Technical note 1

Primary, lower secondary and upper secondary attainment rate evolution and projections
Technical note for the 2015 EFA Global Monitoring Report[1]

The 2015 GMR (pp. 291) argues that "*the lower secondary attainment rate is expected to be 50% in low income countries, 80% in lower middle income countries and 92% in upper middle income countries, if recent trends continue. Even the achievement of universal primary education, a core goal of Jomtien and Dakar, appears on current evidence beyond reach*". The analysis was intended to inform the discussion around the post-2015 global education targets, with emphasis on the prospects for achieving proposed new targets.

In addition, as in the case of the MDGs, there is some confusion regarding the relationship between, on the one hand, global targets and, on the other hand, targets that would apply to the circumstances of individual countries. In principle, according to one of the architects of the MDG, such confusion should not exist:

"*Global targets apply at the global level. Unfortunately, the global MDG canon has turned them into yardsticks for measuring and judging performance at the national level. Hence the MDG debate suffers from misplaced concreteness. Interpretation of the MDGs as one-size-fits-all targets neglects the historical background of each country (…) Performance can be measured by absolute or relative benchmarks. Both are valid but neither gives a complete picture. Most MDGs are expressed in relative terms, such as reducing poverty by half (…) Since proportional changes tend to be inversely related to the initial situation, the misinterpretation of the MDGs as one-size-fits-all targets puts the least developed and the low income countries at a disadvantage. Global goals and targets were earlier expressed in either absolute terms or as combined relative and absolute benchmarks*" (Vandemoortele and Delamonica, 2010).

In other words, while global targets should have served just that purpose, they were misused by being considered as applicable to individual countries as well. This misuse should be avoided in the development of the post-2015 agenda. However, it is inevitable that is an expectation for the global target framework to be used as a basis to develop consistent national targets as part of an accountability process. The note therefore also aims to inform a discussion about target setting at the level of individual countries and country groups.

This short note presents the approach followed to project the future level of primary, lower secondary and upper secondary education attainment rates in low and middle income countries based on the most recent trends using evidence from household surveys. The three sections that follow describe the methodology, data sources and main results. A concluding section discusses some caveats and tentative implications.

1. Indicators and model

Three indicators are considered, namely the fraction of a cohort that has completed primary, lower secondary and upper secondary school respectively. In the remainder of the paper, the three attainment rate indicators refer respectively to the three-year age group of individuals who were 3-5 years older than the official age of entry into the last grade of the respective education level. For example, in the case of primary education, if the official age of entry into the last grade of primary school is 11 years, the attainment rate is calculated over the age group 14 to 16 years[2]. The reason is that in many countries late entry means that the attainment rate does not peak until well after the official expected graduation age.

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[1] This note is based on and extends a background paper to the 2015 EFA Global Monitoring Report (Lange, 2015).
[2] The relevant age group for calculating the lower (upper) secondary attainment rate would be 17 to 19 years (20 to 22 years) if the official age of entry into the last grade of lower (upper) secondary school were 14 years (17 years).

As all three indicators are bounded between zero and one, the logistic growth (or S-shaped) model is estimated (e.g. Meyer et al., 1992; Clemens, 2004). This model accounts for floor and ceiling effects. For example, progress towards education indicators is more difficult to achieve, and therefore slows down, at higher levels of attainment (i.e. getting the last children to complete primary education)[3].

This logistic growth-model is based on two-parameters:

$$y_t = 1 / (1 + e^{-\beta(t-a)})$$

where **β** determines the slope of the S-shaped function and **a** its point of inflection. The greatest changes in absolute terms are observed when $y_t = 0.5$. Taking the derivative of with respect to t yields:

$$dy/dt = \beta y_t(1 - y_t) \Leftrightarrow (dy/dt)/y_t = \beta(1 - y_t)$$

Changes in relative terms are approaching zero as $y_t \rightarrow 1$. In what follows, β is referred to as the transition speed but is actually the rate at which the indicator changes initially, when y_t is close to zero. A uniform transition speed was imposed across countries. Re-arranging the first equation, replacing $-\beta a = \boldsymbol{\alpha}$, a country-specific intercept, and adding the error term, we obtain:

$$-\ln [(1 - y_{it})/y_{it}] = \alpha_i + \beta_t + \varepsilon_{it}$$

where i and t are subscripts referring to countries and years respectively. The left hand-side maps from the unit-interval, on which the indicator is defined, onto the real line. This motivates the introduction of country-fixed effects α_i: introducing a country-specific intercept is equivalent to shifting the regression line for each country horizontally, accounting thus for country-specific levels of educational attainment at a given point in time. If y_{it} is interpreted as the probability that a member of cohort t attains, for example, primary education, then the left hand-side of the equation can be interpreted as minus the logarithm of the inverse odds of attaining a particular level of education. Coefficient estimates can thus be interpreted as the change in this quantity as the variable changes by one unit. In particular, β can be interpreted as an estimate of the annual percentage change in the odds[4].

2. Data

The analysis is based on data from Demographic and Health Survey, Multiple Indicator Cluster Survey, and national household surveys from 78 of the 142 low- and middle-income countries, which represent 88% of the total population. The surveys were carried out between 2008 and 2013. These surveys are also used for the World Inequality Database in Education.

Ideally, historic attainment rates would be available through surveys for every country and every year. In the absence of such data, a retrospective / pseudo-cohort approach is followed to re-create the evolution of attainment rates. In other words, if the primary education attainment rate in year t is calculated over the age group 14 to 16 years, the attainment rate for year t-1 is calculated over the age group 15 to 17 years and so on. This approach leads to potential selectivity problems. For example, more educated people have higher life expectancy and may be over-represented in older cohorts, although this problem is partly overcome by

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[3] While ceiling effects for primary and lower secondary education have been observed for richer countries and is therefore safe to assume that a similar path will be followed by poorer countries, it is far from certain that the same will hold for upper secondary education, where hardly any country has achieved universal completion.
[4] In some cases, attainment rates are very close to one. For that reason, weights were applied w = y (1 − y), which gave little weight to observations close to zero or one and maximum weight to observations on rates around 0.5.

focusing only on cohorts going back no more than 20 years where differential mortality rates are too small to bias the results. Conversely, more educated people have higher chance to emigrate to high income countries and may be under-represented in older cohorts, although this bias is also small and can be safely ignored.

A source of potentially more serious bias is the fact that children enrol in school late and/or tend to repeat grades in relatively large numbers in some countries. As a result, for example, they have not reached the final grade of primary even by the age of 14. The attainment rate therefore appears to be slowing down at the younger ages, when in fact all that is captured is delayed attainment of an education level. For that reason, observations for up to three of the most recent years are trimmed if they are lower by at least three percentage points relative to the maximum level observed to prevent an artificial bias from being introduced. The estimation for the three attainment rates is based on a balanced panel of observations from the period 1992-2008 for these 78 countries[5].

3. Results

The model allows the average transition speed towards universal primary, lower secondary and upper secondary attainment to be calculated. This is done by regressing the transformed indicator on time and on a complete set of country fixed effects. The resulting estimates of β are 0.050 for primary attainment, 0.046 for lower secondary attainment, and 0.039 for upper secondary attainment, and are highly significant. This means that countries that have a primary attainment rate close to zero have on average a cohort-on-cohort change of about 5 percent. We can use this estimate to plot the average transition curve (Figure 1).

Four curves are plotted for each of the three attainment rates over the period 2010-2100 according to the World Bank country income group classification (June 2013): low income countries, lower middle income countries, upper middle income countries, and all low and middle income countries. Results are weighted with the projected population until 2100 for each country using the World Population Prospects (2012 Update) of the United Nations Population Division[6]. As the share of today's low income countries in the total population is expected to grow, the average for all low and middle income countries is pulled closer to the low income country average from 2030 onwards.

Figure 1. Projected attainment rates by country income group and level, 2010-2100

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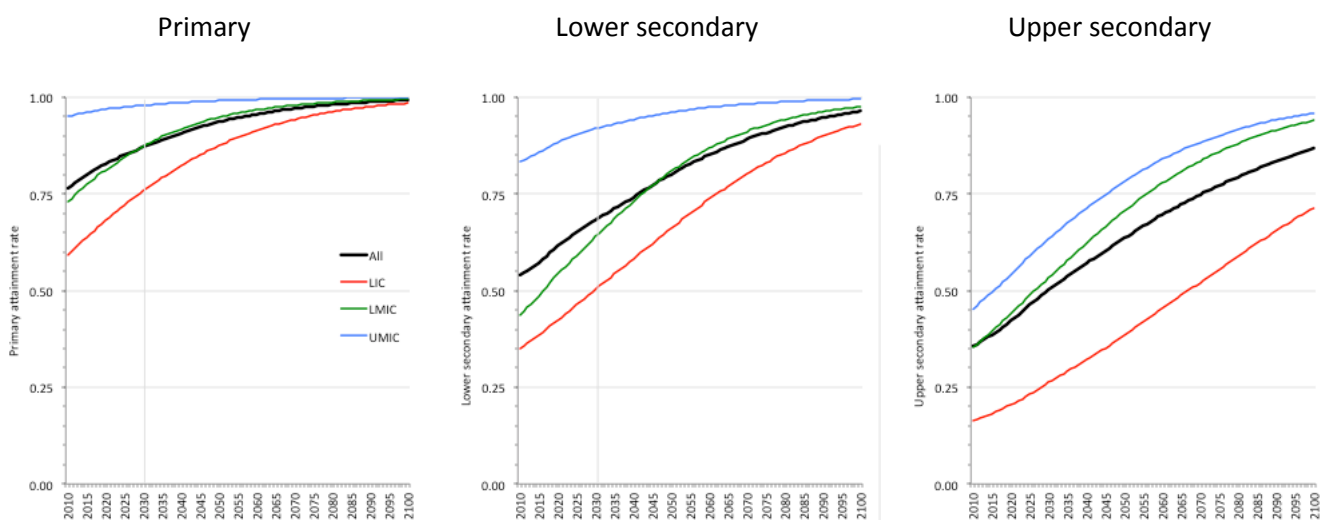
[5] This dataset is used to estimate attainment rates over this period shown in Figures 0.7 (primary) and 0.11 (lower secondary) as well as the percentage of children who have never been to school in Figure 0.6 in the 2015 GMR.
[6] http://esa.un.org/wpp/ASCII-Data/ASCII_FILES/WPP2012_DB04_POPULATION_ANNUAL.CSV

The following table summarises the results (Table 1). Although the proposed targets envisage universal lower secondary and upper secondary attainment rates, neither of these targets will be reached at recent rates of progress. For example, it is projected that across low and middle income countries, the lower secondary attainment rate will be 76% in 2030, while a rate of 95% will only be achieved in the 2080s. Likewise, it is projected that across low and middle income countries, the upper secondary attainment rate will be 50% in 2030, while a rate of 95% will not be achieved before the end of the century. This should not come as a surprise. High income countries are still far from achieving universal upper secondary attainment education rates. For example, among the 28 European Union countries, only 79% of 20-24 year olds attained upper secondary education in 2010[7].

Table 1. Projected attainment rates (2015, 2030 and 2050) and year of achieving 95%-97% attainment rates

	Primary				Lower secondary				Upper secondary			
	Low income	Lower middle income	Upper middle income	Low & middle income	Low income	Lower middle income	Upper middle income	Low & middle income	Low income	Lower middle income	Upper middle income	Low & middle income
2015 (%)	64	85	96	84	39	68	86	67	18	39	50	38
2030 (%)	76	92	98	**89**	50	80	92	**76**	26	52	63	**50**
2050 (%)	87	96	99	94	66	90	96	85	38	70	78	63
Year to reach												
95%	2073	2042	2010	**2053**	after 2100	2067	2044	**2086**	after 2100	after 2100	2094	**after 2100**
97%	2085	2054	2021	2066	after 2100	2079	2056	2100	after 2100	after 2100	after 2100	after 2100

Annex 1 presents the equivalent results broken down by region.

Note that the results are somewhat pessimistic for two reasons. First, the projected attainment rates refer to the above-mentioned (older) age groups. In practice, the primary attainment rate of 14-16 year olds is achieved four years earlier if problems of late enrolment and repetition are overcome. It is recommended that the projected years of reaching an attainment rate of 95-97% are adjusted downwards by five years.

Second, the results exclude high income countries: if the calculations include the latter, then these targets will be achieved at the global level a few years earlier than indicated above.

4. Discussion

The above results suggest that the currently proposed targets are too optimistic given recent rates of progress. The unfinished business, i.e. universal primary education, will be achieved only around 2050. Reaching an attainment rate of 95% in lower education secondary will be reached in the 2080s, while the Open Working Group target of universal upper secondary education will not be achieved this century in low and middle income countries.

Nevertheless, it is important to keep in mind some limitations of these indicative projections. First, as mentioned above, the projections are based on recent trends. Yet, these countries have seen some major changes since 2000 and are called upon to intensify their efforts after 2015. These projections may not be capturing the effects of the most recent changes and do not capture the anticipated changes post-2015; therefore they should be seen as the baseline scenario, in other words a picture of how attainment rates will evolve if nothing else changes.

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[7] http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tps00186&plugin=1

Second, the projections are based on a very simple model. They are, in effect, linear projections based on a particular transformation of attainment rates. This model (i) accounts well for historical rates well and (ii) has some theoretical basis embedded in the human capital approach (Clemens, 2004). However, the model may not be capturing important non-linearities, for example in the relationship between income and schooling (i.e. if the income elasticity of demand for schooling is context-specific, households more likely to face credit constraints may exhibit a higher elasticity).

Last but not least, projections based on current low rates in some countries to a distant future are highly uncertain. Yet, they do put into perspective the level of ambition embedded in the agenda under discussion. For example, they raise the question of what level of mobilisation will make it possible to bring forward the achievement of universal lower secondary education by 60 years to meet even the less ambitious of the two post-2015 target proposed.

The projections also highlight that achieving a global target and achieving national targets are two issues that should be treated separately. For example, the achievement of a lower secondary education attainment rate of 68% in low and middle income countries by 2030 on average is compatible with the fact that one in four of these countries will have attainment rates below 50%.

This note shows that if an effort were to be made to apportion the effort for reaching a global target between countries, then two parameters will need to be taken into account. First, countries follow an S-shaped path to universal attainment; therefore a simple relative target (e.g. halve the proportion of the cohort who do not attain, say, lower secondary education) will not be fair. Second, the overall influence of low income countries on the chances of achieving a global target will grow, as their share of global population will grow disproportionately; therefore, demographic projections will need to be taken into account.

References

Clemens, M. 2004. The Long Walk to School: International Education Goals in Historical Perspective Washington, DC, Center for Global Development. (Working Paper 37.)

Lange, S. 2015. Have Education Goals Accelerated Progress? Background paper for 2015 Education For All Global Monitoring Report

Meyer, J. W., F. O. Ramirez and Y. N. Soysal. 1992. World Expansion of Mass Education, 1870-1980. Sociology of Education, Vol. 65, No. 2, pp. 128-149

Vandemoortele, J. and E. Delamonica. 2010. Taking the MDGs Beyond 2015: Hasten Slowly. Poverty in Focus. Number 19. http://www.ipc-undp.org/pub/IPCPovertyInFocus19.pdf

Annex 1: Results by region

Figure A1. Projected attainment rates by region and level, 2010-2100

Sub-Saharan Africa

South and West Asia

East Asia and the Pacific
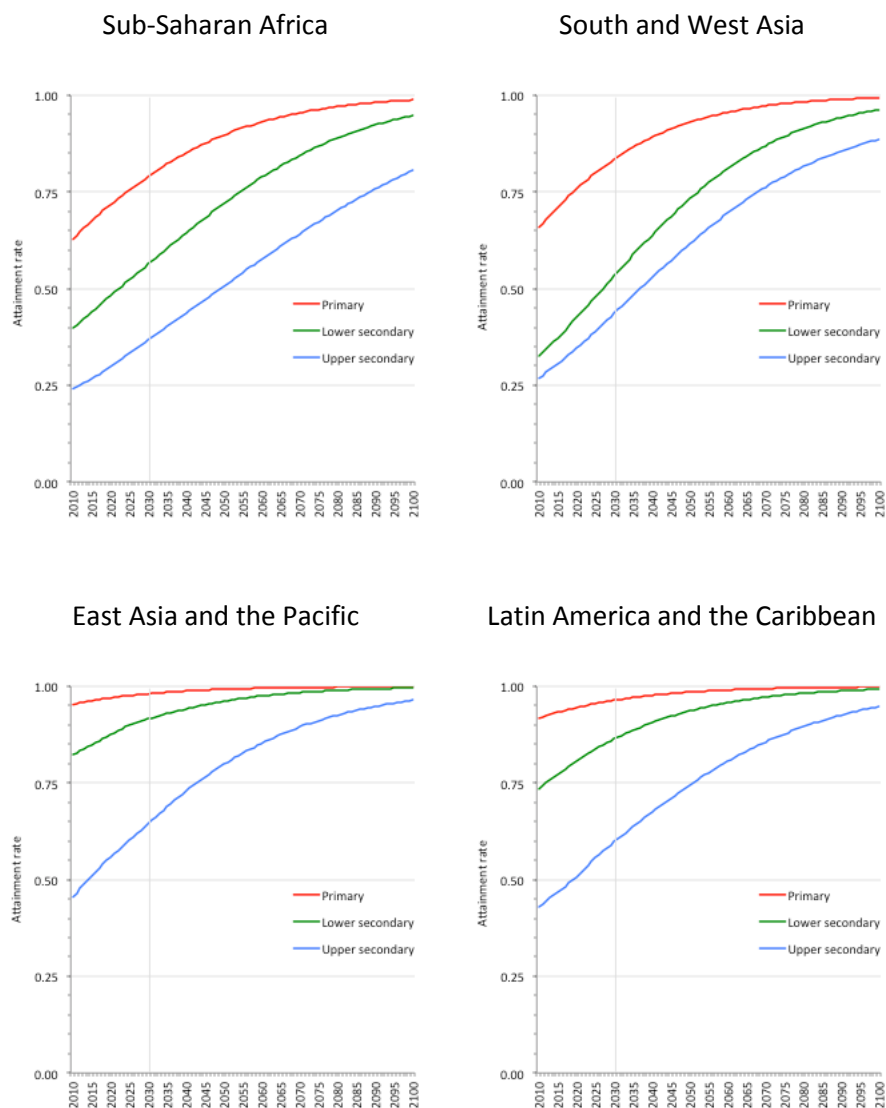
Latin America and the Caribbean

Table A1. Projected attainment rates (2015, 2030 and 2050) and year of achieving 95%-97% attainment rates

	Primary				Lower secondary				Upper secondary			
	Sub-Saharan Africa	South/West Asia	Latin America/Caribbean	East Asia/Pacific	Sub-Saharan Africa	South/West Asia	Latin America/Caribbean	East Asia/Pacific	Sub-Saharan Africa	South/West Asia	Latin America/Caribbean	East Asia/Pacific
2015 (%)	68	82	93	96	44	65	77	85	27	30	47	51
2030 (%)	79	90	**96**	98	56	78	**86**	92	37	43	**60**	65
2050 (%)	90	96	99	99	72	90	94	96	51	60	75	80
Year to reach												
95%	2068	2046	2023	2006	after 2100	2068	2056	2044	after 2100	after 2100	after 2100	2091
97%	2079	2057	2034	2020	after 2100	2080	2068	2056	after 2100	after 2100	after 2100	after 2100

Note: The estimates are representative of the low and middle income countries in each region. In the case of East Asia and the Pacific, they are therefore not inclusive of high income countries such as Australia and Japan.

Annex 2: Sources

Country	Survey	Year	Country	Survey	Year
Afghanistan	MICS	2010	Kazakhstan	MICS	2010
Albania	DHS	2008	Kenya	DHS	2008
Argentina	EPH	2012	Kyrgyzstan	DHS	2012
Armenia	DHS	2010	Lao PDR	MICS	2011
Bangladesh	DHS	2011	Lesotho	DHS	2009
Belarus	MICS	2012	Madagascar	DHS	2008
Belize	MICS	2011	Malawi	DHS	2010
Benin	DHS	2011	Maldives	DHS	2009
Bhutan	MICS	2010	Mali	DHS	2012
Bolivia, P. S.	DHS	2008	Mexico	ENIGH	2012
Bosnia and Herzegovina	MICS	2011	Mongolia	MICS	2010
Brazil	PNAD	2012	Morocco	HYS	2009
Burkina Faso	DHS	2010	Mozambique	DHS	2011
Burundi	DHS	2010	Nepal	DHS	2011
Cambodia	DHS	2010	Nicaragua	ENMV	2009
Cameroon	DHS	2011	Niger	DHS	2012
Central African Republic	MICS	2010	Nigeria	DHS	2013
Chad	MICS	2010	Pakistan	DHS	2012
China	CHNHS	2009	Palestine	MICS	2010
Colombia	DHS	2010	Peru	DHS	2012
Congo	DHS	2011	Philippines	DHS	2008
Costa Rica	MICS	2011	Rwanda	DHS	2010
Côte d'Ivoire	DHS	2011	Sao Tome and Principe	DHS	2008
D. R. Congo	MICS	2010	Senegal	DHS	2010
Ecuador	ENEMDU	2013	Serbia	MICS	2010
Egypt	DHS	2008	Sierra Leone	MICS	2010
Ethiopia	DHS	2011	South Africa	GHS	2013
Gabon	DHS	2012	Suriname	MICS	2010
Ghana	MICS	2011	Swaziland	MICS	2010
Guatemala	ENCOVI	2011	Tajikistan	DHS	2012
Guinea	DHS	2012	TFYR Macedonia	MICS	2011
Guyana	DHS	2009	Timor-Leste	DHS	2009
Haiti	DHS	2012	Togo	MICS	2010
Honduras	DHS	2011	Tunisia	MICS	2011
India	NSS	2008	U. R. Tanzania	DHS	2010
Indonesia	DHS	2012	Uganda	DHS	2011
Iraq	MICS	2011	Ukraine	MICS	2012
Jamaica	MICS	2012	Viet Nam	MICS	2010
Jordan	DHS	2012	Zimbabwe	DHS	2010

Technical note 2

Inequality in the primary education attainment rate
Technical note for the 2015 EFA Global Monitoring Report

The 2015 GMR (pp. 9) argues that "*the probability that children from the poorest quintile of households would not attain primary school in 2010 was more than five times higher than the corresponding probability of children from the richest quintile, a ratio that has slightly increased compared with 2000*". This short note presents the steps taken to calculate this result.

The primary attainment rate is defined as the fraction of an age cohort that has completed primary school. The reference group are individuals who were 3-5 years older than the official age of entry into the last grade of primary education. For example, if the official age of entry into the last grade of primary school is age 11, the attainment rate is calculated over the age group 14 to 16 years. The reason is that in many countries late entry means that the attainment rate does not peak until well after the official expected graduation age.

The analysis is based on data from Demographic and Health Surveys, Multiple Indicator Cluster Surveys, and national household surveys from 72 of the 142 low- and middle-income countries. Two waves of surveys were used for each country, the first carried out around 2000 and the second around 2010 (see Table 2). In each country, the primary attainment rate has been calculated for adolescents in households ranked at the bottom and top quintiles (20%) of a wealth distribution. Wealth in these surveys is mostly estimated on the basis of responses to questions related to household possession of *assets*. A wealth index is then calculated using principal component analysis to give a composite measure of household living standards[8]. In a few cases, these living standards – and the allocation of households into five groups – have been calculated on the basis of the distribution of household per capita *consumption* (e.g. the India National Sample Survey).

In Table 1, the average attainment rates by country, quintile and wave have been calculated with and without population weights. Between the two survey waves, the weighted average of adolescents from the poorest quintile who had not attained primary school fell from 43% to 34% (from 54% to 45% unweighted), while the respective figures for the richest quintile fell from 9.6% to 6.5% (from 19% to 12% unweighted). The ratio of two averages between the poorest to the richest increased between the two waves. In the case of the weighted average, the probability that children from the poorest quintile of households would not attain primary school increased from 4.5 to 5.3.

In averaging across countries, the Report follows practices of similar work reported by international agencies and academic researchers in the fields of education and health[9]. That said, when compiling survey evidence from different countries and time points, it should be recognized that wealth indices are not strictly comparable across countries and over time. Rather they are only indicative of the extent of inequality between groups as defined for a specific survey. In this regard an over time analysis of inequality trends has limitations.

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[8] See, for example, the DHS wealth index http://www.dhsprogram.com/topics/wealth-index/Index.cfm.
[9] In the case of education, see, for example: UNICEF (2015) *State of the World's Children report*, Tab.13; United Nations (2013) *The Millennium Development Goals Report*, p.15; King E and VT Nguyen (2013) *Intersecting sources of education inequality*, Chapter 26 in Figart DM and TL Warnecke (eds.) *Handbook of Research on Gender and Economic Life*, Fig.26.2; and Majgaard K and A Mingat (2012) *Education in Sub-Saharan Africa: A Comparative Analysis*, Fig.3.4. In the case of health, see, for example: Marmot M et al. (2008) *Closing the gap in a generation: health equity through action on the social determinants of health*, Lancet, Vol. 372, No. 9650, Fig.3; and Houweling TAJ and AE Kunst (2009) *Socio-economic inequalities in childhood mortality in low- and middle-income countries: a review of the international evidence*, British Medical Bulletin, Vol. 93 (1), Figs. 4 and 6A.

A number of researchers have attempted to develop a comparable index to address this issue[10]. While these efforts also have drawbacks[11], it will be useful to apply their insights into such analyses in the future.

Table 1. Percentage of adolescents who have not attained primary education

| Year | | Unweighted | | | Weighted | | |
		(1) Poorest	(2) Richest	(1)/(2) Ratio	(1) Poorest	(2) Richest	(1)/(2) Ratio
2000	Average	54.4	18.7	2.9	42.8	9.6	4.5
2010	Average	45.1	11.5	3.9	34.4	6.5	5.3

Table 2. Sources

Country	Year	Survey	Year	Survey	Country	Year	Survey	Year	Survey
Albania	2000	MICS	2008	DHS	Jordan	2002	DHS	2012	DHS
Argentina	2004	EPH	2012	EPH	Kazakhstan	1999	DHS	2010	MICS
Armenia	2000	DHS	2010	DHS	Kenya	1998	DHS	2008	DHS
Bangladesh	1999	DHS	2011	DHS	Kyrgyzstan	1997	DHS	2012	DHS
Belarus	2005	MICS	2012	MICS	Lao PDR	2000	MICS	2011	MICS
Belize	2006	MICS	2011	MICS	Lesotho	2000	MICS	2009	DHS
Benin	2001	DHS	2011	DHS	Madagascar	1997	DHS	2008	DHS
Bolivia, P. S.	1998	DHS	2008	DHS	Malawi	2000	DHS	2010	DHS
Bosnia/Herzeg.	2000	MICS	2011	MICS	Mali	2001	DHS	2012	DHS
Brazil	1999	PNAD	2012	PNAD	Mexico	2000	ENIGH	2012	ENIGH
Burkina Faso	1998	DHS	2010	DHS	Mongolia	2000	MICS	2010	MICS
Burundi	2000	MICS	2010	DHS	Morocco	2003	DHS	2009	HYS
C.A.R.	2000	MICS	2010	MICS	Mozambique	1997	DHS	2011	DHS
Cambodia	2000	DHS	2010	DHS	Nepal	2001	DHS	2011	DHS
Cameroon	1998	DHS	2011	DHS	Nicaragua	2001	ENMV	2009	ENMV
Chad	2000	MICS	2010	MICS	Niger	1998	DHS	2012	DHS
China	2000	CHNHS	2011	CHNHS	Nigeria	2003	DHS	2013	DHS
Colombia	2000	DHS	2010	DHS	Pakistan	2006	DHS	2012	DHS
Congo	2005	DHS	2011	DHS	Peru	2000	DHS	2012	DHS
Côte d'Ivoire	1998	DHS	2011	DHS	Philippines	1998	DHS	2008	DHS
D. R. Congo	2000	MICS	2010	MICS	Rwanda	2000	DHS	2010	DHS
Dominican Rep.	1999	DHS	2007	DHS	S.Tome/Principe	2000	MICS	2008	DHS
Ecuador	2000	ENEMDU	2013	ENEMDU	Senegal	2005	DHS	2010	DHS
Egypt	2000	DHS	2008	DHS	Serbia	2005	MICS	2010	MICS
Ethiopia	2000	DHS	2011	DHS	Sierra Leone	2000	MICS	2013	DHS
Gabon	2000	DHS	2012	DHS	South Africa	2002	GHS	2013	GHS
Ghana	1998	DHS	2011	MICS	Suriname	2000	MICS	2010	MICS
Guatemala	2000	ENCOVI	2011	ENCOVI	Swaziland	2000	MICS	2010	MICS
Guinea	1999	DHS	2012	DHS	Tajikistan	2000	MICS	2012	DHS
Guyana	2000	DHS	2009	DHS	Togo	2000	MICS	2010	MICS
Haiti	2000	DHS	2012	DHS	Uganda	2000	DHS	2011	DHS
Honduras	2005	DHS	2011	DHS	U. R. Tanzania	1999	DHS	2010	DHS

[10] See, for example, Smits J and R Steendijk (2013) The International Wealth Index, NiCE Working Paper 12-107
[11] Rutstein SO and S Staveteig (2014) Making the Demographic and Health Surveys Wealth Index Comparable DHS Methodological Reports No. 9, ICF International.

Country					Country				
India	1996	NSS	2008	NSS	Ukraine	2005	MICS	2012	MICS
Indonesia	1997	DHS	2012	DHS	Viet Nam	2000	MICS	2010	MICS
Iraq	2000	MICS	2011	MICS	Zambia	2001	DHS	2007	DHS
Jamaica	2005	MICS	2011	MICS	Zimbabwe	1999	DHS	2010	DHS