic growth and above-average improvements in health and education.

We also honed in on countries which underperformed compared to what could have been reasonably expected from them at the outset. We identified a number of associated factors that concurred with a country's underperformance, such as HIV prevalence, low social expenditures and the state of democracy of a country.

Bibliography

Anand, S. and A, Sen. 2000. “The Income Component of the Human Development Index.” Journal of Human Development and Capabilities 1(1): 83–106.

Asher, J., and B. Daponte. 2010. “A Hypothetical Cohort Model of Human Development.” Human Development Research Paper 40. United Nations Development Programme, Human Development Report Office, New York.

Barro, R. J. and X. Sala-i-Martin. 1992. “Convergence.” Journal of Political Economy 100, 223–251.

Barro, R. J., and X. Sala-i-Martin. 2003. “Economic Growth.” 2nd edition. Cambridge, MA: MIT Press.

Cheibub, J. A., J. Gandhi, and J. R. Vreeland. 2009. “Democracy and Dictatorship Revisited Dataset.” University of Illinois at Urbana-Champaign.netfiles.uiuc.edu/cheibub/www/DD_page.html. Accessed 15 April 2010.

Choi, J., Kovacevic, M., and F. Rodriguez. 2010. “The New Human Development Index: A comparison with older methodologies.” Mimeo.

Durlauf, S., P. A. Johnson, and J. Temple. 2005. “Growth Econometrics.” In Handbook of Economic Growth, eds. P. Aghion, and S. Durlauf. Amsterdam: Elsevier.

Easterly, W. 2009. How the Millennium Development Goals are Unfair to Africa. World Development , 37 (1), 26–35.

Evans, Paul & Karras, Georgios, 1997. "International integration of capital markets and the cross-country divergence of per capita consumption," Journal of International Money and Finance, Elsevier, vol. 16(5), pages 681-697.

Georgiadis, G., J. Pineda, and F. Rodríguez. 2010. “Has the Preston Curve Broken Down?” Human Development Research Paper 32. United Nations Development Programme, Human Development Report Office, New York.

Gertner, J. 2010, May 10. The Rise and Fall of the G.D.P. The New York Times , p. 60.

Gray, G., & Purser, M. 2010. “Human Development Trends since 1970: A Social Convergence Story.” Human Development Research Paper No. 2 . New York: United Nations Development Programme, Human Development Report Office.

Heleniak, T. 2010. Human Development Indicators – USSR, Yugoslavia, Czechoslovakia, 1970 – 1990. Commissioned background paper for the HDR 2010.

Higgins, M. J., Levy, D., and Young, A. T. 2006. Growth and Convergence Across the U.S.: Evidence from County-Level Data. Review of Economics and Statistics 88.

Lederman, D, and W. F. Maloney. "Neither Curse nor Destiny: Introduction to Natural Resources and Development." Natural resources, neither curse nor destiny. Ed. Daniel Lederman and William F. Maloney. Palo Alto, CA: Stanford Economics and Finance, an imprint of Stanford UP, World Bank, 2007.

Maddison, A. 2010. Historical Statistics of the World Economy: 1–2008 AD. Paris: Organisation for Economic Co-operation and Development.

Mankiw, N Gregory & Romer, David & Weil, David N, 1992. "A Contribution to the Empirics of Economic Growth," The Quarterly Journal of Economics, MIT Press, vol. 107(2), pages 407-37, May.

Milanovic, B. (2003), "The Ricardian vice: Why Sala-i-Martin's calculations of world income inequality are wrong." Development Research Group, World Bank, Washington, DC.

Ocampo, J. A., R. Vos, and J. K. Sundaram. 2007. Growth Divergences: Explaining Differences in Economic Performance. New York: Zed Books for the United Nations.

Oeppen, J., and J.W. Vaupel. 2002. "Broken Limits to Life Expectancy." Science 296(5570): 1029–32.

Pineda, J. and F. Rodriguez. 2010. "Curse or Blessing? Natural Resources and Human Development." Human Development Research Paper 4. United Nations Development Programme, Human Development Report Office, New York.

Pritchett, L. 1997. "Divergence, Big Time." The Journal of Economic Perspectives 11(3): 3–17.

Ranis, G., & Stewart, F. 2010. "Success and Failure in Human Development, 1970–2007." Human Development Research Paper No. 10 . New York: United Nations Development Programme, Human Development Report Office.

Ravallion, M. 1996. "How Well Can Method Substitute for Data? Five Experiments in Poverty Analysis." The World Bank Research Observer 11(2): 199-221.

Raworth, K., and D. Stewart. 2002. "Critiques of the Human Development Index: A Review." In Readings in Human Development, Concepts, Measures and Policies for a Development Paradigm, eds. S. Fukuda-Parr, and A. K. Shiva Kumar. New York: Oxford University Press.

Riley, J. C. 2005. "Poverty and Life Expectancy." Cambridge, UK: Cambridge University Press.

Rodrik, D. 1999. “Where Did All the Growth Go? External Shocks, Social Conflict, and Growth Collapses.” Journal of Economic Growth 4(4): 385–412.

Rodriguez, F. 2007. “Cleaning Up the Kitchen Sink: Growth Empirics When the World is Not Simple.” Working Paper. Wesleyan University, Middletown, CT.

Rodriguez, F. and J. Wolfers. 2010. “What Does the Human Development Index Measure?” New York Times Blog: Freakonomics. Posted June 1, 2009. http://freakonomics.blogs.nytimes.com/2009/06/01/another-perspective-on-the-human-development-index/

Sala-i-Martin, X. 1996. “Regional Cohesion: Evidence and Theories of Regional Growth and Convergence.” European Economic Review 40, 1325–1352.

Sala-i-Martin, X. (2002), “The World Distribution of Income.” NBER Working paper No. 8905, May.

Srinivasan, T. N. 1994. “Human Development: A New Paradigm or Reinvention of the Wheel?” The American Economic Review 84(2): 238-43.

UCDP and PRIO (Uppsala Conflict Data Program and International Peace Research Institute). 2009. “UCDP/PRIO Armed Conflict Dataset.” Centre for the Study of Civil War, Oslo. www.prio.no/CSCW/Datasets/Armed-Conflict/UCDP-PRIO/. Accessed 7 June 2010.

UNDESA (United Nations Department of Economic and Social Affairs). 2006. “World Economic and Social Survey 2006: Diverging Growth and Development.” New York.

UN Statistics Division (United Nations Statistics Division). 2010. United Nations Commodity Trade Statistics Database—UN Comtrade. New York. comtrade.un.org/db/dqBasicQuery.aspx. Accessed 3 August 2010.

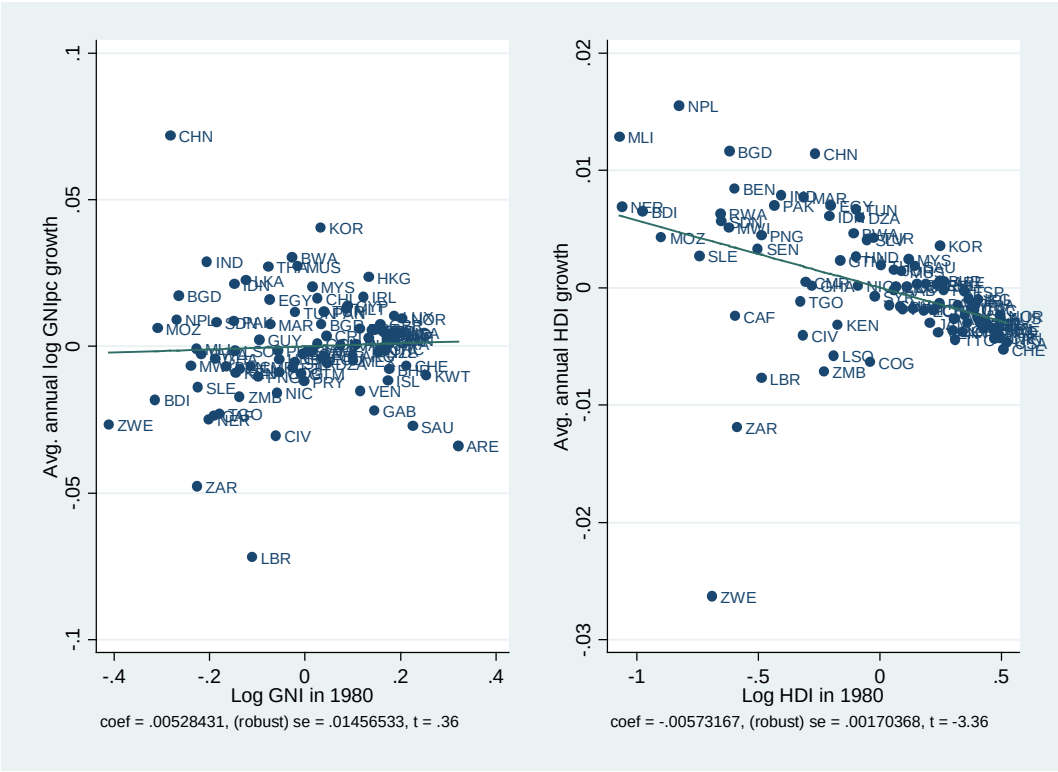
Wolfers, J. 2010. “What Does the Human Development Index Measure?” New York Times Blog: Freakonomics. Posted May 22, 2009. http://freakonomics.blogs.nytimes.com/2009/05/22/what-does-the-human-development-index-measure/.

World Bank. 1993. “The East Asian Miracle: economic growth and public policy.” The International Bank for Reconstruction and Development/The World Bank. Washington, DC.

World Bank. 2010. “World Development Indicators 2010.” Washington, DC.

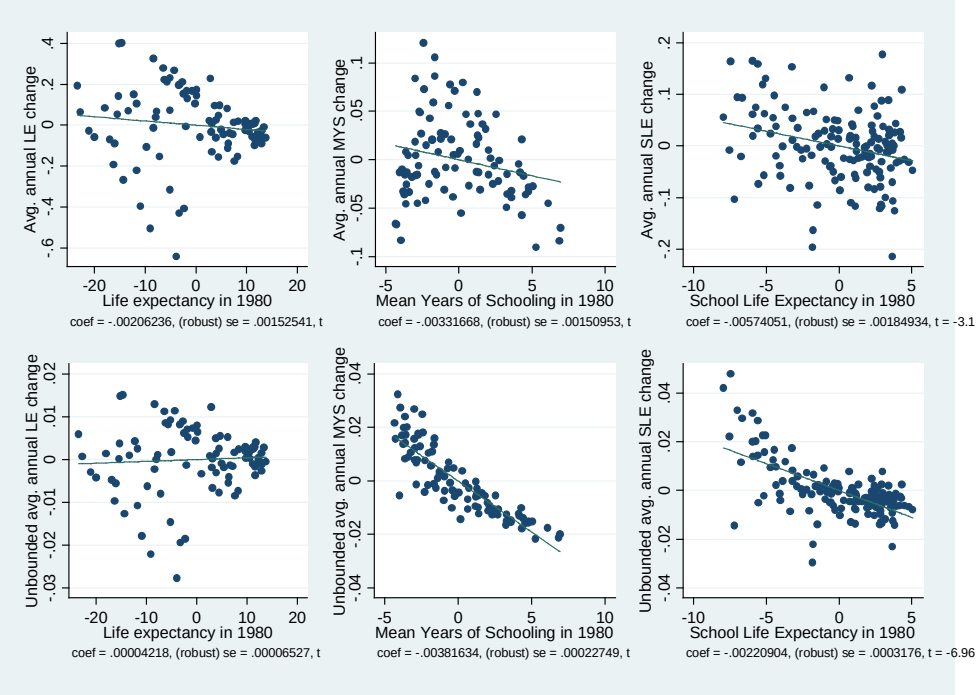
Appendix:

Figure A.1: Convergence of HDI components, 1980-2010 – official HDI from HDR2010



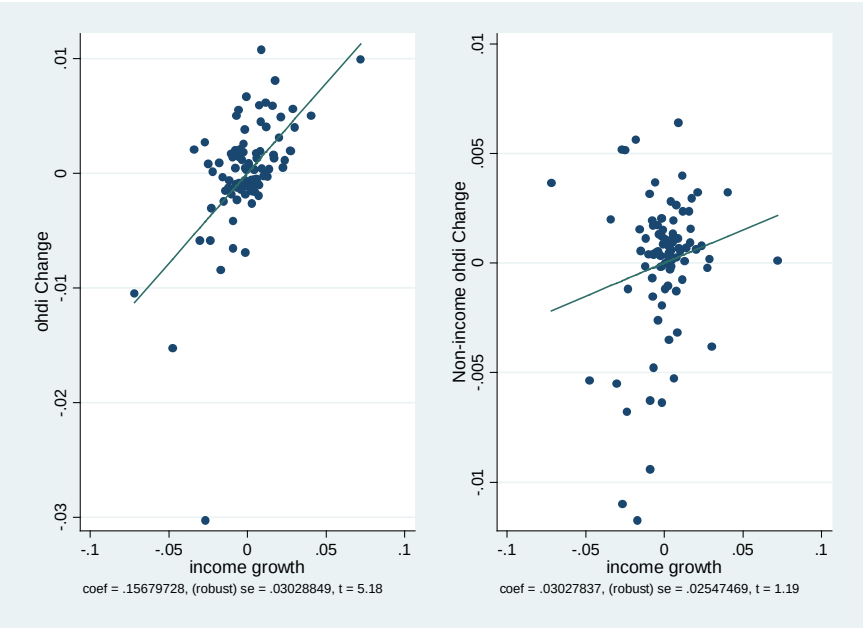
Source: HDI trends dataset and own calculations.

Figure A.2: Convergence of HDI components, 1980-2010 – official HDI from HDR2010



Source: HDI trends dataset and own calculations.

Figure A.3: Economic growth and HDI, 1970–2010 – official HDI from HDR2010



Source: HDI trends dataset and own calculations.

A note on data permutations

No indicator series other than life expectancy was complete for all countries and all years. For the other three variables, Gross Enrolment, Adult Literacy and GDP, we applied alternative data sources in order to expand the time and country coverage. Here is a brief description of the main manipulation to the data in order to have a balanced panel since 1970 to 2010 for all variables for the 135 countries.

GER: Gaps in the GER time series data are common. In the case that data at the beginning of our UNESCO-UIS master series was missing, we extrapolated the exact value of the first observed value of the series backwards up until 1970. Similarly, we extrapolated the last observed value of the series forward, if data at the end of the series was missing. These new data points were only created if the last observed value of a series was at least as late as 2000 and the first at least as early as 1980. We filled the missing values in between two data points with linear interpolation. In table A.1, we checked how sensitive our results are to an alternative extrapolation technique of gross enrolment. Instead of taking the last/first observed value and taking it back/forward, we linearly interpolated the last/first value. As shown in the table, the results are robust to this alteration.

Literacy: We first linearly interpolate direct national estimates with recent estimates based on its global age-specific literacy projections model compiled by UIS-UNESCO. We then compute the growth rates of additional archival literacy data from UIS-UNESCO and apply them to the levels of adult literacy from the master data, extending the series back to 1970 and forward to 2010. For the case in which there were no overlapping observations between the two series in one year and a growth rate imputation is thus made impossible, the level values from this archival data are

applied without permutation to the master data. Following these data unification steps, linear interpolation was again applied to fill missing values between any two observations.

Several countries that have attained high levels of adult literacy no longer collect and report literacy data. For these countries and for countries which report a value above 99 percent, we assume a 99 percentage value, following standard practice in the Human Development Reports.[30]

GDP: Because the GDP per capita data from WDI is neither extending far enough back, nor available for the most recent years, we calculated growth rates of corresponding GDP variables of other datasets and then retrospectively and prospectively applied them to the master data. The growth rate of the GDP variable *rgdpch* (which is constant prices through chain GDP data in 2005 prices from the Penn World Tables 6.3., PWT 6.3) was computed and applied to calculate the GDP back to 1970 in the case the data was of sufficient quality.

The data to complement the series up to 2010 is taken from the World Economic Outlook (WEO) database of the International Monetary Fund (IMF) of the April 2010 version. The variable used was GDP per capita controlled for PPP.[31] We calculated annual growth rates of the WEO GDP data and applied those prospectively to the WDI data, which in most cases was available until 2008. For some remaining countries, more than just the last two years were imputed using the WEO GDP data: For Brunei Darussalam, Iran and Kuwait, and Mauretania and Oman the last three years, for Qatar and the United Arab Emirates the last four years and for Zimbabwe the last five years.

[30] The countries which have achieved this level are: Albania, Armenia, Australia, Austria, Azerbaijan, Belarus, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Guyana, Iceland, Ireland, Italy, Japan, Kazakhstan, the Republic of Korea, Kyrgyzstan, Latvia, Lithuania, Luxembourg, Moldova, Netherlands, New Zealand, Norway, Poland, Russian Federation, Slovakia, Slovenia, Sweden, Switzerland, Tajikistan, Tonga, Ukraine, United Kingdom, and United States.

Similarly as we did for GER, we also calculated an alternative GDP series to check for the sensitivity of the results. In doing so, we converted the WEO-IMF data to real prices, by applying the GDP-deflator to the series. The growth rate of this constant variable was then calculated and applied to the most recently observed value. The correlation coefficient between the therewith established series with the original one was 0.9999 with both Pearson and Spearman type correlations. We calculated every result presented in this paper with both datasets (for the key results, see table A.1.) and found that the main findings do not change.

The combination of the results emerging from both an alternative GER and GDP extrapolation, presented on table A.1, also revealed that our results are robust to different extrapolation methods.

Table A.1: Data-extrapolation sensitivity check, 1970 - 2010

			hybrid HDI	hyrbid HDI with alternative extrapolation of:		
				GDP	GER	GDP and GER
convergence:	GDP	coefficient	-0.00076	-0.00078		
		SE	0.00133	0.00134		
		t	-0.57	-0.58		
	GER	coefficient	-0.01577		-0.01931	
		SE	0.00084		0.00126	
		t	-18.83		-15.29	
	HDI	coefficient	-0.00895	-0.00900	-0.00985	-0.01513
		SE	0.00086	0.00085	0.00098	0.00053
		t	-10.41	-10.58	-10.05	-28.61
Growth and HDI / nonincome HDI change:	HDI and income	coefficient	0.10778	0.10853	0.10444	0.10802
		SE	0.02136	0.02177	0.02320	0.02714
		t	5.05	4.99	4.5	3.98
	niHDI and income	coefficient	0.01960	0.01966	0.01918	0.01937
		SE	0.01677	0.01679	0.02204	0.02206
		t	1.17	1.17	0.87	0.88

Source: HDI trends dataset and own calculations.