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Human Assets Index Retrospective series : 2013 update

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Introduction

Human capital, a broad concept including education and health, plays a central role in economic development and human well-being. As a consequence, low human capital became one of the three criteria used by the United Nations Committee for Development Policy (UN-CDP) for identifying Least Developed Countries (LDCs)[1]. Since 1991, the UN-CDP has used a composite index to measure human capital at the country level. In 2003 this index was reshaped and was renamed the Human Assets Index (HAI) (see UN-CDP webpage on LDCs, and Guillaumont, 2009).

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1. The two other criteria are the GNI per capita and the Economic Vulnerability Index. See Guillaumont (2009) and UN-DESA-DPAD-CDP web-page on LDCs: http://www.un.org/en/development/desa/policy/cdp/index.shtml

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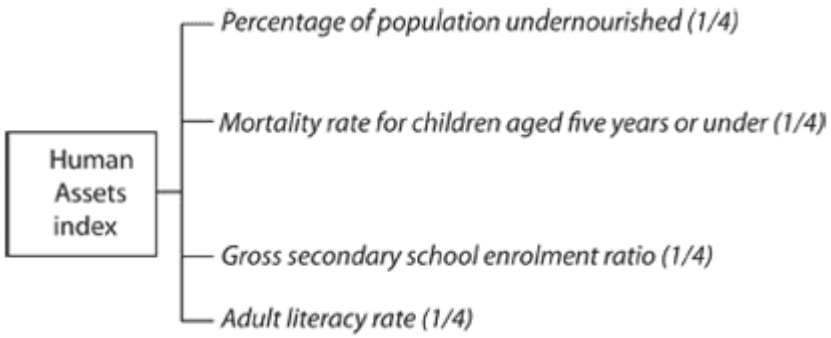
As shown in Figure 1, the HAI is a composite indicator which combines four indicators, two indicators of health and nutrition outcomes (Percentage of the population undernourished, Mortality rate for children aged five years or under) and two indicators of education (Gross secondary school enrolment ratio, Adult literacy rate).

Figure 1 – The four components of the Human Asset Index (Source: UN-CDP)



Numbers in parenthesis indicate the weight in the overall HAI.

Source: UN-CDP

The primary data for each variable are rescaled and converted into index values using a max-min procedure. The HAI is then calculated as the simple average of the four component indices so that they carry an equal weight of 25% in the HAI. The four components and the HAI then lie within the range 0 to 100.

The overall methodology and the four components of the HAI have remained unchanged since 2006. However, the bounds used in the max-min procedure were readjusted in 2009 and 2012 by the UN-CDP, following changes in the extreme values observed. Table 1 shows these changes between the 2009 and the 2012 Reviews.

The UN-CDP has currently released data for 130 developing countries for the triennial Reviews of 2006, 2009 and 2012. The data in these Reviews are not directly comparable because of changes in the limits used in the max-min procedure.[2]

[2] at the UNDP-DESA-DPAD LDCs data retrieval webpage
http://www.un.org/en/development/desa/policy/cdp/ldc/ldc_data.shtml

Table 1 – Changes in the bounds used in the min-max procedure

	2009 Review Bounds		2012 Review Bounds	
Components	Min	Max	Min	Max
Undernourishment Index	2.5	65	5	65
Under Five Mortality Index	10	240	10	175
Secondary School Enrolment	5.7	100	10	100
Literacy Index	15	100	25	100

Source: UN-CDP

Even if these methodological changes remain marginal, the analysis of long term trends in human capital levels requires the calculation of retrospective series with a constant definition over time, as was done three years ago by the Ferdi after the 2009 Review (Korachais, 2011)[3]. Retrospective series of the HAI were used by, among others, Guillaumont (2009, 2011, 2013), Guillaumont and Wagner (2012), Guillaumont, MacGillivray and Wagner (2013) and Wagner (2014).

The construction of retrospective series faces various challenges. The main one is historical data availability, which is especially weak for some developing countries. HAI is based on social statistics which are characterized by their scarcity as compared to economic statistics, which are used, for example, in the Economic Vulnerability Index retrospective series (Cariolle and Goujon, 2013). Following Korachais (2011) we use econometric tools to consistently impute missing data into the incomplete historical series.

In this update of the HAI retrospective series, we mainly rely on the methods used in Korachais (2011). We construct two sets of retrospective series:

- The first called "HAI FOS" (From Official Sources) is designed using official but uncompleted statistics (sometimes completed with simple interpolations).

- The second called "HAI WFG" (With Filled Gaps) expands the country/year coverage using econometric tools to generate missing data.[4]

However in the years since the work of Korachais (2011) some methods for generating data have become irrelevant due to the increasing availability of primary data since 2011. We also use the new bounds from the UNCDP's 2012 Review. The "HAI WFG" series are now made available for more than 130 developing countries at an annual frequency covering 1970-2011.

[3] The FERDI background paper on the retrospective HAI and the associated database are referenced on the UNDP-DESA-DPAD LDC data retrieval webpage. The CDP points out that "the FERDI data is meant for analytical purposes only. Due to differences in methodologies, data sources and data revisions, the FERDI historical time series may differ from the data used by the CDP and its secretariat in the triennial reviews of the list of the LDCs."

[4] Since series are completed with generated values from econometric estimates using explanatory variables such as the GNI per capita or the Gini coefficient, we advise using them for econometric analyses only very cautiously. "HAI FOS" series may not generate the same endogeneity bias.

This document details the methodology used to set up the HAI FOS and HAI WFG series. The first section presents some general results from the HAI retrospective series and the second section details the calculation of the four components.

1. Human assets index retrospective series

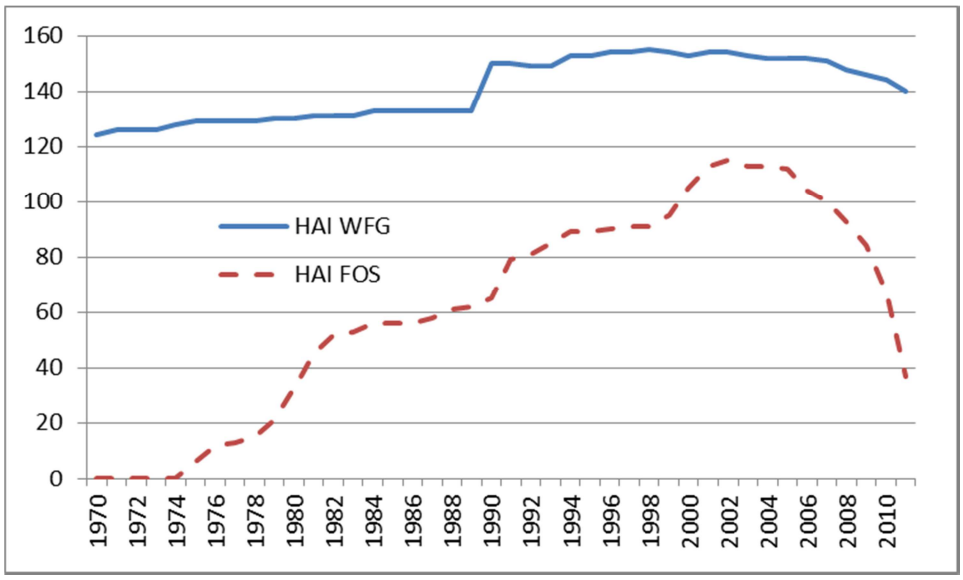
The HAI retrospective series include two databases. The first one called "HAI FOS" (From Official Sources) uses official but incomplete statistics. The second one "HAI WFG" (With Filled Gaps) extends the dataset using econometric tools to generate missing data.

Poor data availability for the Literacy Rate component results in a low sample size for the HAI FOS series. However, data availability increases over time. From the 1980s, the HAI WFG series are available for more than 130 countries, which is the number of countries covered by the UN-CDP data in the 2006-2012 Reviews.

Table 2 – Number of LDCs and Non-LDCs covered by HAI FOS and WFG, by decade

	HAI FOS			HAI WFG		
Decades	LDCs	Non-LDCs	Total	LDCs	Non-LDCs	Total
1970s	0	0	0	45	84	129
1980s	18	46	64	45	88	133
1990s	26	72	98	47	109	156
2000s	35	86	121	46	109	155

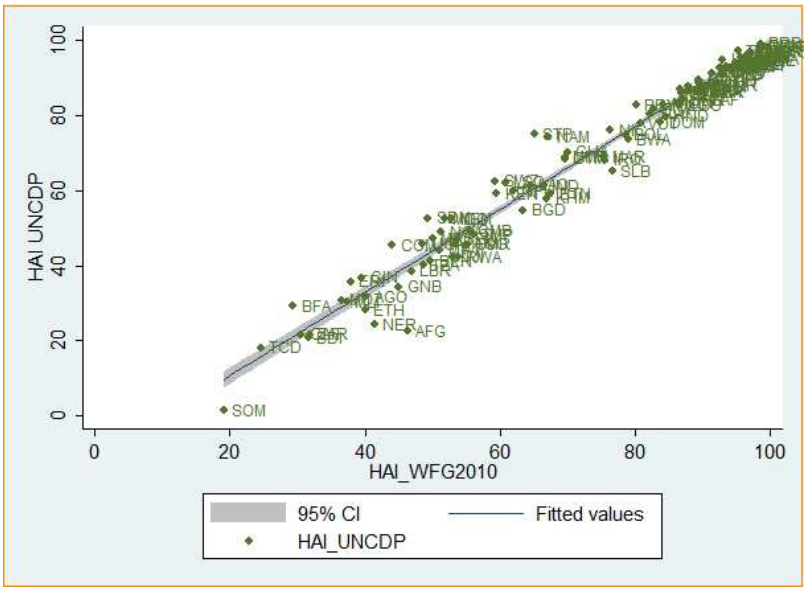
Figure 2 – Country coverage, HAI WFG and HAI FOS, number of countries



1.1. Comparison between UN-CDP and retrospective HAI WFG scores

As a first relevance check, we compare the scores between the UN-CDP HAI 2012 and the retrospective HAI WFG series for the year 2010 (this corresponds to the year of the data used by the UN-CDP Review 2012). Figure 3 shows a high correlation between the scores of the 130 countries covered by the two HAI, with a Spearman's rank correlation coefficient of 98.6%, with no extreme outlier. The marginal discrepancies that can be observed for some countries are mainly explained by the updating of primary data since the UN-CDP 2012 Review.

Figure 3 – Correlation between the scores from the HAI WFG and the UN-CDP 2012 Review HAI, for the year 2010, 130 countries.



1.2. Changes in the retrospective HAI scores: LDCs versus non LDCs

The trends in the HAI FOS and the WFG series are similar but differ marginally. These differences are mainly caused by low quality data and discrepancies in the data recorded for the Literacy Rate (see details in the section on this component).

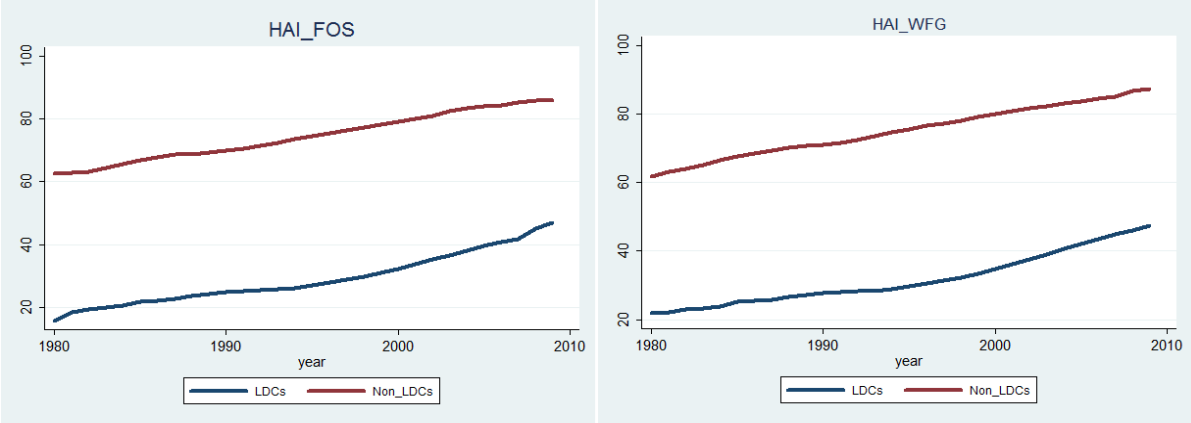
Table 3 shows the average levels of HAI FOS and WFG over the last three decades for LDCs and non-LDCs. For the sake of comparability, average levels were calculated for a common sample of 61 countries for which data are complete in both series over the three last decades (17 LDCs and 44 Non-LDCs).

Figure 4 shows a continuous improvement in HAI in recent decades, particularly for LDCs. However, according to both HAI series, a large gap remains between the averages of the two groups of countries.

Table 3 – HAI FOS and WFG averages for 17 LDCs and 44 Non-LDCs

	HAI FOS average		HAI WFG average	
Decades	LDCs	Non-LDCs	LDCs	Non-LDCs
1980s	21.9	66.1	24.4	66.8
1990s	27.2	74.0	29.8	75.1
2000s	38.1	82.2	41.2	83.4

Figure 4 – Changes in HAI FOS and WFG averages for 17 LDCs and 44 Non-LDCs



LDC and non-LDC group averages may mask considerable variation within each group. Figure 5 shows the distribution of the HAI WFG scores (country average scores by decade) for the two groups of countries. The two groups clearly follow two distinct distributions, with a limited intersection, suggesting that the HAI clearly discriminates these two groups.

However, the LDC curve has flattened over time, demonstrating an increase in the dispersion of the scores within the LDC group. Conversely, non-LDC scores are increasingly concentrated around the group's mean (as an increasing number of non-LDCs have come nearer to the HAI maximum of 100).

Figure 6 shows the changes in HAI between the 1980s and 2000s by country. Improvements in the HAI scores are higher in the MENA and Asia regions, than in Sub-Saharan Africa, where the majority of LDCs are situated.

Figure 5 – Changes in the distribution of HAI WFG for 45 LDCs and 88 non-LDCs

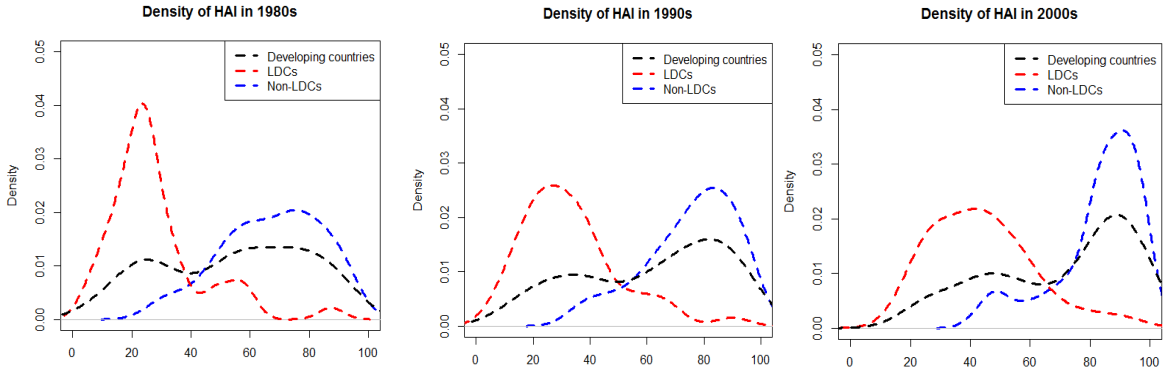
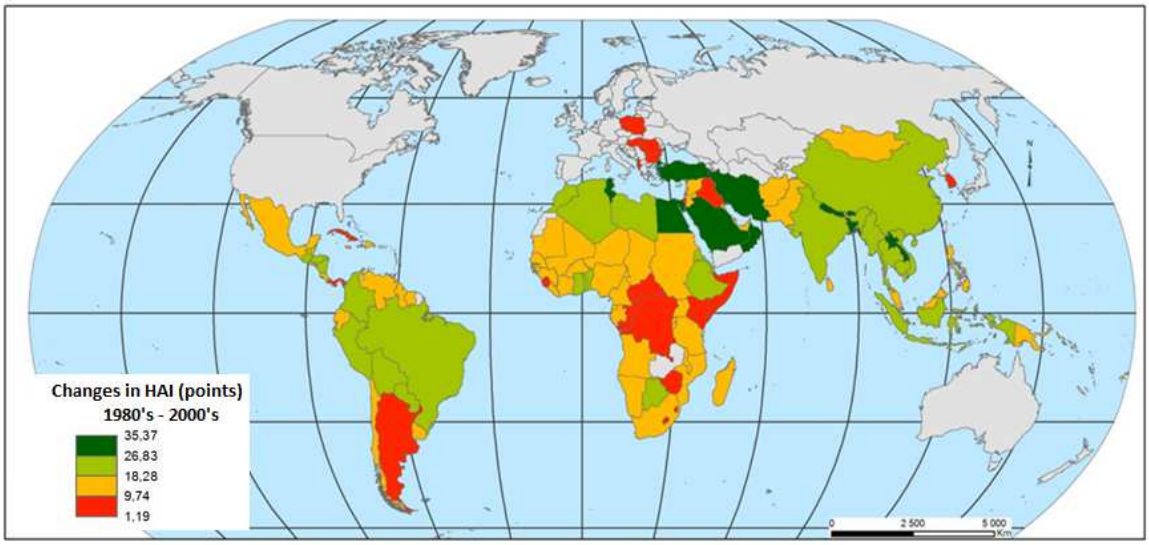


Figure 6 - Changes in the HAI WFG by country, 1980s-2000s



2. Undernourishment index

2.1. Definition

As indicated in the UN-DESA-DPAD definitions, the percentage of the population undernourished "provides information on the prevalence of undernourishment in the total population. It shows the proportion of the population whose dietary consumption continuously falls below an established minimum dietary energy requirement for maintaining a healthy life and carrying out light physical activity.[5] Undernourishment compromises the health status and educational achievement and has an important negative impact on productivity. This indicator is regularly reported by the United

[5] The average minimum energy requirement per person is about 1800 kcal per day. The exact requirement is determined by a person's age, body size, activity level and physiological conditions such as illness, infection, pregnancy and lactation (source: FAO).

Nations Food and Agriculture Organization of the United Nations (FAO), Food Security Statistics, available from http://www.fao.org/economic/ess/ess-fs/en/ and from http://data.un.org/

2.2. Data availability

The primary data about the proportion of undernourished people are available for 143 developing countries since 1991, and 145 countries since 2008 (source: UNSTATS).

Data for before 1991 are generated using data on kcal consumption that are available from 1961 to 2009 (source: FAO). Kcal consumption is available for 128 countries before 1992, and a larger number of countries for more recent years.

Table 4 – Data availability for Kcal consumption

Periods	1961-1991	1992-2005	2006-2009
Number of countries	128	151	148

2.3. Calculation principles for the retrospective series of the Undernourishment index

Undernourishment index U FOS

The FOS undernourishment index is retrieved from official sources. Missing data (for the years before 1991) are estimated using two simple econometric regressions predicting undernourishment prevalence from available information on the mean level of dietary energy consumption (kcal) and, when possible, on income distribution measured by the Gini index (Method 1 and 2).

Method 1 for U FOS (using kcal consumption and Gini)

The first econometric regression uses information on the average daily level of kilocalorie consumption per capita, and on income distribution (Gini index). Regression results are displayed on appendix I.

The following model is estimated using the Within estimator for the sample of countries/years with complete information on U, kcal, and Gini (2223 observations for 120 countries):

$$U_{1it} = \alpha_1 + \beta_1 * \overline{kcal_{it}} + \gamma_1 * Gini_{it} + \mu_{1i} + \varepsilon_{1it}$$

With U_{1it} prevalence of undernourishment in country i and year t

$\overline{kcal_{it}}$ mean level of energy supply, in kilocalories per capita and per day.

$Gini_{it}$ Gini coefficient

μ_{1i} Country fixed effect

ε_{1it} error term

Then the estimated coefficients are used to generate values for U for countries/years for which we have information on kcal and Gini only:

$$\widehat{U_{1it}} = \hat{\alpha}_1 + \hat{\beta}_1 * \overline{kcal_{it}} + \hat{\gamma}_1 * Gini_{it} + \hat{\mu}_{1i}$$

Method 2 for U FOS (using kcal consumption and country fixed effects)

Method 2 is similar to method 1 but is applied when the Gini index is missing. Regression results are also displayed in appendix I. The following model is estimated using the Within estimator (on 2698 observations for 145 countries):

$$U_{2it} = \alpha_2 + \beta_2 * \overline{kcal_{it}} + \mu_{2i} + \varepsilon_{2it}$$

and the generated values for U are:-

$$\hat{U}_{2it} = \hat{\alpha}_2 + \hat{\beta}_2 * \overline{\text{kcal}_{\text{it}}} + \hat{\mu}_{2i}$$

Undernourishment index U WFG

Data on kcal consumption are missing for about 20 countries (Afghanistan, American Samoa, Bhutan, Cayman Islands, Channel Islands, Congo Dem. Rep, Cook Islands, Equatorial Guinea, Guam, Iraq, Kosovo, Nauru, Oman, Palau, Papua New Guinea, Qatar, Somalia, South Sudan, Tonga, Turk and Caicos Islands, Tuvalu), which are excluded from HAI FOS series. We then use three additional methods to generate WFG series for these countries.

Method 3 for U WFG (using income level and Gini, former Method 5 in Korachais, 2011)

The missing data are estimated using an econometric regression predicting undernourishment from available information on the gross national income per capita (GNIpc), the Gini index, time, and country fixed effects.

The following model is estimated using Within estimator:

$$U_{3it} = \alpha_3 + \beta_3 * \ln(GNIpc_{it}) + \gamma_3 * \ln(Gini_{it}) + \delta_3 * t_t + \mu_{3i} + \varepsilon_{3it}$$

Where U is undernourishment retrieved from the FOS database (and not exclusively from primary data).

And U is then generated from:

$$\widehat{U_{3it}} = \hat{\alpha}_3 + \hat{\beta}_3 * \ln(GNIpc_{it}) + \hat{\gamma}_3 * \ln(Gini_{it}) + \hat{\delta}_3 * t_t + \hat{\mu}_{3i}$$

Method 4 for U WFG (using income level and Gini, former Method 6 in Korachais 2011)

Method 4 is similar to method 3 but for countries where no information is available on the prevalence of undernourishment nor on energy consumption for the whole period. The Within estimator cannot be used, and we cannot get country-fixed effects. So instead we exploit region fixed effects, using the OLS estimator:

$$U_{4it} = \alpha_4 + \beta_4 * \ln(GNIpc_{it}) + \gamma_4 * \ln(Gini_{it}) + \delta_4 * t_t + \mu_{4i} * region + \varepsilon_{4it}$$

And U is then generated from:

$$\widehat{U_{4it}} = \hat{\alpha}_4 + \hat{\beta}_4 * \ln(GNIpc_{it}) + \hat{\gamma}_4 * \ln(Gini_{it}) + \hat{\delta}_4 * t_t + \hat{\mu}_{4i} * region$$

Where "region" are a set of dummies for Middle East and North Africa (MENA), Sub Saharan Africa (SSA), South Asia (SA), East Asia and Pacific (EAP), Latin America and Caribbean (LAC) and Europe and Central Asia (ECA).

Method 5 for U WFG (using income level and region effect, former method 8 in Korachais).

This last method is used for countries where data are unavailable on undernourishment, kcal consumption, and Gini index for the whole period. The following model is then applied using the OLS estimator:

$$U_{5it} = \alpha_5 + \beta_5 * \ln(GNIpc_{it}) + \delta_5 * t_t + \mu_{5i} * region + \varepsilon_{5it}$$

And generated Undernourishment is:

$$\widehat{U_{5it}} = \hat{\alpha}_5 + \hat{\beta}_5 * \ln(GNIpc_{it}) + \hat{\delta}_5 * t_t + \hat{\mu}_5 * region$$

For some countries (for instance Russian Federation), data on GNIpc is unavailable for the period 1970-1989, which does not allow to predict Undernourishment for this period.

2.4. Data Sources for Undernourishment

Undernourishment

The most complete and up-to-date data on the prevalence of Undernourishment are provided by UNSTAT: Annual data of the proportion of undernourished people per country for the period 1991-2011. http://data.un.org or http://databank.worldbank.org

Kcal consumption

Energy kcal consumptions are provided by FAO stat for the period 1961-2009.

http://faostat3.fao.org/faostat-gateway/go/to/download/C/*/E

Before 1993: Value of kcal consumption for former Ethiopia is used for Ethiopia and Eritrea; Value from "Serbia and Montenegro" is used for Serbia and Montenegro. For most countries in Eastern Europe and Central Asia, there is no information on kcal consumption before 1991.

Gini index

The income distribution Gini index is retrieved from World Bank data website. http://data.worldbank.org. The Gini database covers the period 1970-2011. Missing values are generated by linear interpolation.

GNI per capita

We use the UN data GNI per capita in current US dollars

http://data.un.org/Data.aspx?q=GNI+per+capita&d=SNAAMA&f=grID%3a103%3bcurrID%3aUSD%3bpcFlag%3a1

Special cases: Former Ethiopia data for before 1990 are used for Ethiopia and Eritrea; Former Sudan data for before 2008 are used for Sudan and South Sudan; Yemen data for before 1989 are the average of the two Yemen.

2.5. Normalization and Bounds

Undernourishment, which is negatively related to human assets, is normalized through the following inversed formula (the higher the undernourishment, the lower the index):

$$U_{Index} = \begin{cases} 100 * \dfrac{Max - x}{Max - min} & if\ min < x < max \\ 0 & if\ x > Max \\ 100 & if\ x < min \end{cases}$$

Where x is the country/year undernourishment prevalence value

Lower bound (Min): 5 Upper bound (Max): 65

2.6. Differences from the previous retrospective Undernourishment index

We follow the UN-CDP 2012 methodology and Korachais (2011) to generate missing values. Bounds used for normalization changed between the UN-CDP 2009 and 2012 Reviews (the Lower bound increased from 2.5% to 5%).

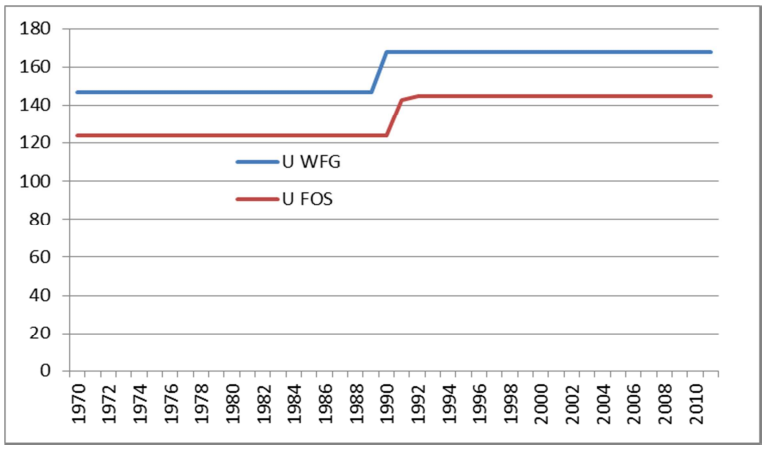
2.7. Changes in the Undernourishment index: LDCs versus non LDCs

Table 5 below shows the number of countries covered by Undernourishment FOS and WFG respectively, and the average levels for LDCs and non-LDCs, by decade.

Table 5 - Country coverage, Undernourishment index FOS and WFG, number of countries, by decade

	U FOS			U WFG		
Decades	LDCs	Non-LDCs	Total	LDCs	Non-LDCs	Total
1980s	41	83	124	49	98	147
1990s	41	104	145	49	119	168
2000s	41	104	145	49	119	168

Figure 7- Country coverage, Undernourishment index FOS and WFG, number of countries



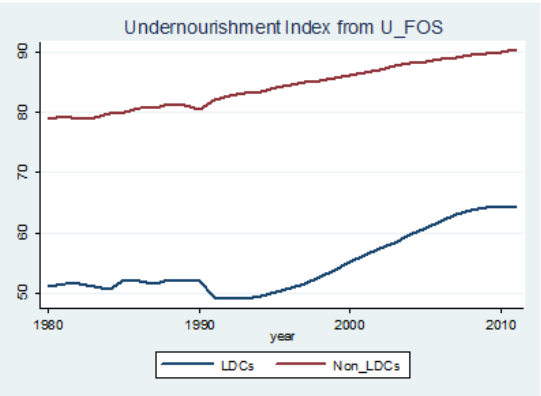
For the sake of comparability, average levels are calculated for a common sample of 124 countries for which Undernourishment data are complete over the three decades (41 LDCs and 83 Non-LDCs). The table and the two graphs below show similar levels and changes in the FOS and WFG Undernourishment index series, suggesting that our methods to generate missing values are not irrelevant.

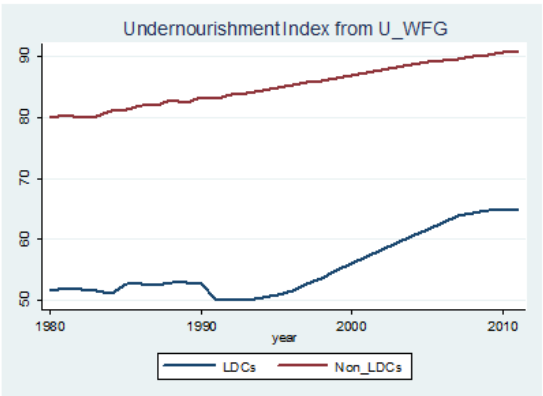
Table 6 - Undernourishment index averages for 41 LDCs and 83 non-LDCs.

	U FOS average		*U WFG average*	
Decades	*LDCs*	*Non-LDCs*	*LDCs*	*Non-LDCs*
80's	*51.6*	*80.0*	*52.2*	*81.2*
90's	*50.8*	*83.7*	*51.7*	*84.6*
2000's	*61.3*	*88.6*	*62.0*	*89.2*

The average Undernourishment index is higher in non-LDCs than in LDCs (which means a higher undernourishment prevalence in LDCs). While the average Undernourishment index has continuously increased during the three decades in non-LDCs, the LDC level decreased during the 1990s, and increased in the 2000s. The increase in the prevalence of undernourishment in the 1990s is generally attributed to natural disasters such as drought, but also political instability, which brought about hunger and malnutrition, particularly in LDCs.

Figure 8 – Changes in the Undernourishment index FOS and WFG averages for 41 LDCs and 83 Non-LDCs





3. Under-5 mortality index

3.1. Definition

As explained in UN-DESA-DPAD definitions, the Under-5 mortality rate "expresses the probability of dying between birth and age five. It is expressed as deaths per 1,000 births. The under-5 mortality rate provides comprehensive information on the health impact of social, economic and environmental conditions in a country. It is seen as more reliable than alternative indicators such as life expectancy, in particular in least developed countries. The indicator is regularly reported by the Population Division of the United Nations Department of Economic and Social Affairs in its World Population Prospects database, available from http://esa.un.org/unpd/wpp/index.htm and http://data.un.org

3.2. Data availability

Primary data from the World Bank at annual frequency are available for 163 countries for the period 1960-2011, with some missing data before 1990.

Table 7 – Number of countries covered by the WB data on Under-5 mortality rate

Year	1960	1965	1970	1975	1980	1985	1990	2000	2010
Number of Countries	89	102	124	133	150	161	163	163	163

The UN-DESA reports under-5 mortality rate at a five-year period frequency for at least 160 countries between 1960 and 2010.

3.3. Calculation principles for retrospective series of under-5 mortality index

The under-5 mortality rate index for the FOS series is constructed directly from official sources, with the annual World Bank data as the primary source. Data are missing for some islands and territories for the whole period, and for some other countries in the 1960s and 1970s.

We used the five-year UN statistics as a secondary source of data. Firstly, we assign as the value for each 5 year period the value for the middle year of the period (the value for the period 1960-65 is taken as that for 1963, the value 1966-70 as 1968, etc). Secondly, we use a simple linear interpolation to estimate other years' values.

The FOS under-5 mortality index is then available for 165 countries for at least one year over the period 1970-2010.

The WFG database is constructed using the previously described FOS under-5 mortality rate and additional information on GNI per capita to fill in the missing values (Palau, St Kitts and Nevis and Tuvalu).

Method 1 for U5M WFG (using GNI per capita)

We estimate Under-5 mortality using the Within estimator on the following model (results of the regression is displayed in appendix III):

$$\log(U5M_{it}) = \alpha_1 + \beta_1 * \log(GNIpc_{it}) + \delta_{1t} * t_t + \mu_{1i} + \varepsilon_{1it}$$

Estimated coefficients are used to generate values for Under-5 mortality for countries/years for which we have information on GNI per capita only:

$$\widehat{U5M_{it}} = \exp(\hat{\alpha}_1 + \hat{\beta}_1 * \ln(GNIpc_{it}) + \hat{\delta}_1 * t_t + \hat{\mu}_{1i})$$

Complete WFG series from 1970 to 2011 are then obtained for all countries but one (Tuvalu before 1974).

3.4. Data Sources

Under-5 mortality rate primary data

Primary data are taken from the World Bank's World Development indicator (annual data from 1960 to 2011). Data are missing for some islands and territories in the 1960s and 1970s. http://data.worldbank.org/indicator/SH.DYN.MORT

Under-5 mortality rate secondary data

The United Nations' population division provides data at a 5-year period frequency between 1950 and 2010 for all countries, including small islands and territories.
http://esa.un.org/unpd/wpp/Excel-Data/mortality.htm

GNI per capita

We use the United Nations' data on GNI per capita in current US dollars
http://data.un.org/Data.aspx?q=GNI+per+capita&d=SNAAMA&f=grID%3a103%3bcurrID%3aUSD%3bpcFlag%3a1

Special cases: Former Ethiopia data before 1990 are used for Ethiopia and Eritrea; Former Sudan data for before 2008 are used for Sudan and South Sudan; Yemen data for before 1989 are the average of the two Yemen.

3.5. Normalization and Bounds

The Under-5 mortality rate, which is negatively related to human assets, is normalized so as to get the index to enter the HAI through the following inversed formula (the higher the undernourishment, the lower the index):

$$U5M_{Index} = \begin{cases} 100 * \dfrac{Max - x}{Max - min} & if\ min < x < max \\ 0 & if\ x > Max \\ 100 & if\ x < min \end{cases}$$

Where x is the under-5 mortality rate value.

Lower bound (Min): 10 Upper bound (Max): 175

3.6. Differences from the previous retrospective Under-5 Mortality (U5M) index

The upper bound used for normalization decreased between the UNCDP 2009 and 2012 Reviews from 240 to 175.

3.7. Changes in the Under-5 Mortality index: LDCs versus non LDCs

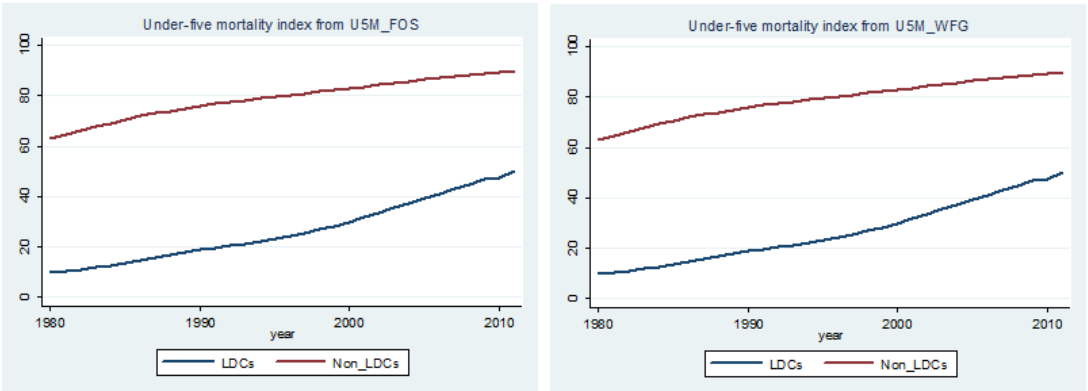
Given the good availability of primary data, both the FOS and the WFG series of U5M cover almost the same large number of countries (between 163 and 165 countries), so that the averages from FOS and WFG are almost identical.

The U5M index averages are very different between LDCs and non-LDCs, but improve significantly over time in both groups. For LDCs in particular, the Under-5 mortality rate has dramatically decreased suggesting significant improvement in socio-economic and sanitary conditions in these countries.

Table 8 - Average of LDCs and Non-LDCs under-5 mortality index by decade.

	U5M FOS average		U5M WFG average	
	LDCs	Non-LDCs	LDCs	Non-LDCs
80's	13.5	69.5	13.5	69.6
90's	23.1	79.2	23.1	79.2
2000's	40.9	86.9	38.3	87.0

Figure 9 – Changes in U5M index FOS and WFG, 163 countries.



4. Adult literacy index

4.1. Definition

As defined by the UN-DESA-DPAD, this indicator "measures the number of literate persons aged fifteen and above expressed as a percentage of the total population in that age group. A person is considered literate if he/she can read and write, with understanding, a simple statement related to his/her daily life".[6] The indicator provides information on the size of the literate adult base population available for enlarging the trained and skilled human resources needed for development. The indicator is regularly reported by the UNESCO Institute for Statistics at http://www.uis.unesco.org .

4.2. Data availability

Primary data availability from the UNESCO Institute for Statistics is quite poor but at least one observation is reported for all 174 countries during the period 1975-2011.

Table 9 – Number of countries covered by UNESCO for Literacy rate

Year	1975	1980	1985	1990	1995	2000	2005	2011
Number of Countries	6	16	5	14	4	42	17	73

4.3. Calculation principles for retrospective series of literacy index

The FOS series for the Literacy index are constructed directly from UNESCO's database but data are missing for many years and countries. The Adult literacy index is the HAI component with the weakest data availability. For countries with more than one observation for the period, the FOS series is constructed using simple linear interpolation. The number of countries covered does not reach 100 until the 2000s, and the maximum is 134 in 2005.

WFG series are obtained using the following econometric methods to estimate missing values. The results of the econometric estimates are reported in appendix IV.

Method 1 for LR WFG (end-of-sample, using lagged values, GNI and country fixed effects)

For missing values at the end of the series, after 2004 and with a maximum of 5 years of extrapolation, we use the following model linking Literacy rate to GNI per capita, time and country fixed effects, and lagged values of Literacy (Within estimator):

$$LR_{it} = \alpha_1 + \beta_1 * \ln(GNIpc_{it}) + \gamma_1 LR_{i,t-1} + \delta_1 * t_t + \mu_{1i} + \varepsilon_{1it}$$

The predicted values (year N+1, year N+2, and so on) are:

$$\widehat{LR_{it}} = \hat{\alpha}_1 + \hat{\beta}_1 * \ln(GNIpc_{it}) + \hat{\gamma}_1 * LR_{i,t-1} + \hat{\delta}_1 * t_t + \hat{\mu}_{1i}$$

[6] "Literacy" also encompasses "numeracy", the ability to make simple arithmetic calculations (Source: UNESCO Institute for Statistics glossary).

Method 2 for LR WFG (beginning of period, using GNI and country fixed effects)

This method generates values at the beginning of the series. It is similar to method 1, but excluding the lagged value of literacy.

$$LR_{it} = \alpha_2 + \beta_2 * \ln(GNIpc_{it}) + \delta_2 * t_t + \mu_{2i} + \varepsilon_{2it}$$

With the predicted values:

$$\widehat{LR_{it}} = \hat{\alpha}_2 + \hat{\beta}_2 * \ln(GNIpc_{it}) + \hat{\delta}_2 * t_t + \hat{\mu}_{2i}$$

Method 3 for LR WFG (region fixed effects)

Method 3 is used for series that have only one observation for literacy over 1970-2008, which prevents us from running country fixed-effects estimates using a within estimator. We then introduce region fixed effects to model 2 and estimate it with the OLS estimator:

$$LR_{it} = \alpha_3 + \beta_3 * \ln(GNIpc_{it}) + \delta_3 * t_t + \mu_{3i} * Region_i + \varepsilon_{3it}$$

Predicted Literacy rate is then:

$$\widehat{LR_{it}} = \hat{\alpha}_3 + \hat{\beta}_3 * \ln(GNIpc_{it}) + \hat{\delta}_3 * t_t + \hat{\mu}_{3i} * Region_i$$

Method 4 for LR WFG (nearest-neighbor)

Bhutan has only one observation of LR in 2005. However, Bhutan and Nepal are neighbor countries with similar structural and socioeconomic conditions. We impute values for Bhutan in 1970-2004 by using the relative deviation from Nepal values. We first calculate a ratio between Bhutan and Nepal literacy rates in 2005:

$$Ratio = {LR_{Bhutan,2005}}\Big/{LR_{Nepal,2005}}$$

and then apply this ratio to generate annual values for 1970-2004:

$$\widehat{LR_{Bhutan,t}} = Ratio * LR_{Nepal,t}$$

4.4. Data Sources

Literacy rate primary data

Data are taken from UNESCO Data Centre database. For all 145 countries at least one observation on the period 1975-2011 is reported.
http://stats.uis.unesco.org/unesco/TableViewer/tableView.aspx?ReportId=210

GNI per capita

We use the United Nations' data on GNI per capita in current US dollars
http://data.un.org/Data.aspx?q=GNI+per+capita&d=SNAAMA&f=grID%3a103%3bcurrID%3aUSD%3bpcFlag%3a1

Special cases: Former Ethiopia data for before 1990 is used for Ethiopia and Eritrea; Former Sudan data for before 2008 is used for Sudan and South Sudan; Yemen data before 1989 are the average of the two Yemen

4.5. Normalization and Bounds

The Adult literacy rate, which is positively related to human assets, is normalized using the following min-max formula (the higher the literacy rate, the higher the index):

$$LR_{Index} = \begin{cases} 100 * \dfrac{x - min}{Max - min} & if\ min < x < max \\ 100 & if\ x > Max \\ 0 & if\ x < min \end{cases}$$

Where x is the Literacy rate value.

Lower bound (Min): 25 Upper bound (Max): 100

4.6. Differences from the previous retrospective LR index

The lower limit used for normalization was increased between the UNCDP 2009 and 2012 Reviews from 15 to 25.

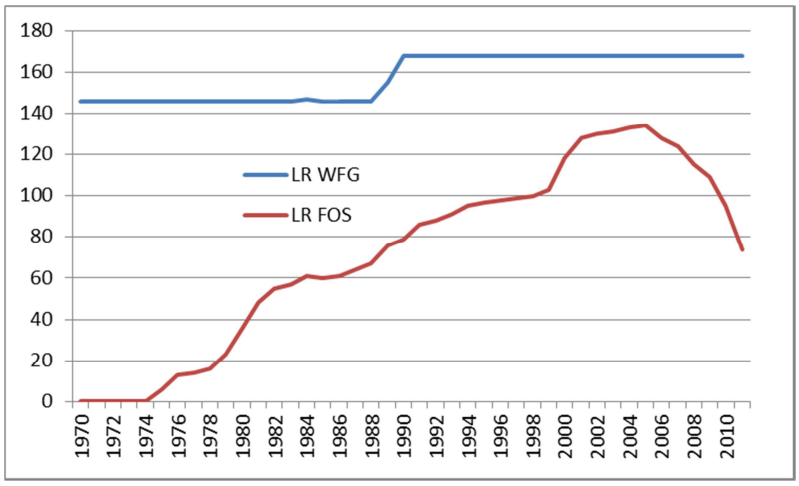
4.7. Changes in the Literacy index: LDCs versus non LDCs

Compared to the other indices, because of the large amount of missing primary data, the sample size for the Literacy index is much smaller. For LR FOS, the number of countries covered increases continuously, reaching 60 in 1985, 80 in 1990, 100 in 1998 and a maximum of 134 in 2005. For LR WFG, a bigger sample size is available as reported in the table below; 146 countries are covered up to 1988, and 168 from 1990 to 2011.

Table 10 - LDCs and Non-LDCs available sample for Literacy index by decade.

	LR FOS			LR WFG		
Decades	LDCs	Non-LDCs	Total	LDCs	Non-LDCs	Total
1980s	19	60	79	48	108	156
1990s	28	76	104	49	119	168
2000s	42	98	140	49	119	168

Figure 10- Country coverage, Literacy index FOS and WFG, number of countries



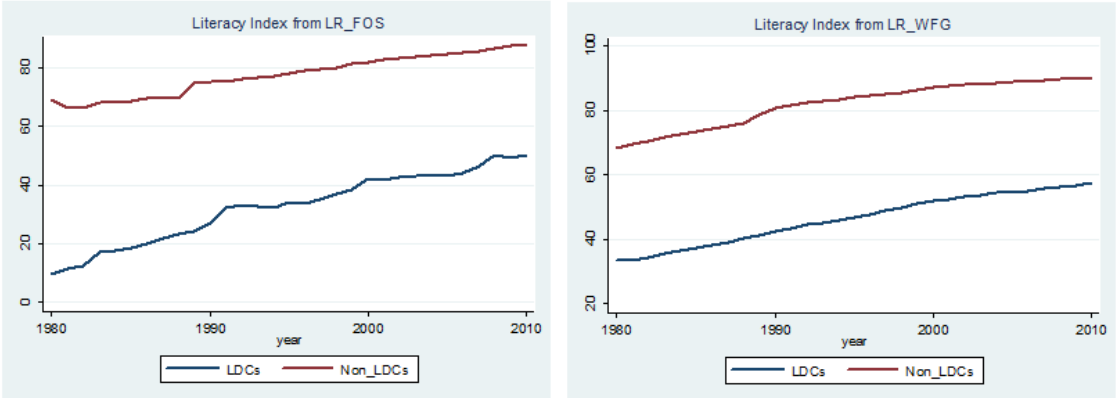
Because of the large difference in country coverage for the Literacy index, the gap between the average FOS and WFG LR indices is wider than for the other three components. Keeping a common sample for LR FOS and LR WFG (79 countries: 19 LDCs and 60 Non-LDCs), a bigger discrepancy can be observed for LDCs between LR FOS and LR WFG. Given the numerous assumptions necessary to fill in missing data for this component, the WFG series must be considered with caution, and considered as preliminary findings.

The graphs below show an increase in the average LR index for both LDC and non-LDC groups during the last three decades, but the gap remain large.

Table 11 - Average LDC and Non-LDC Literacy index by decade.

	LR FOS average		LR WFG average	
Decades	LDCs	Non-LDCs	LDCs	Non-LDCs
1980s	18.4	69.4	36.9	73.0
1990s	33.9	77.9	46.5	83.6
2000s	45.4	85.2	55.3	89.1

Figure 11 – Changes in the Literacy index FOS and WFG averages, 19 LDCs and 60 non-LDCs



5. Secondary enrolment index

5.1. Definition

As defined by the UNDP-DESA-DPAD, this indicator "measures the number of pupils enrolled in secondary schools, regardless of age, expressed as a percentage of the population in the theoretical age group for the same level of education".[7] It provides information on the share of population with the level of skills deemed to be necessary for significant developmental progress. The indicator is regularly reported by the UNESCO Institute for Statistics at http://www.uis.unesco.org .

5.2. Data availability

Compared to literacy rate data, the availability of primary data on school enrolment is greater, but depends on the year. However, at least one observation on one year exists for all 169 countries during the period 1970-2011.

Table 12 – Number of countries covered by UNESCO for School enrolment

Year	1970	1975	1980	1985	1990	1995	2000	2005	2010
Number of Countries	40	98	109	101	101	83	122	125	107

5.3. Calculation principles for the retrospective series of secondary enrolment index

The FOS series on the Secondary enrolment rate are drawn from two UNESCO databases, covering respectively the 1970-1997 and 1998-2012 periods. Simple linear interpolation is used to fill in the gaps between two values.

The WFG series use the following econometric methods to predict missing (estimates are displayed in appendix V).

Method 1 for SE WFG (end-of-sample, using lagged values, GNI and country fixed effects)

For missing values at the end of the series (for a maximum of 5 year of extrapolation), we start by estimating the relationship between Secondary enrolment and income level, time and country fixed effects, as well as the lagged value of Secondary enrolment. The Within estimator is applied to the following model:

$$SE_{it} = \alpha_1 + \beta_1 * \ln(GNIpc_{it}) + \gamma_1 SE_{i,t-1} + \delta_1 * t_t + \mu_{1i} + \varepsilon_{1it}$$

[7] A high secondary enrolment rate generally indicates a high degree of participation, whether the pupils belong to the official age group or not. A rate approaching or exceeding 100% indicates that a country is, in principle, able to accommodate all of its school-age population, but it does not indicate the proportion already enrolled. The achievement of a rate of 100% is therefore a necessary but not sufficient condition for enrolling all eligible children in school. This is one of the limitations of this indicator: the gross enrolment rate can exceed 100% due to the inclusion of over-aged and under-aged pupils because of early or late entrants, and grade repetition. In this case, a rigorous interpretation of the enrolment rate needs additional information to assess the extent of repetition, late entrants, etc. (Source: UNESCO Institute for Statistics glossary).

The Secondary enrolment rate is then generated as:

$$\widehat{SE_{it}} = \hat{\alpha}_1 + \hat{\beta}_1 * \ln(GNIpc_{it}) + \hat{\gamma}_1 SE_{i,t-1} + \hat{\delta}_1 * t_t + \hat{\mu}_{1i}$$

Method 2 for SE WFG (beginning of period, using GNI and country fixed effects)

For values missing at the beginning of the series, we use the following model which includes income level, one year lead value of secondary enrolment, and time and country fixed effects. The Within estimator is used:

$$SE_{it} = \alpha_2 + \beta_2 * \ln(GNIpc_{it}) + \gamma_2 SE_{i,t+1} + \delta_2 * t_t + \mu_{2i} + \varepsilon_{2it}$$

And the predicted values are:

$$\widehat{SE_{it}} = \hat{\alpha}_2 + \hat{\beta}_2 * \ln(GNIpc_{it}) + \hat{\gamma}_2 SE_{i,t+1} + \hat{\delta}_2 * t_t + \hat{\mu}_{2i}$$

Method 3 for SE WFG (nearest-neighbor)

Values are missing for Eritrea for the entire period 1970-1992. We use the relative deviation with the Ethiopia series for 1993-2011, given that they are neighboring countries with similar structural and socioeconomic conditions. We calculate an average ratio between Eritrea and Ethiopia secondary enrolment for 1993- 2011 (years for which Eritrea secondary enrolment rate is available):

$$Ratio = \frac{1}{19} \sum_{t=1993}^{t=2011} \frac{SE_{Eritrea,t}}{SE_{Ethiopia,t}}$$

This is then applied to Ethiopia values to generate values for Eritrea over 1970-1992:

$$\widehat{SE_{Eritrea,t}} = Ratio * SE_{Ethiopia,t}$$

5.4. Data Sources

Gross secondary enrolment rate primary data

Data are taken from two UNESCO Data Centre databases. The first database covers the period 1998-2012: http://stats.uis.unesco.org/unesco/TableViewer/tableView.aspx

The second database covers the period 1970-1997:

http://stats.uis.unesco.org/unesco/TableViewer/tableView.aspx?ReportId=3676

GNI per capita

We use the United Nations' data on GNI per capita in current US dollars http://data.un.org/Data.aspx?q=GNI+per+capita&d=SNAAMA&f=grID%3a103%3bcurrID%3aUSD%3bpcFlag%3a1

Special cases: Former Ethiopia data for before 1990 is used for Ethiopia and Eritrea; Former Sudan data for before 2008 is attributed to Sudan and South Sudan; Yemen data before 1989 are the average of the two Yemen

5.5. Normalization and bounds

The Secondary enrolment rate, which is positively related to human assets, is normalized using the following min-max formula (the higher the enrolment rate, the higher the index):

$$SE_{Index} = \begin{cases} 100 * \dfrac{x - min}{Max - min} & if\ Min < x < max \\ 100 & if\ x > Max \\ 0 & if\ x < min \end{cases}$$

Where x is the Enrolment rate value.

Lower bound (Min): 10 Upper bound (Max): 100

5.6. Differences from the previous retrospective SE index

The lower bound used for normalization was increased between the UNDP 2009 and 2012 Reviews from 5.7 to 10.

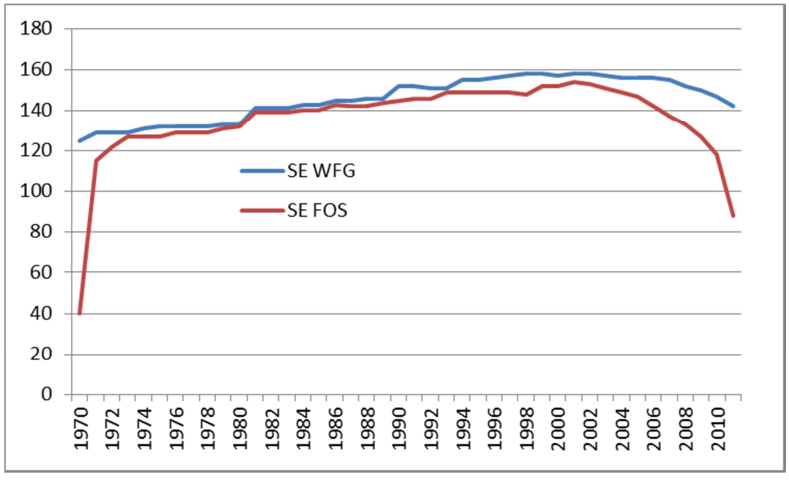
5.7. Changes in the Secondary enrolment index: LDCs versus non LDCs

The size of the sample for Secondary enrolment index is relatively large for both FOS and WFG series, with 120 countries in the 1970s, and 160 in the 2000s. However, the FOS series are incomplete at the beginning and end of the period.

Table 13 - LDCs and Non-LDCs - available sample for Secondary Enrolment index by decade.

	SE FOS			SE WFG		
Decades	LDCs	Non-LDCs	Total	LDCs	Non-LDCs	Total
1980s	44	101	145	45	101	146
1990s	45	111	156	47	113	160
2000s	46	111	157	46	113	159

Figure 12 - Country coverage, Secondary enrolment index FOS and WFG, number of countries



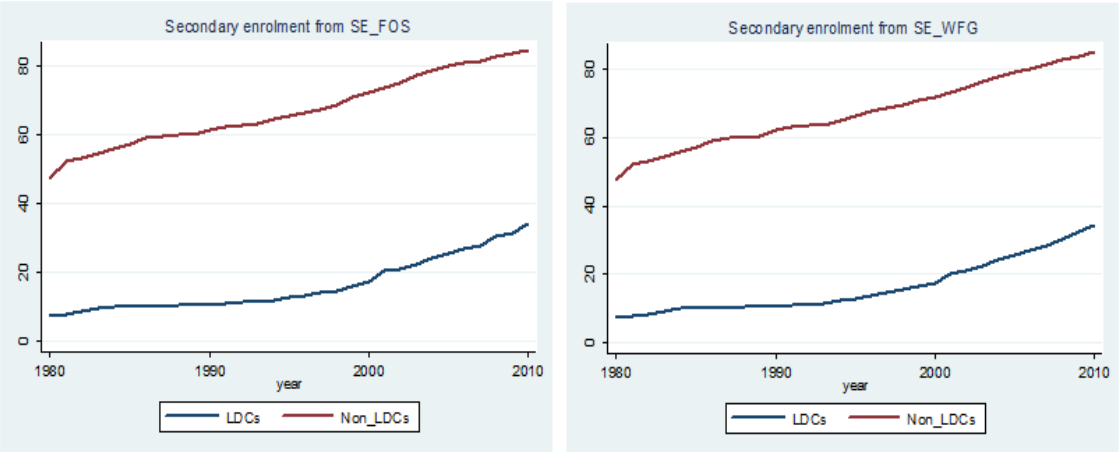
There is no significant difference between the SE average index obtained from the FOS and WFG series. A significant improvement in the Secondary enrolment averages over time can be observed, in both LDCs and non-LDCs, with the gap between the two groups continuing.

Table 14 - Average of LDCs and Non-LDCs Secondary enrolment index by decade.

	SE FOS mean		SE WFG mean	
Decades	LDCs	Non-LDCs	LDCs	Non-LDCs
80's	9.6	56.2	9.5	56.1
90's	12.8	65.5	13.1	66.1
2000's	26.8	80.1	27.6	89.1

Figure 13 shows a clear increase in the secondary enrolment rate for both LDCs and Non-LDCs, which accelerated in LDCs in the 2000s (using a common sample of 145 countries over time for SE FOS and SE WFG: 44 LDCs and 101 Non-LDCs).

Figure 13 – Changes in Secondary enrolment index FOS and WFG averages, 44 LDCs and 101 non-LDCs



6. Conclusions

This working paper details the methods used to construct retrospective series of the Human Assets Index, and its four components, which cover more than 130 countries for the period 1980-2011. Based on group averages, we observe a continuous increase in the HAI in the last decade. The increase is larger for LDCs than non-LDCs. However, there is still a big gap between LDC and non-LDC averages. Furthermore, the variance in the HAI scores for the LDC group has increased over time. Future work should aim at gathering new data on the HAI components (particularly Literacy Rate), and improving methods for substituting for missing data, as well as strictly following the changes in the UN-CDP methodology.

References

Cariolle J. and Goujon M. (2013), A Retrospective Economic Vulnerability Index, 1990-2011: Using the 2012 UN-CDP definitions, FERDI Working Paper I17.

Guillaumont P. (2009) Caught in a trap: Identifying the Least Developed Countries. Economica

Guillaumont P. (2011), The concept of structural economic vulnerability and its relevance for the identification of the Least Developed Countries and other purposes (Nature, measurement, and evolution), CDP Background Paper No. 12, ST/ESA/2011/CDP/12, September 2011.

Guillaumont P. (2013), Measuring structural vulnerability to allocate development assistance and adaptation resources, FERDI Working Paper 68, March 2013, revised version September 2013.

Guillaumont P., McGillivray M. and Wagner L. (2013), Performance Assessment: How it Depends on Structural Economic Vulnerabilty and Human Capital. Implications for the Allocation of Aid. FERDI Working Paper 71, June 2013.

Guillaumont P. and Wagner L. (2012), Aid and growth accelerations: Vulnerability matters, WIDER Working Paper, No. 2012/31.

Korachais C. (2011), Human Assets index: computing retrospective series from 1970 to 2008, FERDI Working Paper 10, July 2011.

UNCDP LDC information: The criteria for identifying least developed countries http://www.un.org/en/development/desa/policy/cdp/ldc/ldc_criteria.shtml

United Nations (2008), Handbook on the Least Developed Country Category: Inclusion, Graduation and Special Support Measures, Committee for Policy Development and United Nations Department of Economic and Social Affairs, November 2008.

Wagner L. (2014), Identifying thresholds in aid effectiveness. Review of World Economics, p.1-20.

Appendix I: Econometric estimation of prevalence of Undernourishment

VARIABLES	Method 1 U	Method 2 U
kcal	-0.0248***	-0.0223***
	(0.00263)	(0.00244)
GINI	0.0709	
	(0.0693)	
Constant	79.09***	75.55***
	(7.358)	(6.219)
No. Observations	2,223	2,698
No. Countries	120	145
R^2 Within	0.522	0.496
R^2 Between	0.751	0.766
R^2 Overall	0.725	0.737

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Appendix II: Econometric estimation of prevalence of Undernourishment (no data on kcal consumption)

VARIABLES	Method 3 U	Method 4 U	Method 5 U
lnGNI	-2.004***	-8.241***	-6.647***
	(0.705)	(0.184)	(0.149)
lnGINI	5.547*	7.392***	
	(2.913)	(0.972)	
LAC		5.821***	8.889***
		(0.593)	(0.413)
SSA		8.562***	12.69***
		(0.627)	(0.472)
SA		3.351***	5.364***
		(0.584)	(0.509)
EAP		5.955***	6.659***
		(0.575)	(0.455)
MEN		4.274***	6.714***
		(0.678)	(0.555)
_Iyear_1971	-0.158	0.265	0.231
	(0.180)	(1.256)	(1.199)
_Iyear_1972	0.363	1.404	1.277
	(0.249)	(1.268)	(1.208)
_Iyear_1973	0.388	2.469**	2.201*
	(0.334)	(1.244)	(1.202)
_Iyear_1974	0.437	3.688***	3.373***
	(0.453)	(1.282)	(1.246)
_Iyear_1975	0.519	4.377***	3.890***
	(0.524)	(1.268)	(1.230)
_Iyear_1976	0.165	4.307***	3.626***
	(0.568)	(1.276)	(1.232)
_Iyear_1977	0.0134	4.733***	3.911***
	(0.640)	(1.259)	(1.223)
_Iyear_1978	-0.337	5.021***	3.921***
	(0.726)	(1.278)	(1.230)
_Iyear_1979	-0.358	5.786***	4.372***
	(0.793)	(1.279)	(1.218)
_Iyear_1980	-0.486	6.425***	4.596***
	(0.915)	(1.288)	(1.216)
_Iyear_1981	-0.788	6.184***	4.421***
	(0.922)	(1.333)	(1.240)
_Iyear_1982	-0.502	6.283***	4.474***
	(0.923)	(1.331)	(1.245)
_Iyear_1983	-0.535	6.123***	4.332***
	(0.942)	(1.336)	(1.247)
_Iyear_1984	-0.672	5.893***	4.103***
	(0.967)	(1.371)	(1.281)
_Iyear_1985	-1.207	5.123***	3.488***
	(0.955)	(1.375)	(1.292)
_Iyear_1986	-1.353	5.262***	3.516***
	(1.024)	(1.373)	(1.286)
_Iyear_1987	-1.120	5.772***	3.877***
	(1.044)	(1.383)	(1.297)
_Iyear_1988	-1.393	5.863***	3.940***
	(1.101)	(1.374)	(1.282)

_lyear_1989	-1.214	6.078***	4.199***
	(1.131)	(1.403)	(1.302)
_lyear_1990	-0.931	6.655***	4.895***
	(1.186)	(1.406)	(1.299)
_lyear_1991	-0.251	7.525***	5.448***
	(1.337)	(1.509)	(1.375)
_lyear_1992	-0.645	7.100***	5.288***
	(1.369)	(1.510)	(1.386)
_lyear_1993	-0.860	6.748***	5.077***
	(1.353)	(1.476)	(1.360)
_lyear_1994	-1.244	6.183***	4.682***
	(1.308)	(1.428)	(1.324)
_lyear_1995	-1.556	6.412***	4.795***
	(1.321)	(1.373)	(1.283)
_lyear_1996	-1.914	6.358***	4.751***
	(1.340)	(1.343)	(1.269)
_lyear_1997	-2.145	6.283***	4.675***
	(1.359)	(1.329)	(1.264)
_lyear_1998	-2.536*	5.721***	4.232***
	(1.336)	(1.308)	(1.257)
_lyear_1999	-2.972**	5.132***	3.785***
	(1.320)	(1.292)	(1.248)
_lyear_2000	-3.382**	4.714***	3.463***
	(1.316)	(1.286)	(1.247)
_lyear_2001	-3.804***	4.361***	3.111**
	(1.325)	(1.283)	(1.246)
_lyear_2002	-4.154***	4.243***	2.889**
	(1.342)	(1.279)	(1.242)
_lyear_2003	-4.362***	4.792***	3.234***
	(1.411)	(1.280)	(1.238)
_lyear_2004	-4.490***	5.523***	3.737***
	(1.489)	(1.290)	(1.239)
_lyear_2005	-4.674***	6.106***	4.163***
	(1.574)	(1.309)	(1.247)
_lyear_2006	-4.766***	6.788***	4.647***
	(1.668)	(1.332)	(1.260)
_lyear_2007	-4.756***	7.812***	5.346***
	(1.794)	(1.348)	(1.267)
_lyear_2008	-4.687**	8.876***	6.017***
	(1.919)	(1.374)	(1.276)
_lyear_2009	-5.001**	8.217***	5.351***
	(1.912)	(1.375)	(1.272)
_lyear_2010	-4.944**	8.825***	5.754***
	(1.983)	(1.392)	(1.278)
_lyear_2011	-4.838**	9.616***	6.333***
	(2.067)	(1.400)	(1.285)
Constant	16.78	38.76***	55.10***
	(10.98)	(3.442)	(1.278)
No. Observations	4,597	4,597	5,627
R-squared		0.532	0.504
No. Countries	120		
R^2 Within	0.284	.	.
R^2 Beween	0.556	.	.
R^2 Overall	0.348	.	.

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Appendix III: Econometric estimation of Under-5 mortality rate

VARIABLES	Method 1 Log (U5M)
Log (GNI)	-0.226***
	(0.0299)
_lyear_1971	-0.0131***
	(0.00290)
_lyear_1972	-0.0203***
	(0.00674)
_lyear_1973	-0.0123
	(0.0123)
_lyear_1974	0.00272
	(0.0192)
_lyear_1975	-0.0106
	(0.0225)
_lyear_1976	-0.0365
	(0.0242)
_lyear_1977	-0.0532*
	(0.0271)
_lyear_1978	-0.0682**
	(0.0308)
_lyear_1979	-0.0812**
	(0.0345)
_lyear_1980	-0.0984**
	(0.0383)
_lyear_1981	-0.135***
	(0.0394)
_lyear_1982	-0.180***
	(0.0392)
_lyear_1983	-0.223***
	(0.0389)
_lyear_1984	-0.261***
	(0.0390)
_lyear_1985	-0.304***
	(0.0394)
_lyear_1986	-0.327***
	(0.0412)
_lyear_1987	-0.347***
	(0.0427)
_lyear_1988	-0.363***
	(0.0450)
_lyear_1989	-0.386***
	(0.0462)
_lyear_1990	-0.384***
	(0.0490)
_lyear_1991	-0.416***
	(0.0492)
_lyear_1992	-0.442***
	(0.0495)
_lyear_1993	-0.471***
	(0.0499)
_lyear_1994	-0.502***
	(0.0501)
_lyear_1995	-0.515***
	(0.0523)

_Iyear_1996	-0.535***
	(0.0537)
_Iyear_1997	-0.559***
	(0.0544)
_Iyear_1998	-0.597***
	(0.0540)
_Iyear_1999	-0.634***
	(0.0536)
_Iyear_2000	-0.665***
	(0.0537)
_Iyear_2001	-0.701***
	(0.0540)
_Iyear_2002	-0.731***
	(0.0552)
_Iyear_2003	-0.742***
	(0.0584)
_Iyear_2004	-0.750***
	(0.0616)
_Iyear_2005	-0.761***
	(0.0646)
_Iyear_2006	-0.773***
	(0.0679)
_Iyear_2007	-0.778***
	(0.0717)
_Iyear_2008	-0.786***
	(0.0751)
_Iyear_2009	-0.841***
	(0.0747)
_Iyear_2010	-0.858***
	(0.0770)
_Iyear_2011	-0.880***
	(0.0800)
Constant	6.104***
	(0.174)
Observations	6,356
Number of countries	162
R-squared	0.812

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Appendix IV: Econometric estimation of Literacy rate

VARIABLES	Method 1 LR	Method 2 LR	Method 3 LR
LR_lag	0.998***		
	(0.0105)		
lnGNI	0.0904	-4.147***	7.701***
	(0.0917)	(1.125)	(0.247)
SSA			-29.38***
			(0.843)
SA			-23.22***
			(1.272)
EAP			-4.922***
			(0.968)
LAC			-8.662***
			(0.859)
MEN			-27.71***
			(0.935)
_lyear_1976	0.0708		6.525
	(0.0858)		(6.792)
_lyear_1977		1.137***	9.751
		(0.330)	(6.715)
_lyear_1978	0.0463	2.996***	11.37*
	(0.0528)	(1.033)	(6.588)
_lyear_1979	0.0560	4.283***	8.232
	(0.0649)	(1.291)	(6.310)
_lyear_1980	-0.0136	7.147***	13.90**
	(0.0933)	(1.583)	(6.071)
_lyear_1981	0.0367	7.954***	14.08**
	(0.121)	(1.725)	(5.962)
_lyear_1982	0.0480	8.702***	15.14**
	(0.118)	(1.803)	(5.920)
_lyear_1983	0.0689	9.435***	16.89***
	(0.124)	(1.842)	(5.910)
_lyear_1984	0.0705	10.12***	17.07***
	(0.131)	(1.886)	(5.896)
_lyear_1985	0.0828	10.71***	18.38***
	(0.134)	(1.870)	(5.896)
_lyear_1986	0.0201	11.58***	18.94***
	(0.145)	(1.865)	(5.891)
_lyear_1987	0.0359	12.50***	19.53***
	(0.156)	(1.900)	(5.878)
_lyear_1988	0.0431	13.49***	19.53***
	(0.161)	(1.931)	(5.867)
_lyear_1989	0.0282	14.33***	20.30***
	(0.167)	(1.958)	(5.867)
_lyear_1990	0.00179	16.21***	21.97***
	(0.177)	(2.048)	(5.829)
_lyear_1991	-0.0279	16.94***	23.01***
	(0.173)	(2.070)	(5.812)
_lyear_1992	-0.0617	17.59***	23.67***
	(0.175)	(2.085)	(5.808)
_lyear_1993	-0.0861	18.05***	23.73***
	(0.180)	(2.115)	(5.802)
_lyear_1994	-0.0543	18.55***	23.93***

	(0.187)	(2.136)	(5.794)
_lyear_1995	-0.0695	19.58***	23.83***
	(0.192)	(2.185)	(5.791)
_lyear_1996	-0.0570	20.46***	23.80***
	(0.195)	(2.218)	(5.789)
_lyear_1997	-0.0672	21.23***	24.47***
	(0.203)	(2.240)	(5.787)
_lyear_1998	-0.0515	21.71***	25.39***
	(0.209)	(2.235)	(5.785)
_lyear_1999	0.00234	22.42***	26.35***
	(0.226)	(2.243)	(5.781)
_lyear_2000	-0.0144	23.28***	27.52***
	(0.232)	(2.273)	(5.761)
_lyear_2001	-0.158	23.75***	27.57***
	(0.222)	(2.287)	(5.750)
_lyear_2002	-0.228	24.32***	27.92***
	(0.237)	(2.316)	(5.748)
_lyear_2003	-0.298	25.22***	27.46***
	(0.247)	(2.385)	(5.747)
_lyear_2004	-0.379	26.17***	26.54***
	(0.257)	(2.478)	(5.745)
_lyear_2005	-0.467*	27.02***	25.71***
	(0.274)	(2.576)	(5.744)
_lyear_2006	-0.455	27.76***	25.43***
	(0.293)	(2.669)	(5.750)
_lyear_2007	-0.391	28.92***	24.83***
	(0.298)	(2.789)	(5.755)
_lyear_2008	-0.400	30.32***	24.24***
	(0.296)	(2.951)	(5.767)
_lyear_2009	-0.440	30.19***	24.48***
	(0.291)	(2.760)	(5.775)
_lyear_2010	-0.264	31.18***	24.49***
	(0.312)	(2.824)	(5.798)
_lyear_2011	-0.225	32.24***	24.32***
	(0.302)	(2.934)	(5.847)
_lyear_1975		-0.562	
		(2.144)	
Constant	0.272	83.81***	12.43**
	(0.826)	(7.506)	(5.957)
Observations	2,867	3,002	3,002
R-squared	0.992	0.701	0.647
Number of countries	133	144	

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Appendix V: Econometric estimation of Secondary enrolment ratio

VARIABLES	Method 1 SE	Method 2 SE
lnGNI	0.278	0.287*
	(0.172)	(0.166)
SE_lag	0.957***	
	(0.00971)	
SE_lead		0.959***
		(0.00569)
_lyear_1971	-1.926***	-0.241
	(0.605)	(0.288)
_lyear_1972	-1.488***	-0.128
	(0.549)	(0.420)
_lyear_1973	-1.561**	-0.313
	(0.637)	(0.428)
_lyear_1974	-1.378**	-0.508
	(0.541)	(0.475)
_lyear_1975	-1.140**	-0.270
	(0.494)	(0.353)
_lyear_1976	-1.285***	-0.251
	(0.492)	(0.378)
_lyear_1977	-1.213**	0.164
	(0.466)	(0.420)
_lyear_1978	-1.575***	0.0497
	(0.436)	(0.404)
_lyear_1979	-1.432***	0.000849
	(0.405)	(0.451)
_lyear_1980	-1.367***	0.186
	(0.430)	(0.516)
_lyear_1981	-1.489***	0.260
	(0.499)	(0.451)
_lyear_1982	-1.470***	0.285
	(0.402)	(0.411)
_lyear_1983	-1.394***	0.272
	(0.373)	(0.532)
_lyear_1984	-1.279***	0.680*
	(0.420)	(0.394)
_lyear_1985	-1.601***	0.686*
	(0.407)	(0.367)
_lyear_1986	-1.545***	0.982**
	(0.395)	(0.422)
_lyear_1987	-1.811***	1.058***
	(0.403)	(0.385)
_lyear_1988	-1.880***	1.144***
	(0.342)	(0.396)
_lyear_1989	-1.957***	1.034**
	(0.357)	(0.409)
_lyear_1990	-1.756***	0.815*
	(0.364)	(0.415)
_lyear_1991	-1.490***	1.099**
	(0.383)	(0.427)
_lyear_1992	-1.714***	1.283***
	(0.362)	(0.480)
_lyear_1993	-1.875***	0.870**
	(0.406)	(0.407)

_lyear_1994	-1.420***	0.638*
	(0.354)	(0.381)
_lyear_1995	-1.127***	0.776*
	(0.366)	(0.406)
_lyear_1996	-1.238***	0.864**
	(0.381)	(0.407)
_lyear_1997	-1.286***	0.827*
	(0.376)	(0.462)
_lyear_1998	-1.193***	0.509
	(0.446)	(0.407)
_lyear_1999	-0.787**	0.599
	(0.360)	(0.436)
_lyear_2000	-0.766**	0.263
	(0.366)	(0.436)
_lyear_2001	-0.330	0.366
	(0.344)	(0.439)
_lyear_2002	-0.323	0.356
	(0.324)	(0.457)
_lyear_2003	-0.217	0.844*
	(0.326)	(0.455)
_lyear_2004	-0.665*	0.824*
	(0.344)	(0.486)
_lyear_2005	-0.636**	0.673
	(0.296)	(0.477)
_lyear_2006	-0.445	0.755
	(0.326)	(0.514)
_lyear_2007	-0.526	0.900*
	(0.328)	(0.508)
_lyear_2008	-0.652**	0.549
	(0.320)	(0.526)
_lyear_2009	-0.261	0.616
	(0.313)	(0.545)
_lyear_2010	-0.204	0.531
	(0.257)	(0.561)
_lyear_2011		-0.0654
		(0.864)
Constant	2.404*	-1.402
	(1.310)	(0.975)
Observations	5,439	5,441
R-squared	0.966	0.966
Number of countries	160	160

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Appendix VI: Changes in the HAI and its components – LDCs versus non-LDCs

Figure A1 – Change in HAI by decade, FOS and WFG series

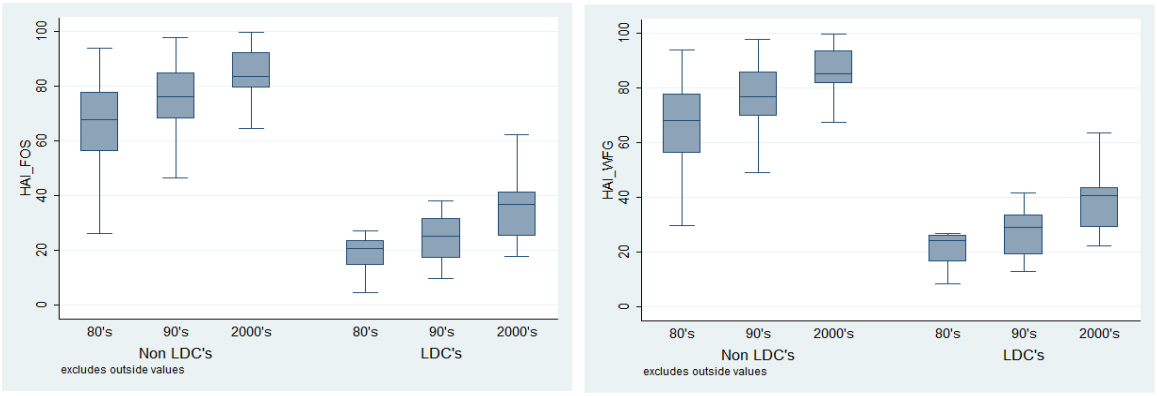


Figure A2 – Change in Undernourishment index by decade, FOS and WFG series

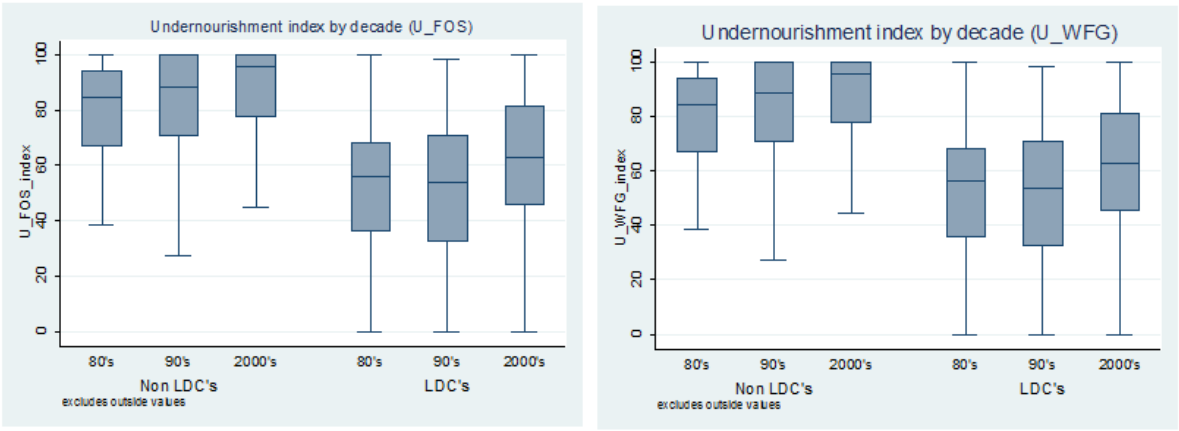


Figure A3 – Change in Under-5 mortality index by decade, FOS and WFG series

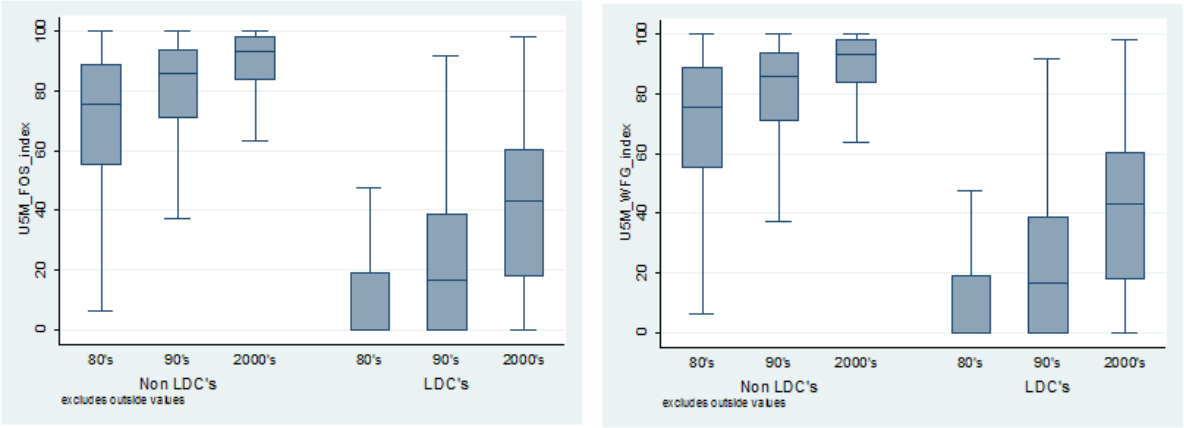


Figure A4 – Change in Literacy index by decade, FOS and WFG series

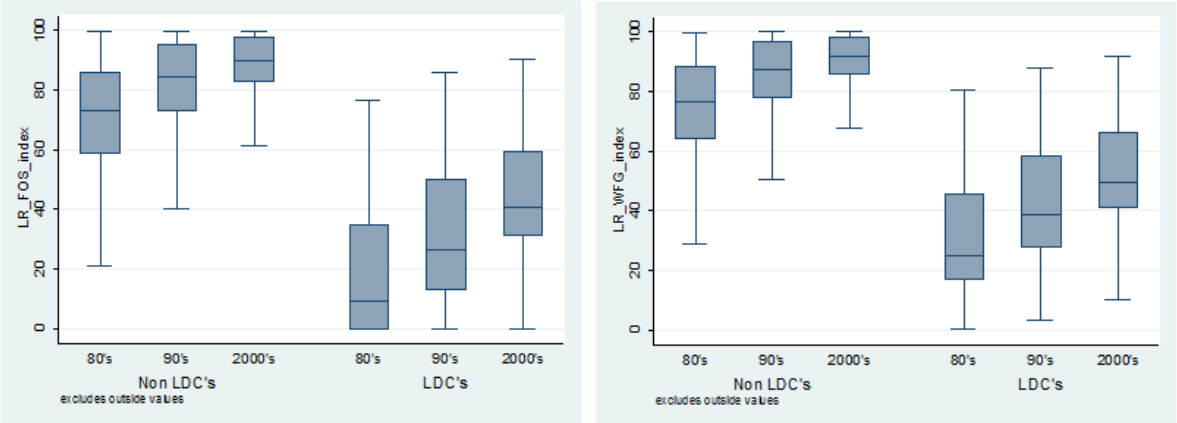
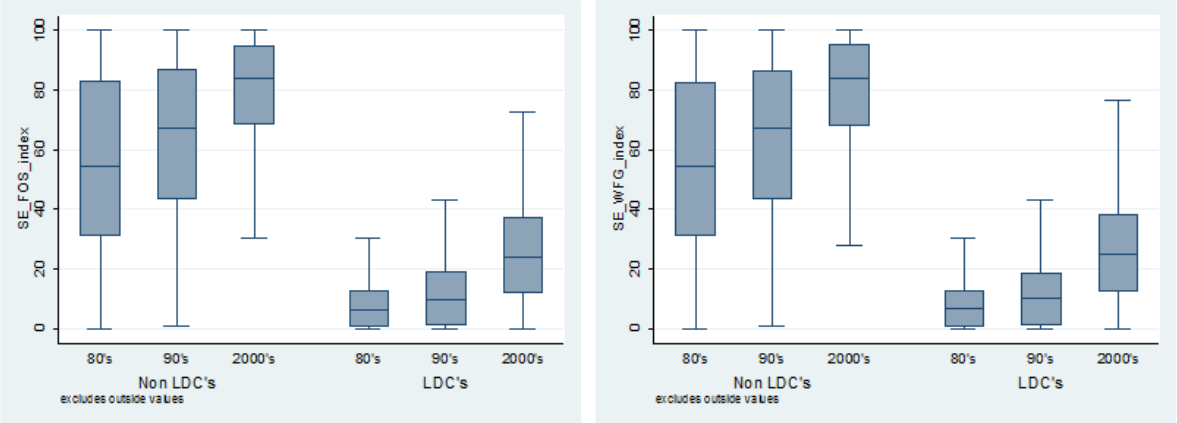


Figure A5 – Change in Secondary enrolment index by decade, FOS and WFG series



Appendix VII: Changes in the HAI score by country

Figure A6 – Changes in the HAI between 1980s and 1990s

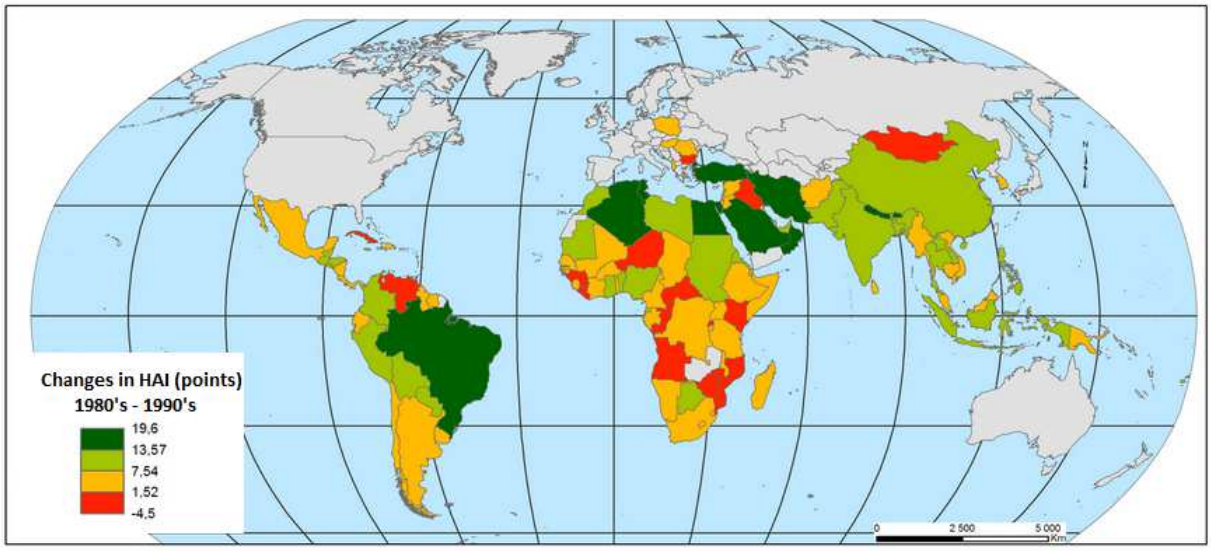
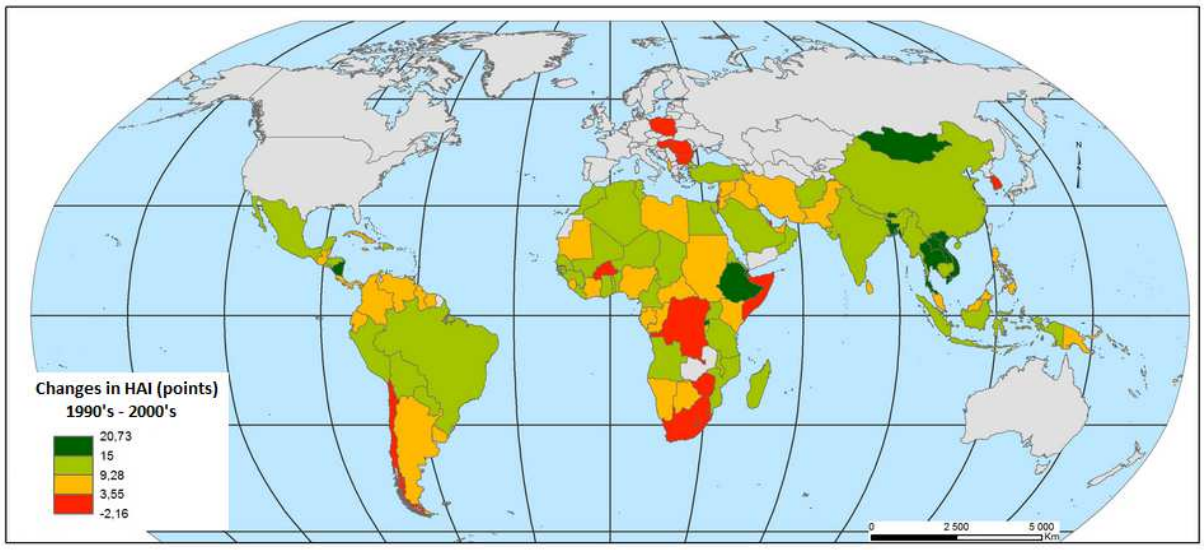


Figure A7 – Changes in the HAI between 1990s and 2000s



"Sur quoi la fondera-t-il l'économie du monde qu'il veut gouverner? Sera-ce sur le caprice de chaque particulier? Quelle confusion! Sera-ce sur la justice? Il l'ignore."

Pascal

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