Monitoring Millennium Development Goals in Time Distance Perspective

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Abstract. The new generic time distance methodology offers a new view of the implementation of the MDGs that is exceptionally easy to understand and communicate. S-time-distance calculates the time lead or time lag of actual values from the lines to 2015 MDGs targets. Progress has been made in all selected indicators and in all world regions, yet looking at the implementation of MDGs for the selected 10 indicators for Developing Regions only two were ahead and the other 8 indicators were behind the lines for between 4 years and nearly 13 years. The largest delays were for maternal mortality ratio and prevalence of underweight children under-five years of age; by regions in sub-Saharan Africa, Western Asia and Southern Asia. Detailed results are presented in sections on Official Development Aid, for 8 MDGs indicators across countries in sub-Saharan Africa and for 190 countries for under-five mortality rate.

The application to monitoring of the MDGs gives a new broader understanding of the situation in a dynamic context to enriching the policy debate. The time distance methodology can be usefully applied also in monitoring plans, budgets, forecasts, etc. and SICENTER developed a free web tool to facilitate this for interested users.

Key words – millennium development goals, S-time-distance, monitoring, foreign aid, Africa, child mortality

1. INTRODUCTION

This article demonstrates the analytical and presentation capabilities of the novel time distance methodology that can be used as one of the measures of the implementation of MDGs across a number of relevant indicators by numerous users. The comparison across many indicators from different fields of concern is a very important topic of interest of international organisations and aid donors at the world and regional levels as well as in the national and sub-national analysis and reports of implementation of the MDGs. A substantial effort by the international and national organisations has been and will be channelled into collecting the necessary data for the related system of indicators; time distance concept can be helpful for a better utilisation of data for policy debate.

The new generic time distance methodology offers a new view of data that is exceptionally easy to understand and communicate. Statistical measure S-time-distance measures the distance (proximity) in time between the points in time when the two series compared reach a specified level of the indicator X. Expressed in time units (years, months, etc.) the interpretation for monitoring with S-time-distance measure is straightforward and intuitively understandable to everyone. For given level of actual values it deals with the deviation (lead or lag in time) between the time when such actual value was attained and the time when that level was supposed to be reached on the line to the respective 2015 MDGs target. It is like tracking the actual arrivals in comparison with the train or bus timetable, the difference being that the geographical space is here replaced with the indicator space. Thus it represents an excellent presentation and communication tool that is intuitively understood by policy makers, experts, managers, media and the men on the street.

It is complementing rather than replacing existing statistical measures for monitoring implementation of targets (or plans, budgets, forecasts, goodness-of-fit in regressions and models). In the empirical part of the article the time lead or time lag in implementing MDGs

targets for selected indicators is evaluated for the aggregate of developing regions, for seven world regions and for eight indicators for Sub-Saharan countries. The case of child mortality presents an example how this new view of the implementation can be performed across 190 countries. Conclusions summarize the pertinent methodological and substantive points.

2. TIME DISTANCE METHODOLOGY

At the theoretical level the present state-of-the-art does not realize that, in addition to static comparison, in comparing time series indicators there exists in principle a theoretically equally universal measure of difference (distance) in time for a given level of the variable. S-time-distance concept enables additional exploitation of data and visualization for time related databases and indicator systems. A new set of information with clear interpretability, hidden in the available data, is now provided due to an added dimension of measurement and analysis.

The present state-of-the-art neglects this additional information available in time series databases and thus leads to an information loss that has no justification. The results and conclusions based on the two-dimensional analysis, static measures and time distance, attach a new dimension and new insight, while none of the earlier results are lost or replaced.

The new view of information, using levels of the variable(s) as identifiers and time as the focus of comparison, is theoretically universal, intuitively understandable and can be usefully applied to a wide variety of substantive fields at macro and micro levels. Here we shall only briefly define the two novel generic statistical measures, S-time-distance and S-time-step, to indicate the overall framework and then return to the less complex and easily understandable application for monitoring implementation of the MDGs targets and similar applications.

Time distance in general means the difference in time when two events occurred and as such is used in many fields, like history or spatial analysis. However, S-time-distance is a special category of time distance, which is defined for the level of the analyzed indicator. The generic concept of S-time-distance has a wide area of application (see e.g. Sicherl 1994, 2004, 2007a, 2009).

In graphical terms, the usual way is to compare the time series in the vertical dimension, i.e. for a given point in time. The S-time-distance approach uses an additional perspective; it compares the respective time series in the horizontal dimension, i.e. for a given level of the variable. The observed distance in time (the number of years, quarters, months, etc.) is used as a temporal measure of disparity between the two series in the same way that the observed difference (absolute or relative) at a given point in time is used as a static measure of disparity[1].

Namely, when we compare time series for a given variable for two or more units there are two obvious directions of comparison: by time and by level of the variable. Granger finds the time distance concept a useful addition to the present state-of-the-art (Granger, Jeon 1997)[2].

The present state-of-the-art looks at the time series for two units (cases)

$$X = X_i\,(t) \text{ and } X = X_j\,(t) \qquad (1)$$

and arrives at static distance like $\Delta X_{ij}(t) = X_i(t) - X_j(t)$.

Time distance method looks at the inverse relations

$$t = t_i (X) \text{ and } t = t_j (X). \quad (2)$$

The result is a time matrix with new information from which two time distance generic measures can be derived (Sicherl 2007a).

Table 1. *Time matrix: time when a specified level of the variable was achieved in each compared unit*

Level	**Time $t_i (X_L)$**	**Time $t_j (X_L)$**
X_{L1}		$t_j (X_{L1})$
X_{L2}	$t_i (X_{L2})$	$t_j (X_{L2})$
X_{L3}	$t_i (X_{L3})$	$t_j (X_{L3})$
…	…	…
X_{Ln}	$t_i (X_{Ln})$	

Two operators applied to the above time matrix lead to the derivation of two novel statistical measures expressed in standardized units of time that everybody understands. The first suggested statistical measure ***S-time-distance*** measures the distance (proximity) in time between the points in time when the two compared series reach a specified level of the variable X. It compares two series by subtracting *horizontally* the respective times for a given level in the time matrix.

S-time-distance for a given level of X_L is defined as[3]

$$S_{ij}(X_L) = \Delta t(X_L) = t_i(X_L) - t_j(X_L) \quad (3)$$

The sign of the time distance comparing two units is important to distinguish whether we are dealing with time lead (-) or time lag (+) (in a statistical sense and not as a functional relationship)

$$S_{ij}(X_L) = -S_{ji}(X_L). \quad (4)$$

Subtracting the respective times in the time matrix for consecutive levels of the variable for each column *vertically* derives the second suggested measure ***S-time-step***. These vertical differences can be labelled as time steps and represent an alternative description to the growth rate measure. The concept of S-time-step measures the growth characteristics of a series, using the inverse relation to the conventional $\Delta X/\Delta t$ or growth rate metrics (Sicherl 2007a). This second statistical measure S-time-step and its relation to S-time-distance will not be discussed further in this paper.

For monitoring implementation of the MDGs the two series in the time matrix are very simple. One of them is the series of actual values for the analyzed indicator in the first column which defines the relevant levels. Next is the series of times when these levels were achieved which is simply the actual time related to the values. The third series is the calculated time on the line to the 2015 MDGs target when the actual values were assumed to be reached. This also depends on the assumption whether linear or exponential line to target is selected.

Comparing actual values with target (or estimated) values in two dimensions

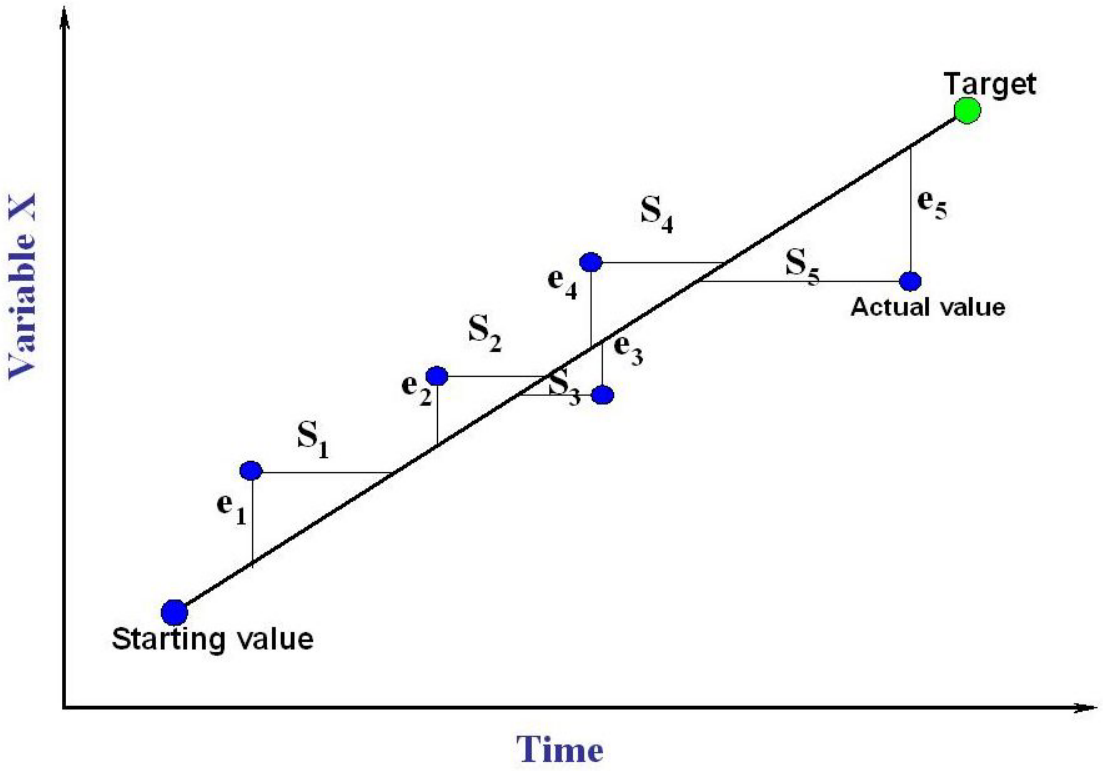


Figure 1. *Monitoring: S-time-distance deviations from the line to target*

Figure 1 explains the calculation of the two dimensions of deviations from the assumed line to target. The values of e_i are static measures of deviation (absolute or relative differences) and S_i are S-time-distances indicating time lead or time lag of actual values against assumed lines to target[4]. For instance, the actual value of infant mortality for the aggregate of developing regions was 51 in 2007 according to UNSD. On the linear line of decrease to the 2015 target of infant mortality rate of 23.6 it is estimated that the value of 51 should have been achieved already in 2000.6, which means that the time delay is 6.4 years (2007 – 2000.6). This is the difference between second and the third column in the time matrix for the level of 51.

Figure 2 presents the empirical example of monitoring the implementation of MDGs target for under-five mortality rate for the aggregate of developing countries in the two dimensions (for more details see Section 6). Again, the actual value of the indicator for 2008 (or any other year) is compared to the desired decreasing line to target and the deviations in the two directions are calculated. The results will depend not only on the actual values but also on the selection of the line to the targets. The two simplest variants are linear or exponential line to target. In this article we shall use the linear line for the indicators with desired decreasing tendency (like Figure 2) and exponential line to target for indicators with desired increasing tendency (like school enrolment).

We can observe that deviations from the line to target are increasing over time both for S-time-distance and for static measures of deviation. Over the 18 years of the analyzed period by 2008 the time delay increased to 7.4 years. Expressed in standardized time units S-time-distance measure is intuitively understandable by everybody. As mentioned before, it is like comparing actual arrivals with the train (airplane, bus) timetable. As it is comparable across

variables, fields of concern and units of comparison S-time-distance can thus be used as an excellent complementary analytical and presentation tool for policy debate.

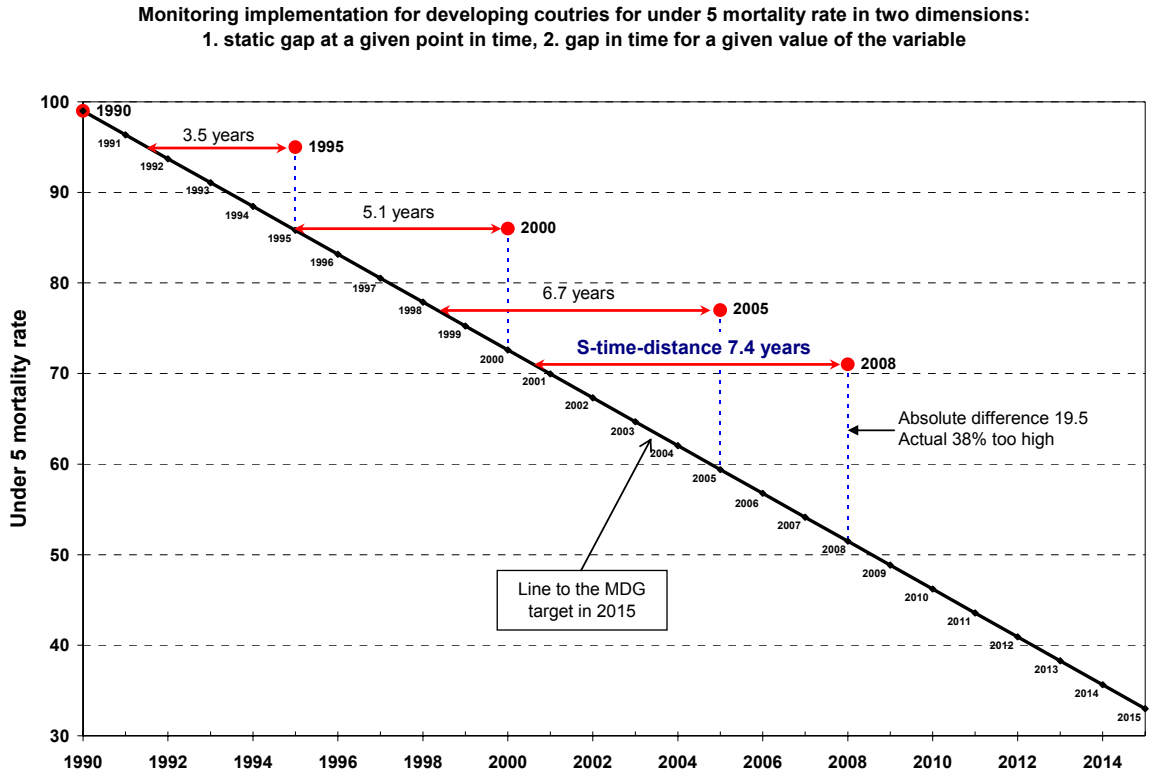


Figure 2. *Example of monitoring in two dimensions*

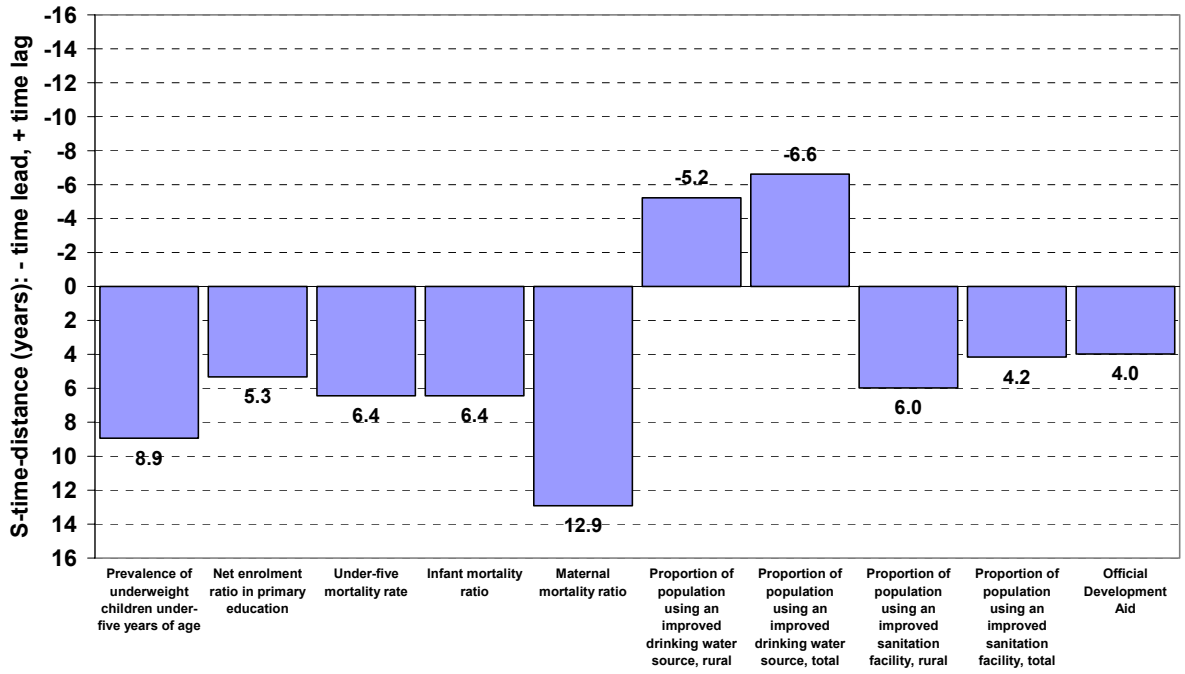
SICENTER developed a free web tool which allows a variety of interested users such as international and national organizations, NGOs, experts, managers, educators, students and media to monitor with S-time-distance the lead or lag in time for the UN Millennium Development Goals, the Lisbon and NRP targets in the case of EU and or other planned, budget, or aid disbursement targets at world, regional, national, sub-national and business levels[5]. The tool is available at http://www.gaptimer.eu/s-t-d_monitoring_tool.html

3. IMPLEMENTATION OF SELECTED MDGS FOR DEVELOPING REGIONS

Implementation of the Millennium Development Goals is an important global issue. It requires continuous monitoring and communication of the situation at the world, regional, national and sub-national levels. For this we need data and institutions but also statistical measures that are transparent and easily understood by everyone.

The MDG Progress Chart (United Nations 2009b) is very useful to give a quick assessment of the complex issue of levels, trends and progress made over 18 indicators, as it can deal also with qualitative judgments. For a more restricted number of selected indicators for which numerical estimates are available the MDG Progress Chart can be complemented with time distance measure of monitoring the progress of implementation[6] to provide some additional information or background facts for such judgments.

S-time-distance deviation from the line to target for selected indicators:
DEVELOPING REGIONS, around 2005-2007



Source: Author's calculations based on data from United Nations (2009a)

Figure 3. *Time distance view of the implementation of the Millennium Development Goals forDeveloping Regions*

Figure 3 provides a quick time distance view in numerical terms across 10 selected indicators using indicator values from the statistical annex of the MDG Report 2009 (United Nations 2009a) launched in July 2009. It is understood that both the Report and the results in this article are affected by problems of accuracy and gaps in national data as well as by problems of reconciling national and international data (ibid.). With this caveat we can still say that the time distance view of the deviation of the actual developments from the respective line(s) to the 2015 MDGs targets provides a rapid transparent overview of the situation for the aggregate of developing regions over 10 indicators from six areas of MDGs.

The results in Figure 3 and Table 2 show that the degree of implementation of MDGs is far from satisfactory. Of the selected 10 indicators for the aggregate of Developing Regions only for two indicators (proportion of population using an improved drinking water source, total and rural) the implementation of the MDGs targets are ahead of the line to target, in these cases more than five years ahead. For the other eight indicators the delays behind the lines to the respective MDGs targets vary between four years for Official Development Aid (ODA) and 12.9 years for maternity mortality rate.

Table 2. *S-time-distance deviation from the lines to the MDGs targets in years (- time ahead, + time behind the line to target)*

	Developing Regions	Northern Africa	Sub-Saharan Africa	Latin America and the Caribbean	Eastern Asia	Southern Asia	South-Eastern Asia	Western Asia
Prevalence of underweight children under-five years of age	8.9	-1.2	12.2	-5.7	-8.0	11.4	0.8	17.0
Net enrolment ratio in primary education	5.3	-2.3	3.8	0.8	N/A	-0.2	N/A	5.8
Under-five mortality rate	6.4	-4.7	9.2	-3.8	-2.2	3.2	-3.9	-1.5
Infant mortality rate	6.4	-2.4	10.3	-2.2	-0.7	4.5	-2.1	-0.3
Maternal mortality ratio	12.9	3.0	14.3	5.7	-0.8	8.0	3.9	9.7
Proportion of population using an improved drinking water source, rural	-5.2	1.8	5.6	-0.2	-9.0	-9.0	-7.8	-1.2
Proportion of population using an improved drinking water source, total	-6.6	-0.9	5.9	-9.0	-9.0	-9.0	-8.2	1.5
Proportion of population using an improved sanitation facility, rural	6.0	1.1	11.9	0.9	0.5	3.8	-0.6	5.9
Proportion of population using an improved sanitation facility, total	4.2	-3.0	11.0	-1.7	-1.5	5.3	-2.0	3.7

Source: Author's calculations based on data from United Nations (2009a)

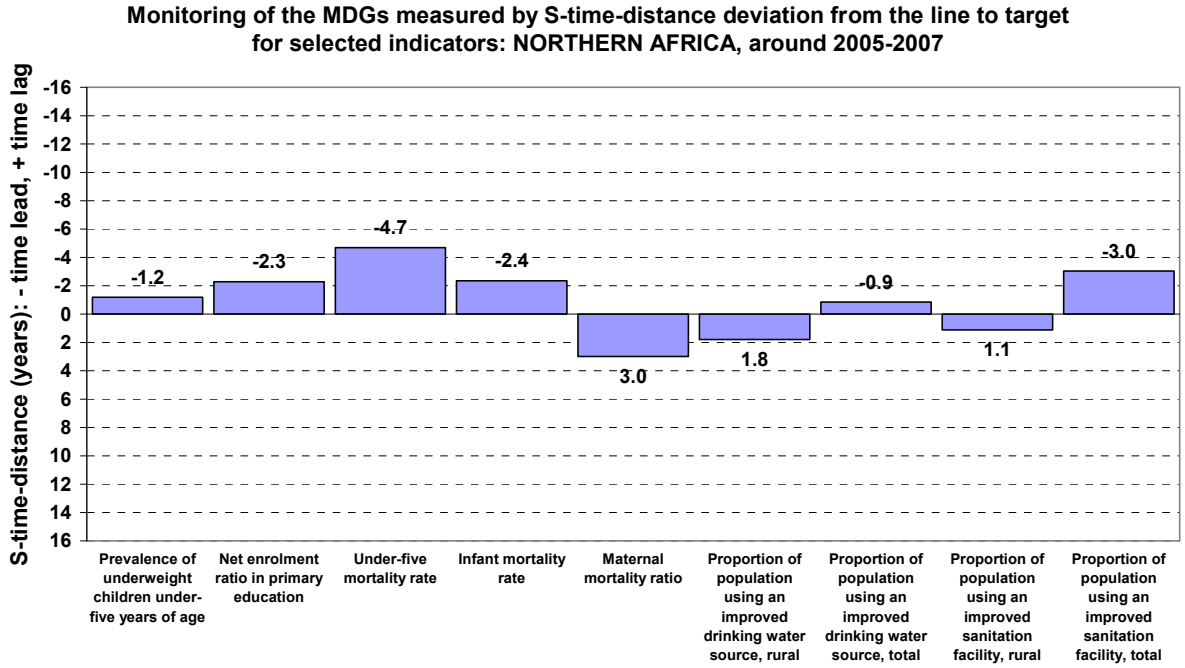


Figure 3a. *Time distance view of the implementation of the MDG for Northern Africa*

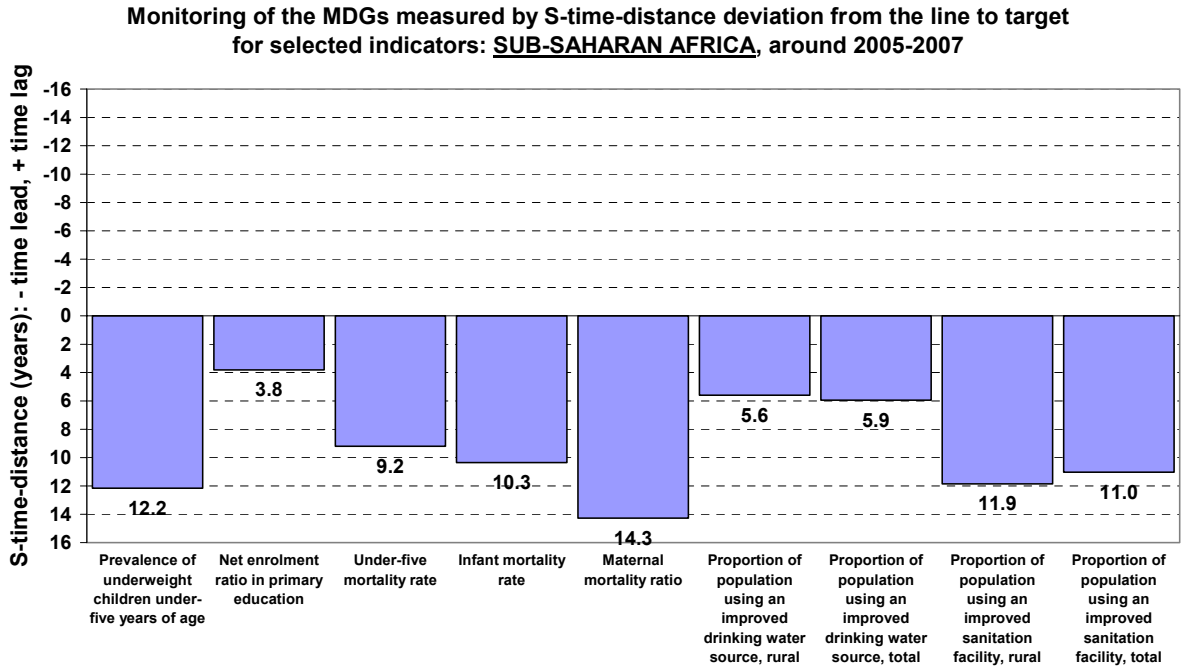


Figure 3b. *Time distance view of the implementation of the MDG for Sub-Saharan Africa*

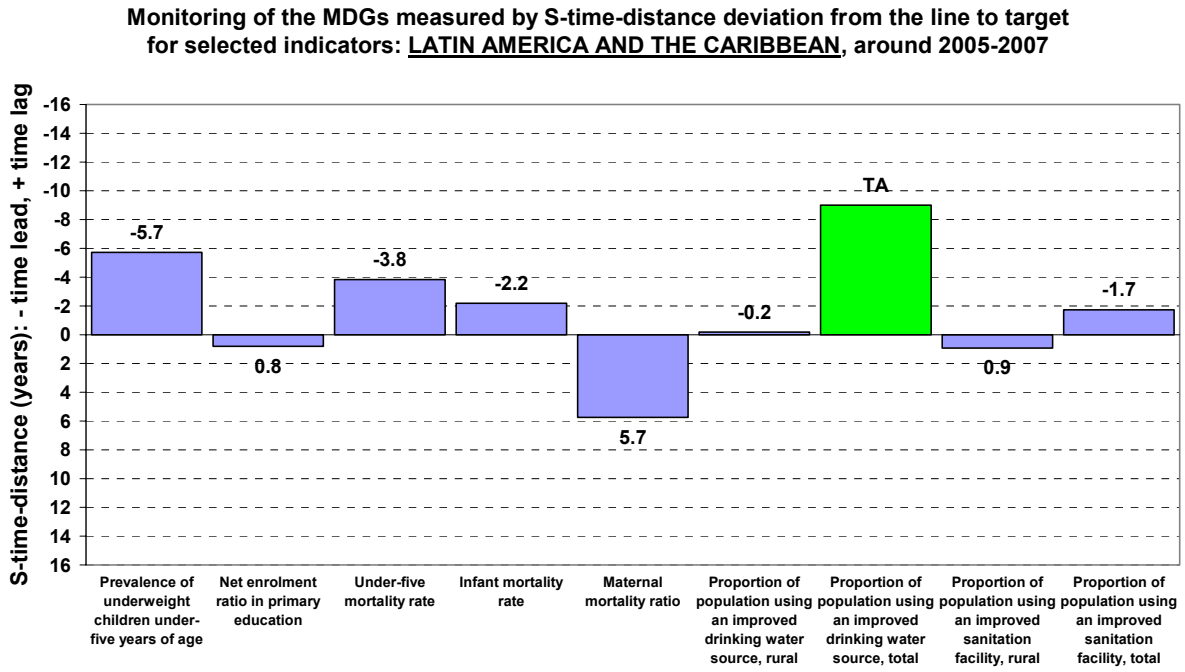


Figure 3c. *Time distance view of the implementation of the MDG for Latin America and the Caribbean*

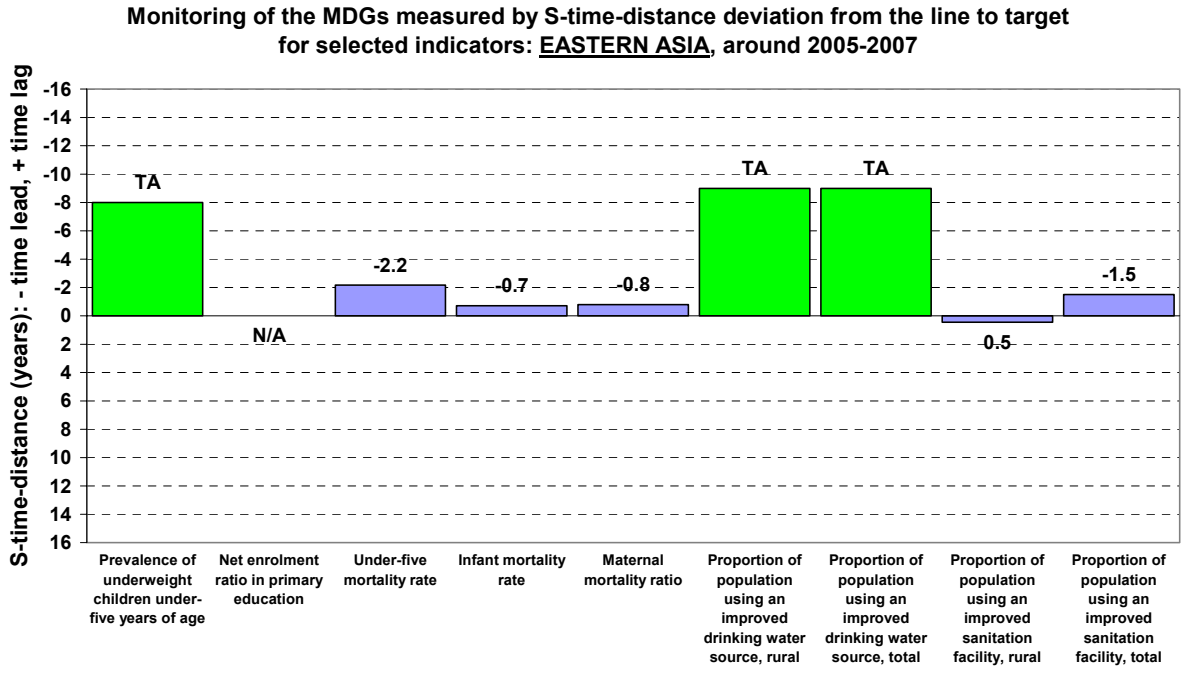


Figure 3d. *Time distance view of the implementation of the MDG for Eastern Asia*

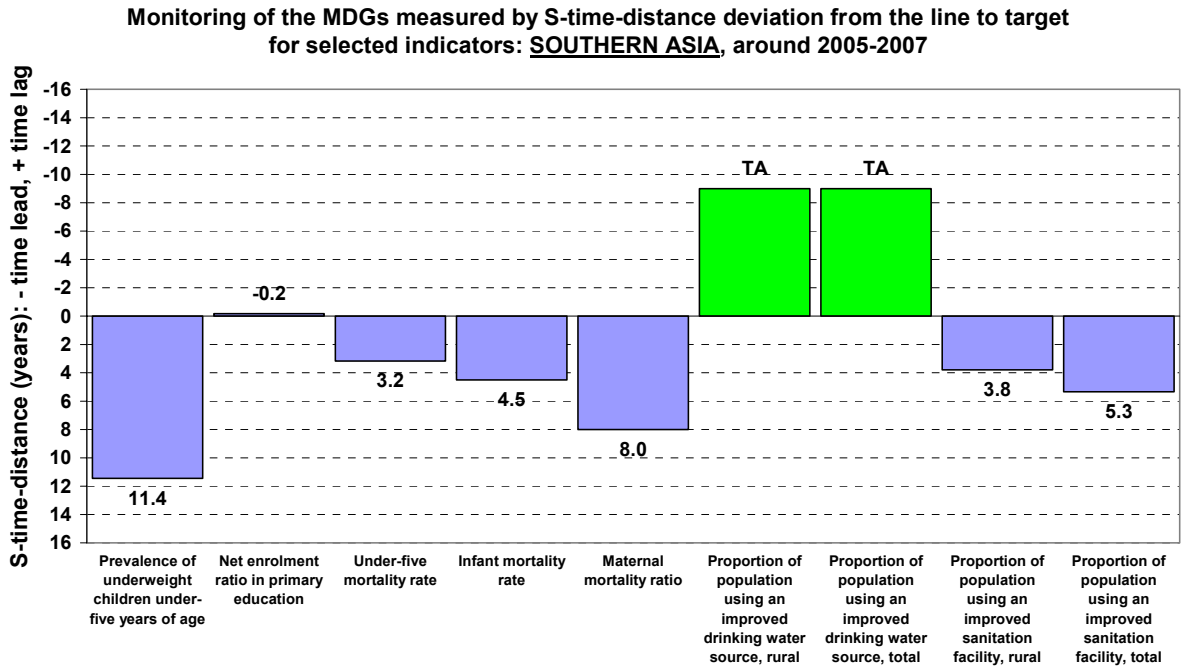


Figure 3e. *Time distance view of the implementation of the MDG for Southern Asia*

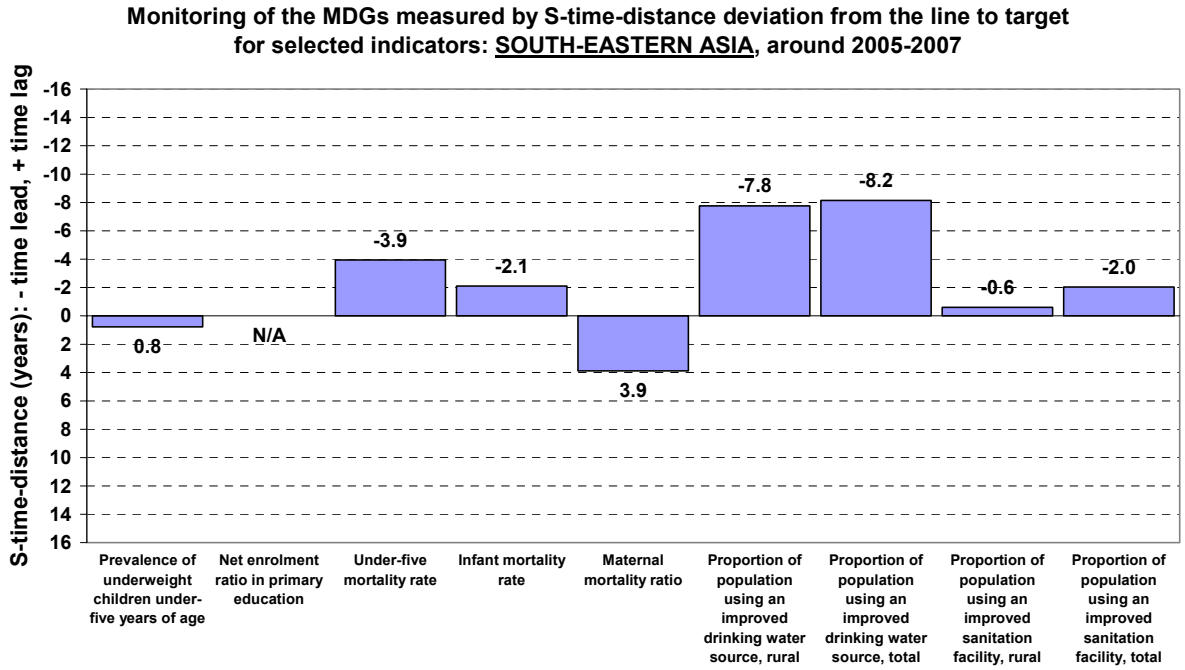


Figure 3f. *Time distance view of the implementation of the MDG for South-Eastern Asia*

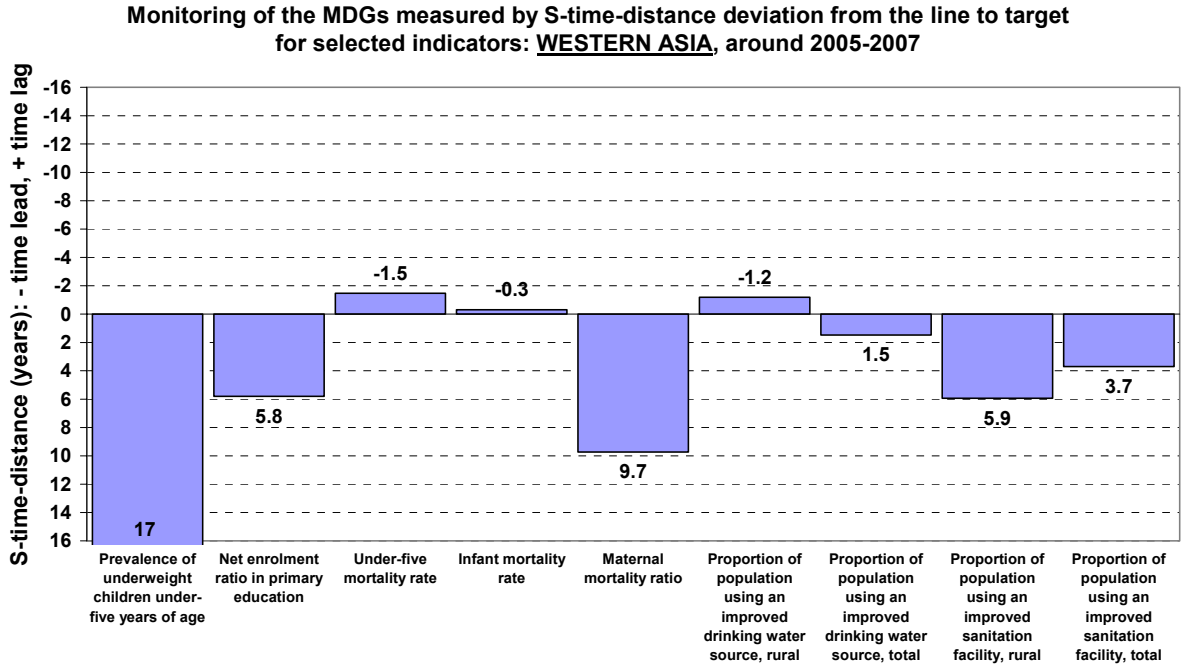


Figure 3g. *Time distance view of the implementation of the MDG for Western Asia*

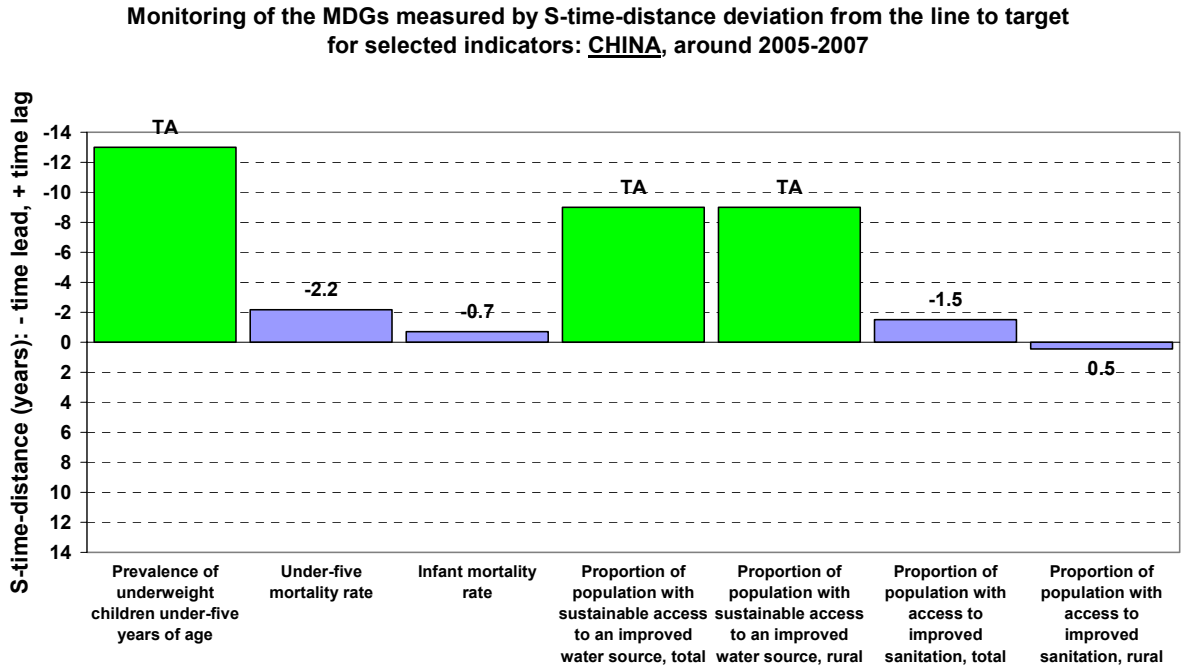


Figure 3h. *Time distance view of the implementation of the MDG for China*

Comparisons across fields of concern in Figure 3 and in Table 2 show that the most pressing issues in implementing MDGs are maternal mortality ratio and prevalence of underweight children under-five years of age. The time distance delay for maternal mortality ratio of nearly 13 years for the aggregate is especially pronounced in sub-Saharan Africa, Western Asia and Southern Asia; only Latin America and Caribbean region is just about on the line to target.

The delay for the prevalence of underweight children under-five years of age is nearly nine years for the aggregate, with even higher delays for sub-Saharan Africa, Western Asia and Southern Asia. In contrast with maternal mortality for this indicator two regions, East Asia and Latin America and Caribbean regions, are considerably ahead of the line to target. China is an outstanding performer; it has already reached their 2015 MDGs targets for prevalence of underweight children under-five years of age, for population under 1$ PPP per day and for the two indicators on proportion of population using an improved drinking water source.

The other five indicators in Figure 3 and Table 2 show the range of time distance delays for the aggregate between four and six years. There are differences among regions; sub-Saharan Africa stands out with much higher delays. The situation in sub-Saharan Africa will be examined in more detail in Section 5. Figure 3 shows also that the time distance for ODA behind the line to the UN assumed target of 0.7 percent of GNI in 2015 is about four years, which will be discussed in Section 4.

These conclusions have to be explained by making a clear distinction between the progress made in the world in the analyzed period and the considerable delays in the implementation of the MDGs. On the one hand, time distances for seven world regions in Table 2 imply[7] that for all of the nine indicators in these regions the current values are better than the starting 1990 values. Thus progress has been made in all selected indicators and in all world regions but it has been quite uneven across regions as well as across countries within the regions. On the other hand, the deviations from the line to the MDG targets depend not only on the performance of the countries and international institutions but also on how well the goals and targets were established in the search of balance between desirability and feasibility.

On the methodological side a comment is in place on the issue of advantages and disadvantages of various statistical measures for measuring implementation of the MDGs targets. We shall here discuss two static measures of deviation (absolute and relative deviation) and S-time-distance deviation from the line to target. Firstly, all these measures are useful; all are understandable concepts showing diverse perspectives and should be used simultaneously for better understanding of the complex situation. Lack of space is the reason that we concentrate on the time distance aspect here.

Secondly, absolute deviations are expressed in the specific units for each indicator like infant mortality rate per 1000 live birth. They are very important for planning, actions and monitoring in specific fields but cannot be compared directly across a number of indicators because of different units used. Relative deviations like ratios between actual values and calculated values on the line to target (or expressed in percentage deviations) in principle allow comparisons of this aspect across more indicators. When used across many indicators for MDGs implementation the problem is that for certain indicators the desired direction of the line to target is increasing, while for others it is decreasing. This makes it rather cumbersome to follow or to graph such estimates across indicators with different desired directions as it is mentioned in Easterly (2009).

Thirdly, S-time-distance can deal with such problems of comparisons across more indicators. It has a convenient technical characteristic that it is invariant for monotonous transformations of the compared time series. Negative (or positive) sign for S-time-distance in Table 2 gives the correct result that such region is ahead (or behind) of the respective line to target whatever the desired direction of the line to target for the indicator. Similarly, it can in the same way deal with the problem when the same problem is expressed with alternative indicators like child mortality or child survival rate.

The under-five mortality rate per 1000 live birth for 2008 of 71 in Figure 2 can be alternatively expressed as child survival rate per 1000 live birth of 929. Comparisons with the two respective lines to targets will give the same result for 7.4 years delay for S-time-distance (also the same value of absolute differences of 19.5 but with different sign) and very different percentage deviations. For child mortality rate the percentage deviation from the respective line to target indicates that the child mortality rate is 38 percent too high, while for child survival rate it indicates that it is 1.4 percent too low – a very different perceptions built on the basis of percentage deviations when the same situation is expressed by two differently specified indicators.

All measures are needed but obviously the time distance information seems to be at least as helpful in providing a proper perception of the progress in implementation or the lack of it as is the percentage difference. The same conclusion was reached in using the time distance monitoring method for analyzing delays in delivering Lisbon Strategy targets for the EU (Sicherl 2008).

4. DELAYS IN OFFICIAL DEVELOPMENT ASSISTANCE

In this section the time distance methodology will be used to evaluate the situation of implementation of the indicator percentage of gross national income devoted to official development assistance (ODA/GNI) in relation to the assumed line to the UN 2015 target of 0.7 percent. An exponential line to this target is assumed and the respective S-time-distance deviations are calculated for the OECD DAC countries. Several of the analyzed countries are not officially committed to this target but such common benchmark allows for the relative comparisons of the official development assistance effort. S-time-distance measure was used to get an easily understandable overview of the situation whether the 22 DAC countries are on- or off- the track to this target.

Table 3 clearly shows that for the net official development assistance 2008 was another disappointing year. Tracking the timetable for reaching the UN target with time distance showed how widely the performance in 2008 was off the track: the delay of four years for DAC total means that the actual ODA/GNI value in 2008 was at the level supposed to be achieved already in 2004 on the line to the UN target. The percentage shortfall would amount to 36 percent for the USA and 61percent for Japan. Also the hypothetical projections for 2010 by the OECD-DAC Secretariat indicate that no radical breakthrough is in sight. Public awareness of these facts should be instrumental for public pressure on the governments for far-reaching improvements in this domain.

Table 3. *DAC countries by S-time-distance deviation from the exponential line to the UN ODA/GNI 2015 target for the period 2000 - 2008*

	2000	2001	2002	2003	2004	2005	2006	2007	2008
DAC Countries, Total	0	1.0	1.4	1.4	1.8	-0.3	1.6	3.9	4.0
Sweden	TA	TA	TA	TA	TA	TA	TA	TA	TA
Luxembourg	TA	TA	TA	TA	TA	TA	TA	TA	TA
Norway	TA	TA	TA	TA	TA	TA	TA	TA	TA
Denmark	TA	TA	TA	TA	TA	TA	TA	TA	TA
Netherlands	TA	TA	TA	TA	TA	TA	TA	TA	TA
Ireland	0	-1.2	-3.5	-2.0	-1.0	-1.3	-4.6	-3.6	-3.8
Spain	0	-3.0	-0.2	2.4	2.9	2.4	1.2	-1.1	-0.7
Austria	0	-4.3	0.4	> 3	4.0	-6.0	-3.6	-3.2	-0.1
Finland	0	0.4	-0.2	0.8	0.8	-2.3	1.3	2.3	2.0
Belgium	0	0.4	-2.0	-8.5	1.1	-3.7	-1.4	3.0	2.0
United Kingdom	0	1.0	> 2	1.8	1.8	-2.4	-2.9	4.8	2.4
Germany	0	1.0	2.0	2.4	3.4	0.5	1.5	2.0	2.6
France	0	0.4	-1.7	-2.1	-1.5	-3.0	-2.0	2.4	3.4
United States	0	0.3	0.0	-0.1	-0.1	-1.1	1.5	3.4	3.5
Switzerland	0	1.0	> 2	0.2	0.1	-0.4	3.2	5.3	4.1
Italy	0	-0.3	-1.8	0.6	2.7	-2.1	2.2	3.6	4.2
Australia	0	> 1	> 2	> 3	> 4	> 5	4.4	5.4	4.4
Canada	0	> 1	0.4	> 3	2.9	0.5	3.8	5.4	4.4
New Zealand	0	1.0	> 2	> 3	> 4	3.9	4.9	5.9	5.4
Portugal	0	> 1	1.4	> 3	-9.4	> 5	> 6	> 7	7.4
Greece	0	> 1	1.4	2.4	> 4	> 5	> 6	> 7	8.0
Japan	0	> 1	> 2	> 3	> 4	5.0	> 6	> 7	> 8

Source: Author's calculations based on data for ODA/GNI %: 2000-2005 UN MDG data web page, accessed 9 May 2008, for 2006-2008 OECD web page, for 2008 OECD(2009) accessed 8 July 2009

S-time-distance in years: - actual ahead of path to target + behind the path to target

TA - Target already achieved

> x - Actual value is worse that the starting value, therefore S-time-distance is more than x years

There is a wide gap between the development assistance efforts among the observed 22 countries. Only countries encompassing about 10 percent of population of DAC countries are ahead of the line to the UN target. The ODA/GNI value in the five European countries that have already reached the 0.7 percent target is in relative terms four times higher than in the group of four countries (United States, Japan, Italy and Greece) where it does not exceed 0.2 percent of their GNI. It is sad that the latter group includes more than one half of the population of the DAC countries. Overall, countries with nearly 90 percent of population in the DAC countries are behind the line to target, with time delays between two and eight years. They need to find the political will to do much better[8].

5. AFRICA - THE RESULTS FOR SUB-SAHARAN COUNTRIES

The results for world regions in Table 2 have shown that the time distances behind the respective lines to the MDGs targets are very large for sub-Saharan Africa. With the exception for net enrolment ratio in primary education and proportion of population using an improved drinking water source the time delays the lines to targets for the other six indicators range from nine to 14 years.

Table 4. *Frequency distribution of sub-Saharan countries for S-time-distance deviation from the lines to their MDG target*

Selected indicators	Years ahead of the line to MDG target				Years behind of the line to MDG target				Number of countries
	TA	-18 − -12	-12 − -6	-6 − 0	0 − 6	6 − 12	12 − 18	WTS	
Population undernourished, percentage, 2004	2		3	10	6	7	4	14	46
Net enrolment ratio in primary education, 2006-2007			2	8	9	3	2	5	29
Under-five mortality rate, 2007				3	13	15	11	6	48
Infant mortality rate, 2007				2	10	19	12	5	48
Proportion of population with sustainable access to an improved water source, total, 2006	7		1	8	5	6	6	2	35
Proportion of population with sustainable access to an improved water source, rural, 2006	6			6	6	7	5	6	36
Proportion of population with access to improved sanitation, total, 2006	1			3	7	15	6	4	36
Proportion of population with access to improved sanitation, rural, 2006	1			4	5	14	6	6	36
Number of countries	17	0	6	44	61	86	52	48	314
Percentage distribution	5.4%	0.0%	1.9%	14.0%	19.4%	27.4%	16.6%	15.3%	100.0%

Source: Author's calculations based on data from United Nations (2009c)

S-time-distance (- time ahead, + time behind the line to target)

TA - Target already achieved
WTS - Actual value is worse that the starting value

However, as mentioned in Section 3, in general considerable delays in the implementation of the MDGs need not mean that substantial progress has not been made in the analyzed period. This is also the case for sub-Saharan Africa, despite its difficult situation. Easterly (2009) argued that MDGs are unfair for Africa and that the degree of their implementation should not be overshadowing the successes achieved.

Table 4 presents frequency distribution of sub-Saharan countries for S-time-distance deviation from the line to their MDG target for eight selected indicators. This table allows for a more detailed examination of these issues on the basis of between 29 and 48 countries for each indicator depending on data availability, which in total for eight indicators amounts to 314 cases. The first conclusion shows that in only 48 out of 314 cases, i.e. in about 15 percent the current results were worse than the starting 1990 values. The worst situation is for the indicator percent of the population undernourished where for 14 sub-Saharan countries out of 46 (30 percent) the results in 2004 were worse than in 1990.

In general terms across all eight indicators measured at the country level progress was achieved in the analyzed period in about 85 percent of cases. Compared with the lines to MDGs targets the situation is very different; S-time-distance analysis shows that about 79 percent of cases are behind the lines to target and 21 percent of cases are ahead of them (about five percent even already reached their 2015 targets).

A question was be raised in Section 3 whether the rule that was setting the MDGs targets mostly in relative terms for the aggregate of developing countries and world regions (and implicitly for individual countries), i.e. across all units, was an appropriate approach to balance desirability and feasibility. It is understandable that this made the explanation of the action of the world community easier. However, it may be rather unrealistic to expect that the same targets (e.g. same percentage changes for a given indicator) can be achieved from very different starting positions[9]. We shall discuss this question in Section 6 on the example of child mortality. In general it remains a very important question for preparation of the next phase of the MDGs.

6. AN EXAMPLE OF RESULTS FOR 190 COUNTRIES – CHILD MORTALITY RATE

In this section we shall use UNICEF data for 2007 for 190 countries and for 2008 for world regions for under five mortality rate for implementation of this MDG (and for 2007 for infant mortality rate for benchmarking the position of these countries against benchmark Sweden). Data source is UNICEF web page (2009). This is a more recent source than United Nations (2009a and 2009c) used in the previous sections which means that there may be some differences in S-time-distance numerical results for child mortality.

Figure 4 is not an example of monitoring MDGs implementation but an evaluation of the degree of world disparities in infant mortality by S-time-distance measure. It is a benchmarking exercise elaborating the point made in the previous section that different countries have (and have had) very different starting positions. Here we shall only show the summary result of benchmarking the 2007 values for 190 countries against Sweden as a benchmark[10]. The procedure is as follows. The trend for Sweden as a benchmark is approximated from the long time series data by Mitchell (2003) for infant mortality rate for the period starting in the year 1751. To diminish the yearly variations we calculated three-years moving averages for Sweden. The 2007 values of infant mortality indicator for 190 countries are taken from the web page of UNICEF (2009); then for each country it is

evaluated in which year its 2007 value was attained in Sweden in the past. Subtracting this historical information from 2007 gives the S-time-distance estimate of the time lag behind Sweden for the current level of infant mortality for the respective country.

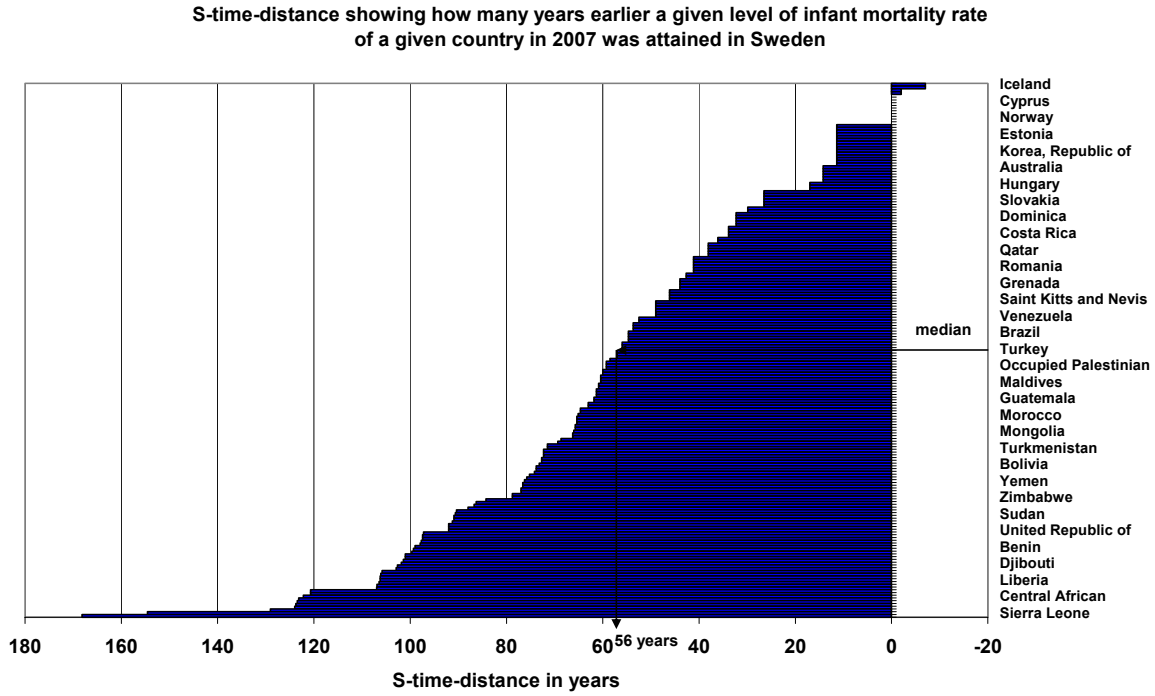


Figure 4. *Benchmarking world disparity for infant mortality rate in the time distance perspective*

This is now a brief new picture of the situation for infant mortality in the world if we are using gap timing procedure for benchmarking against historical development[11]**.** Obviously this is only the first descriptive illustrative step that has to be further extended with more detailed substantive qualitative and quantitative analyses at the regional, country and sub-national levels. There is no room to display the detailed results here except to show a summary perception of the situation in the time dimension. The median is at about 56 years, which means that about 95 countries (i.e. one half of the countries presented) show larger time lag behind Sweden.

Obviously there are very different starting positions from which the targeted goal of the two-third decrease of infant mortality and consequently the degree of implementation are calculated. For instance, infant mortality for Africa decreased from 101 in 1990 to 79 in 2008 and that for Asia from 63 to 41. In absolute terms both Africa and Asia decreased infant mortality by 22 infants per 1000 live birth, i.e. these are equal achievements in the infant mortality rate. However, the decrease measured in percentage terms for the period 1990-2008 is 22 percent for Africa and 35 percent for Asia. The percentage rule for setting the MDG target thus understates the progress made in Africa and puts a more demanding target in terms of feasibility to regions and countries with more difficult starting positions[12].

Returning to the implementation for under-five mortality rate of the MDGs target as they were officially set by the common percentage rule Figure 5 shows the S-time-distance results for the UNICEF defined regions. The time delay behind the respective line to target is 7.4 years for the aggregate of developing countries (see also Figure 2). The range of S-time-distances between regions is very high, from being nearly three years ahead the line to target for Latin America and Caribbean region and CEE/CIS region to more than 11 years behind

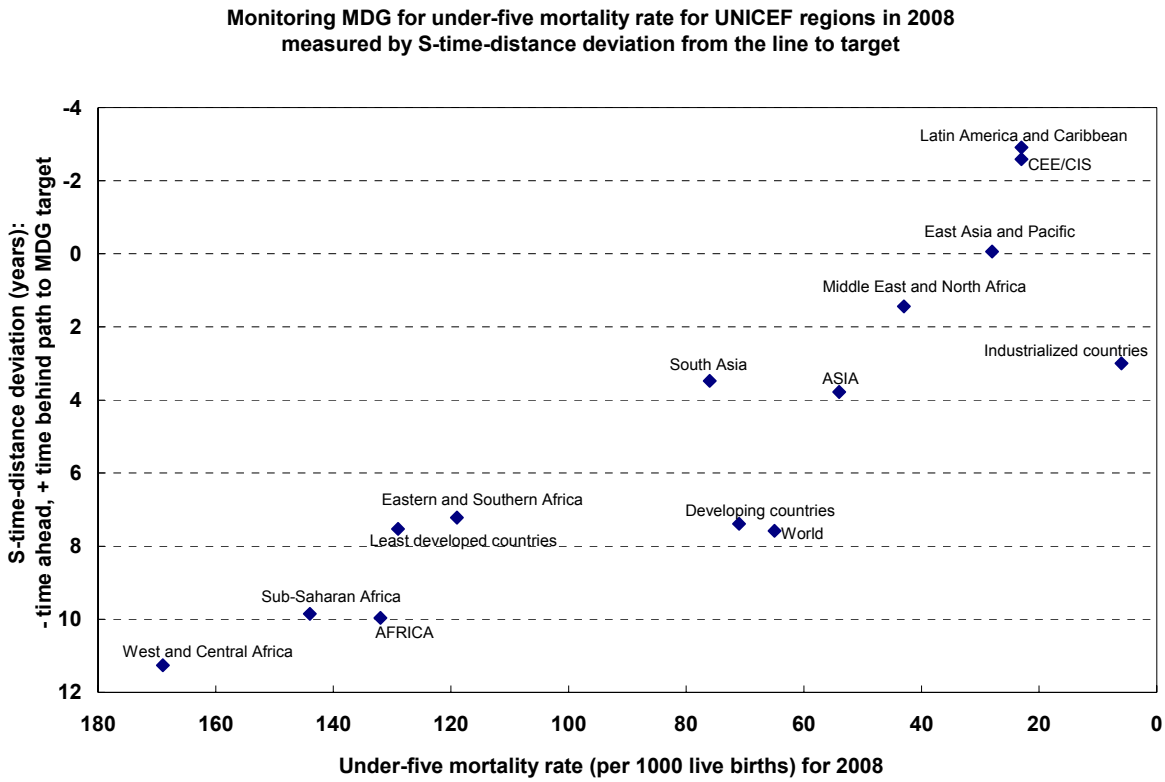


Figure 5. *Under-five mortality rate by regions – the relation between levels and S-time-distance deviations*

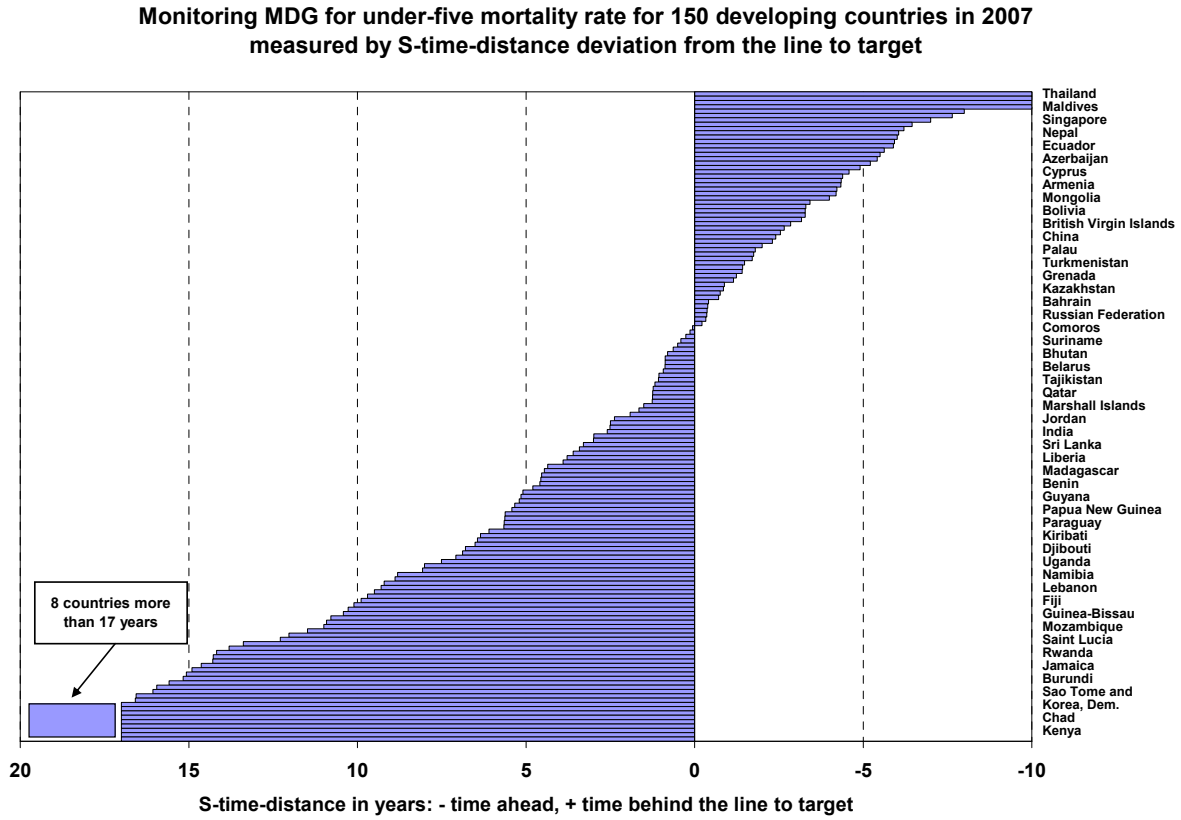


Figure 6. *Time lead or time lag from the line to the MDGs target for under-five mortality rate*

for West and Central Africa. It is remarkable that across developing regions a clear tendency is observed that the S-time-distance deviation from their lines to target increase with the level of the mortality rate. This is another indication that the same official percentage decrease for units at very different starting positions does not look realistic.

Figure 6 shows the calculated values of S-time-distance deviations from the lines to MDGs targets for 150 developing countries in 2007. Of these countries 54 countries were ahead of their line to target and 96 countries behind. There were five countries that already achieved their 2015 targets (Thailand, Viet Nam, Peru, Maldives and Turkey) and eight countries for which the time delay was more than 17 years (which means that their value in 2007 was worse than their starting position in 1990, seven of them are from Africa).

7. CONCLUSIONS

The new generic time distance methodology offers a new view of data that is exceptionally easy to understand and communicate. S-time-distance is complementing rather than replacing existing statistical measures for monitoring implementation of targets (or plans, budgets, forecasts) and can be used as one of the measures of the implementation of MDGs across a number of relevant indicators by many users.

S-time-distance measures the distance (proximity) in time between the points in time when the two series compared reach a specified level of the indicator X. In the monitoring application for the actual value in a given year it calculates the deviation (lead or lag in time) between the time when such actual value was attained and the time when this level was supposed to be reached on the line to the respective 2015 MDGs target. It is expressed in time units thus being an excellent presentation tool that is intuitively understood by policy makers, experts, managers, media and the men on the street.

Using data from the statistical annex of the UN MDG Report 2009 the time distance calculations show that across selected 10 indicators from six areas of MDGs the degree of implementation is far from satisfactory for the aggregate of developing regions. Only for two indicators (proportion of population using an improved drinking water source, total and rural) the implementation of the MDGs targets are ahead of the line to target. For the other eight indicators the delays behind the lines to the respective MDGs targets vary between four years for Official Development Aid (ODA) and 12.9 years for maternity mortality rate.

The most pressing themes in implementing MDGs are maternal mortality ratio and prevalence of underweight children under-five years of age. The time distance delay for the aggregate is nearly 13 years for the first and nine years for the second indicator; with even larger delays in sub-Saharan Africa, Western Asia and Southern Asia. The other five indicators show the range of S-time- distance delays for the aggregate between four and six years. On the other hand, e.g. China is an excellent performer; it has already reached their 2015 MDGs targets for four indicators.

Notwithstanding the above conclusions a clear distinction must be made between the progress made in the world in the analyzed period and the considerable delays in the implementation of the MDGs. Progress has been made in all selected indicators and in all world regions (though it has been quite uneven across regions as well as across countries within the regions). With respect to MDGs implementation analysis for seven world regions indicated that for four of

them the S-time-distances are in general not far from the respective lines to targets, while the unsatisfactory overall results are mainly influenced by the situation in sub-Saharan Africa, Western Asia and Southern Asia.

On the methodological side there is an important discussion of advantages and disadvantages of various statistical measures (absolute and relative static measures and S-time-distance) for measuring implementation of the MDGs targets. All these measures are useful; they are understandable concepts showing diverse perspectives and should be used simultaneously for better understanding of the complex situation. On the example of infant mortality it was shown that the percentage rule for determining the MDGs target understates the progress made in Africa and puts a much more demanding target in terms of feasibility to regions and countries with more difficult starting positions

The general picture is complemented by time distance monitoring of official development aid, the situation in sub-Saharan countries and for 190 countries for under-five mortality rate. Tracking the timetable for reaching the UN target of 0.7 percent of GNI with time distance showed that the performance in 2008 was off the track: the delay of four years for DAC total means that the actual ODA/GNI value in 2008 was at the level supposed to be achieved already in 2004 on the line to the UN target. The overall conclusion is that countries with nearly 90 percent of population of the DAC countries are behind the line to target, with time delays between two and eight years. They need to find the political will to do much better.

Looking by countries for sub-Saharan Africa for eight indicators it is important to emphasize that progress was achieved in the analyzed period in about 85 percent of cases. On the other hand, compared with the lines to MDGs targets the situation is very different; S-time-distance analysis shows that about 79 percent of cases are behind the lines to target and 21 percent of cases are ahead of them. The worst situation is for the indicator percent of the population undernourished where for 14 sub-Saharan countries out of 46 (30 percent) the results in 2004 were worse than in 1990.

The time distance analysis for many countries is also examined for its applications for benchmarking and monitoring on the case of a single indicator. For the 2007 levels of infant mortality for 190 countries it was estimated when such a value was attained against the long term trend for benchmark Sweden. The median is at about 56 years, which means that about for 95 countries the time lags behind Sweden are more than half of century. This background information indicates that improvements of this situation will be with us for a long time also in the next set of MDGs.

For under-five mortality rate out of 150 developing countries 54 countries were ahead of their line to MDGs target and 96 countries lagging behind. It is remarkable that across developing regions a clear tendency is observed that the S-time-distance deviations from their lines to target are higher in the regions with higher level of the mortality rate. This indicates that the rule of same official percentage decrease for units at very different starting positions needs to be re-examined.

Time distance is first and foremost important as an innovative concept of looking at data in a novel complementary and intuitively understandable way. The application to monitoring of the implementation of Millennium Development Goals showed that it is useful for bringing about new broader understanding of the situation in a dynamic context and for enriching the policy debate.

It should be reasonably easy to incorporate the S-time-distance methodology for monitoring implementation of the MDGs in the work of the UN, the World Bank and other agencies on these issues. This methodology can be used a standard complementary procedure in numerous other activities of the UN and other international agencies and at the national and local levels, like monitoring and evaluation of implementation of development plans and policy targets, as well as for monitoring budgets. To facilitate this SICENTER developed a free web tool which allows a variety of interested users including besides such organizations also NGOs, experts, managers, educators, students and media to monitor with S-time-distance the lead or lag in time of implementation of targets. The time distance information seems to be at least as helpful in providing a proper perception of the progress in implementation or the lack of it as is the percentage difference.

NOTES

[1] This innovation opens the possibility for simultaneous two-dimensional comparisons of time series data in two specified dimensions: vertically (standard measures of static difference) as well as horizontally (Sicherl time distance), providing a new dimension of analysis to a variety of problems.

[2] 'As Sicherl … proposes ... observed time distance is a dynamic measure of temporal disparity between the two series intuitively clear, readily measurable, and in transparent units….. It is suggested that one should complement conventional vertical measures with horizontal measures' (Granger and Jeon 1997).

[3] For details see Sicherl (2002), also on possible multiple time intersections.

[4] For extensions to measuring deviations between estimated and actual values in regressions and models, forecasting, error in timing and causality, monitoring, business cycle analysis see Sicherl (1994, 1997), to variables other than time Sicherl (1999). It is exactly this specification of deviations between actual and estimated values in S-time-distance analysis that was used by Granger for the extension of the time distance concept as a criterion for evaluation of forecasting models (Granger and Jeon 2003).

[5] The free web tool allows the user to track the implementation of targets by using his/her choice of data and assumptions. It may be that some politicians, some organisations and some experts might not like the additional information on the implementation of targets as it is giving a clear message understandable to everybody. But for the media, NGOs, independent experts and international organisations the transparency provided can be helpful for strengthening the democratic debate.

[6] For earlier work on MDGs see my presentation at the International Conference on the Millennium Goals Statistics, Manila at the invitation of UNSD (Sicherl 2007b).

[7] The same conclusion does not hold on the country level.

[8] Here we are not dealing with the complex problem of confronting expectations of aid and development successes as it is discussed in Clemens, Kenny and Moss (2007). However, it is clear that ODA is by itself in considerable delay with great differences among DAC countries and that the situation is probably worsening in the current crisis.

[9] More flexibility and realistic adjustments are needed in determining targets from very different initial conditions. The EU has already gone through this phase. At the beginning of the decade a uniform set of Lisbon Strategy targets was specified. Later this was changed to the NRP (National Reform Programmes) where the targets are different for different countries and also better incorporated in their specific strategies and policies. Another example is the MDGs Plus targets established in some developing countries.

[10] Due to space limitations only one name out of each four countries can be printed in the Figures 4 and 6. S-time-distance applications for benchmarking development gaps as well as for monitoring MDGs were also presented as animations in Gapminder Community graphs in Sicherl (2009), www.gaptimer.eu/gm2

[11] ITU used time distance method for benchmarking the world disparities in mobile phone penetration rate for 2008; the median S-time-distance behind Sweden was only 7.5 years showing that with large static digital divide the time distances are much smaller than for infant mortality (International Telecommunication Union 2009)

[12] See also Easterly (2009) for the elaboration of the historical experience of the relationship between initial child mortality and subsequent 25-year percentage reduction.

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