MEASURING PROGRESS OF SOCIETIES[1]

Pavle Sicherl

SUMMARY

The perceptions of well-being and societal progress are subjective and the resulting decisions, behaviour and actions are influenced not only by the available statistical data and indicators but also by the *measures that are used in the measurement, analysis, presentation and semantics of discussing these issues* as indispensable elements to form these perceptions. Here as an addition to the present state-of-the-art a new generic statistical measure S-time-distance is suggested to open a new view to many aspects of time series analysis with important technical and policy implications. The novel time distance methodology provides a new insight to many problems, an additional generic statistical measure, and a presentation tool for policy analysis and debate expressed in time units, readily understood by policy makers, managers, media and general public. The benefits of this new view in comparisons, competitiveness issues, benchmarking, target setting and monitoring for economic, employment, social, R&D and environment indicators at the world, OECD, EU, country, regional, city, sector, socio-economic groups, company, project, household and individual levels could be immediately applied to many indicators from many substantive fields using existing data and indicator systems from international, national, regional, business and local sources.

The empirical applications are related to the issues of benchmarking, target setting and monitoring in Lisbon strategy. An innovative methodology for monitoring in the time dimension the implementation of Lisbon and Growth and Jobs strategy at EU level and of National Reform Programmes at national level is proposed, which could be also very useful for assessing implementation of the UN Millennium Development Goals on the world level.

1 INTRODUCTION

Measuring societal progress is a complex undertaking of great social and political importance but with no universal agreement how to deal with the subjective preferences involved. These issues have many options, so they are not expected to be resolved in a short period, much less in this paper. In the vast domain of such issues one can only attempt to select a specific question and try to make an innovative contribution to it.

In the choices to be made in undertaking projects to measure progress I feel that the relative importance of the *development of appropriate measures to build perceptions* of the situation has been underrated (as compared to discussions of the choice of basic orientation, choice of dimension and of indicators). In this field the present state-of-the-art is not fully exploiting the information content available in existing data with respect to certain elements of the time dimensions involved. A new generic statistical measure S-time-distance is suggested to open a new view to many aspects of time series analysis.

[1] SICENTER gratefully acknowledges co-financing of the Slovenian Research Agency under the programme P5-0117.

The application examples are related to re-launch of the Lisbon strategy at the European and national levels. Section 4 opens important policy implications of the broader theoretical framework to look at situations where the present mainly static measures are complemented with the time distance dimension, including relations between growth and cohesion. Section 5 suggests a methodology for monitoring the implementation of Lisbon and Growth and Jobs strategy at EU level and of NRPs at national level in the time dimension. These results could be easily understood also by the men on the street and could thus also contribute to wider participation in decision making. Section 6 shows that the suggested monitoring methodology could be also very useful for assessing implementation of the UN Millennium Development Goals on the world level.

2 MEASURING WELL-BEING AND SOCIETAL PROGRESS[2]

The perception of well-being and societal progress is subjective. An individual assigns different weights to various elements of well-being and progress and also gives different weights to the possible measures by which such elements are measured and presented. The concept of well-being and progress has to deal not only with the categories, measurement, and data availability but also with interpersonal and intertemporal comparisons of the chosen constituent elements.

The OECD World Forum project "Statistics, Knowledge and Policy" is a most welcomed initiative to advance and co-ordinate the work in this field on the OECD and world levels. It was stated that the purpose of the OECD World Forum is to convene and promote research and information sharing among countries, allowing them to compare strategies intended to measure and assess the overall "position" and "progress" of a certain political entity (country, region, etc.) vis-à-vis other similar entities (Giovannini 2005).

Measuring well-being and societal progress in such entities is a complex undertaking and involves in its essence the search how to answer in an agreeable way two questions which transcend fields of concern and technicalities: PERCEPTION ABOUT WHAT (elements of well-being and societal progress) and WHICH MEASURES TO USE TO BUILD PERCEPTION ABOUT THEM (measures to present and to communicate the topics also for policy making). It is a process of discussion among many options, in many cases competing options with respect to the theoretical concepts, statistical measures, data collection procedures and important issues for policy debate.
In policy oriented research three types of issues are involved (Sicherl 1992):

1) estimation of statistical measures of "position" and "progress", which can be thought of as 'objective' measures of the multidimensional notion of distances in time and indicator space for a set of indicators,
2) value judgements that are associated with them and that give subjective weights to the 'objective' measures within and across various dimensions and fields of concern,
3) analysis of behaviour related to reactions of people to the perceptions formed on such basis with respect to the level and change in their position.

This paper will deal with the first type of these issues and will concentrate on the intertemporal aspect of measuring well-being and societal progress, i.e. on one subset of the complex problem. There are many options and choices to be made in the process of measuring progress that are beyond the scope of this paper. For instance, Hall (2005, p. 728) discussed four major areas of decision making relevant to any project measuring progress: 1. Basic design choices (concept,

[2] This and the next section are based predominantly on Sicherl (2006a and 2004c).

audience and approach); 2. Choosing dimensions of progress; 3. Choosing indicators of progress; 4. Presenting the work. In my opinion this categorisation understates the *importance of choice of measures used to build perceptions of the situations*, which should be the fourth group before that of presenting the work.

My position is that, as availability of data and faster computer processing are expanding at an unprecedented pace, the benefit for better decision making and wide participation will depend *critically on the human interface: understanding of the information and communication of that understanding*. Existing concepts, definitions and measures of well-being and progress are conventions with many alternatives and there are no final answers for dealing with interpersonal and inter-temporal issues. I agree with the opinion of Michalos (2003) regarding the objection, that the indicators systems are missing a real theoretical foundation defining the concept of welfare used, 'since there is no generally accepted definition of "scientific theory", this may not be a very serious complaint.'

As the perceptions of well-being and progress are subjective it is thus even more important that we provide to decision makers as well as to general public the information and knowledge in various degrees of complexity with as clear as possible understanding and interpretability so that they can effectively use them as inputs in building their perception and decisions. In general building and utilisation of knowledge depends on scientific, statistical and analytical capabilities, on institutional framework and on social capital.

In this paper I shall deal in this light only with statistical measures at the first level of complexity. Besides the levels of the variable (indicator) the two most widely used measures are growth rate and static difference between two or more units. I shall argue that at the same level of generality there exists a companion generic statistical measure S-time-distance as a special category of time distances defined by the level of the variable. It yields a radical new view of time series datasets that has been left unexplored by the existing methods of time series analysis.

Time, besides money, is one of the most important reference frameworks in a modern society. The main proposition is that people have memories of the past and expectations about the future; they compare over many dimensions and over time. The time perspective, which no doubt exists in human perception when comparing different situations, has been with the S-time-distance method systematically introduced in a specific way both as a concept and as a quantifiable measure in statistical and comparative analysis.

The present state-of-the-art neglects this additional information available in existing time series databases and thus leads to an information loss that has no justification. In the information age this new view of the existing databases should be evaluated as an important contribution to a more efficient utilisation of the available information.

We are here especially concerned with the policy aspect, in particular how the new generic statistical measure can help decision makers and general public to build their perceptions of the situation. It provides new insights from existing data due to an added dimension of analysis[3]. In Section 4 it will be shown that empirically the perceptions of the degree of disparity may be very different in static terms and in time distance, which leads to new conclusions and semantics important for policy considerations.

[3] Marcel Proust said: 'The real voyage of discovery consists not in seeking new lands but in seeing with new eyes.'

In general time distance approach brings about two persuasive advantages for extensive use. First, being expressed in time units, it is intuitively understood by policymakers, professionals, managers, media and the general public, facilitating their subjective perception about their position in this additional dimension. Another technical and presentation advantage is that time distance is comparable across variables, fields of concern, and units of comparison. Thus as an analytical, presentation and communication tool it can be helpful for educating especially younger generations about the multidimensional and dynamic nature of progress and for mobilising the public.

Second, since time distance provides an additional (n+1) dimension of description of the state of a multidimensional space of n variables, earlier results by other methods are left unchanged but new overall conclusions may be reached due to this new dimension of analysis. James Backhouse of the Information Science Department of the London School of Economics evaluated the generic capability of time distance concept: 'Time distance is a generic concept. That means that, as it has been the case e.g. with spreadsheet, one cannot in advance specify all the uses to which a generic framework can be put by imaginative users in numerous fields.' As it is true for any tool, it is the user who makes the final decision which tool is appropriate or not for his/her task, but the field of attaining benefits from application of S-time-distance is wide open for imaginative users.

3 S-TIME-DISTANCE AS A SPECIAL CATEGORY OF TIME DISTANCE

To make the step from *Statistics* to the other two components in the chain of reasoning on key indicators *Knowledge and Policy* it is important to realise that collection and dissemination of quality data on selected indicators is only a necessary but far from sufficient condition for the success of such activity. Johnston (2005) stated: 'Statistics are information, but as Albert Einstein put it, "information is not knowledge". Yet, it is knowledge that leads to good decision-making and spurs progress. Statistics are raw material for the creation of knowledge, just as steel is raw material for manufacturing automobiles'.

The perceptions on well-being and societal progress and the resulting decisions, behaviour and actions undertaken are also influenced by the quantitative *indicators and measures that are used in the measurement, presentation and semantics of discussing these issues*. They are an indispensable part of the elements from which the perceptions are formed and the decisions are being made.

Time distance in general means the difference in time when two events occurred. For instance, historians may say that one needs a certain time distance to an event before its historical importance can be ascertained. In spatial analysis time distance may mean the time needed to come from one point to another point in space. Also poets know about the notion of time distance, e.g. Whitman (1973 [1945]), while economic and social science encyclopedias do not recognize such a notion.

The definition of S-time-distance is to amend this shortcoming in the present state-of-the-art. In our use of time distance as a measure of benchmarking, disparity, of deviation between actual and estimated values in regressions and models, monitoring, etc. we define *a special category of time distance*, which is related to the level of the analysed indicator.

Before defining it in technical terms we can briefly look at its role in discussing the question WHICH MEASURES TO USE TO BUILD PERCEPTIONS about the 'overall position' and 'progress' in the discussed framework for key indicators. First we briefly touch the underlying issue of the position of intertemporal comparisons in building such a perception. The complexity of the

issue requires an interdisciplinary approach, far beyond the scope of this article. Without entering into this intricacy, a minimal analytical framework would in our opinion consist of elements from two types of information (Sicherl, 2004b):

1) Information about the present and intertemporal position of the observed unit, without regard to the position of other units. The level and the growth rate of the relevant welfare attributes can present this.
2) Information about the position of the observed unit in relation to other units. Quantitative measures of static relative position (like absolute and relative differences, and for the case of many units Lorenz curve, Gini coefficient, Theil index, etc.) have to be supplemented by time distance to incorporate the temporal relative position of a given unit with respect to compared units as an essential element of analysis.

At the theoretical level it will be shown that the present state-of-the-art does not realise that, in addition to static comparison, there exists in principle a theoretically equally universal measure of difference (distance) in time when a given level of the variable is attained by the two compared time series. In brief, 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. The observed distance in time (the number of years, quarters, months, etc.) for given levels of the indicator 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.

Comparing two points in a time series database entails three elements of information: (i) the respective level of the variable, (ii) to which unit it belongs, and (iii) at what time it happened. There are two obvious generic directions of comparison: by time and by level (Sicherl, 2004c). The generic nature of S-time-distance can be shown also by specifying operators that can be applied to a time series database. For two units (i) and (j) we can express such database as implicit functions[4]

$$F_i(X, t) = 0 \text{ and } F_j(X, t) = 0. \qquad (1)$$

(a) The present state-of-the-art solves these functions by one of the arguments as

$$X = X_i(t) \text{ and } X = X_j(t) \qquad (2)$$

and arrives at static distance like $\Delta X_{ij}(t) = X_i(t) - X_j(t)$. However, it misses the point that additional theoretically universal and practically relevant measures can be obtained by solving them by the other argument using the inverse relations

$$t = t_i(X) \text{ and } t = t_j(X). \qquad (3)$$

The result is a time matrix with new information from which new generic measures can be derived (ibid.).

[4] See also Sicherl (2004c).

Table 1: Time matrix from the inverse relations: 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[5]

$$S_{ij}(X_L) = \Delta t(X_L) = t_i(X_L) - t_j(X_L) \qquad (4)$$

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)

$$S_{ij}(X_L) = -S_{ji}(X_L). \qquad (5)$$

S-time-distance is calculated from the original values of the variable (with some possible interpolation and extrapolation) without referring to any other information than levels of the variable and time subscripts. This is a confirmation of the statement that time distance provides an additional (n+1) dimension of description of the state of a multidimensional space of n variables (X_i, i=1, ….n).

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 labeled 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. S-time-step as a measure expressed in units of time is defined as

$$S_i(\Delta X_L) = (t_{XL+\Delta X} - t_{XL})/\Delta X. \qquad (6)$$

S-time-step is obtained by simple subtraction of consecutive times in columns in the time matrix in Table 1 if ΔX_L is kept constant. This second statistical measure S-time-step and its relation to S-time-distance will not be discussed further in this paper (ibid.).

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

Since events are dated in time, in time series comparisons, regressions, models, forecasting and monitoring, the notion of time distance always existed as a "hidden" dimension. What was needed was to systemize and formalize the approach and define an appropriate statistical measure for operational use. The new view of information, using levels of the variable(s) as identifiers and time as the focus of comparison and numeraire, is theoretically universal[6], intuitively understandable and can be usefully applied as an important analytical and presentation tool at various levels to a wide variety of substantive fields.

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). Granger and Jeon (1997, 2003a) extended it to comparisons of leading and lagging indicators and used the time distance as a criterion for evaluating forecasting models[7]. In technical terms, in the analysis of time series the idea of time distance is a generic concept like static difference and the growth rate over time. In this paper we shall show some examples of application of the S-time-distance methodology in a limited way mainly in relation to measuring progress with benchmarking and monitoring in the context of Lisbon strategy.

4 POLICY IMPLICATIONS: DIFFERENT STATISTICAL MEASURES MAY LEAD TO DIFFERENT PERCEPTIONS ABOUT THE SITUATION

4.1 New insights for benchmarking, gap analysis, monitoring plans, budgets, projections and scenarios

Empirically, the perceptions of the degree of disparity may be very different in static terms and in time distance, which leads to new conclusions and semantics important for policy considerations. In the context of discussing Lisbon strategy this methodology could have been usefully applied for benchmarking and monitoring at various levels. As shown in the Figure 1, the application for the *evaluation of the magnitude of the gap in benchmarking analysis in two dimensions is self-explanatory*. It clearly showed on an issue of world interest that the perception of the degree of disparity in time was very new and different from that in static terms. The results and conclusions based on the two-dimensional analysis add a new dimension and new insight, while none of the earlier results are lost or replaced. It is intended to complement rather than replace the conventional static measures of disparity. For a better perception of the reality all of the perspectives have to be studied simultaneously.

The second immediate application is in *monitoring the implementation* of the Lisbon strategy in two dimensions. Targets are usually expressed not only in terms of the indicator values but simultaneously also in time. As processes towards their implementation are related to time, it is

[6] The generic concept of S-time-distance has a wide area of application (see e.g. Sicherl 1994, 2004a, 2004b, 2004c). Granger finds the concept a useful addition to the present state-of-the-art (Granger, Jeon 1997). They used the idea of time distance as a criterion for evaluating forecasting models (Granger, Jeon 2003a).

[7] 'As Sicherl (1973, 1993) 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'. ……'Sicherl's several works have presented a non-technical discussion of the theory of time-distance. This concept can help us to think more clearly about the forecastibility of series' (Granger, Jeon, 1997). They also analyzed four models of inflation in the USA not only with the standard method of average squared deviations between the projected and actual values, but also with the time distance method deviations, which produced significantly different results (Granger and Jeon, 2003b).

very natural and useful to describe e.g. the degree of implementation in two dimensions: 1 per cent below the path to target at a given point in time, and 2 months behind in terms of the achieved level in that year. In other words, the target line (estimate) is 1 per cent too high and 2 months too early. Generally speaking, whenever there are two series with time subscripts, e.g. actual value and estimated (forecast, budgeted, planned, targeted, etc.) values, it is possible to study deviations in two dimensions: deviation in the indicator space (at a given point of time) and deviation in time (for a given level of the indicator)[8].

There are alternative ways of expressing these matters, but it is obvious that the interpretation for how to overcome the time delay may be a very relevant additional practical procedure to be routinely applied to a large number of physical and financial indicators before turning to the more complicated programs. The use of the additional measure of deviation of the actual implementation from the plan, budget, target or forecasts at a project or activity level is straightforward and does not need at this point further elaboration. It is especially useful in the cases where the targets are clearly established and/or the monitoring is already a legal or administrative requirement. This can be a standard procedure in numerous other activities of the Commission and of the national and local levels like monitoring and evaluation of implementation of structural funds policy and of development plans, as well as for the relevant budgets.

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. *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.* Some examples of monitoring the deviations of the actual development from the Lisbon targets in two dimensions for a few indicators will be provided below.

4.2 Gap analysis and Lisbon 1 target setting

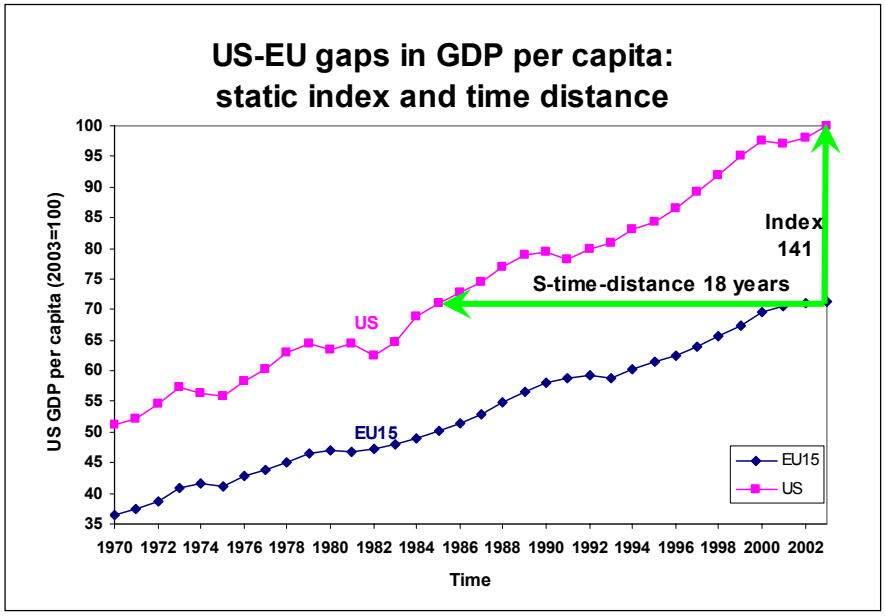
In dealing with target setting and monitoring of the Lisbon strategy we are essentially dealing with two cases. One is the Lisbon strategy proclaimed in 2000 within a EU15 framework, while its re-launch with National Reform Programmes has been done within the EU25 framework. In order to simplify the discussion we shall use the labels Lisbon 1 and Lisbon 2, as it was done by Pisany-Ferry and Sapir (2006).

At its time Lisbon 1 was courageous, ambitious and providing a vision in the right direction of the knowledge-based society. However, the implementation in the first four years has been disappointing. While the most important reasons for this have been the lack of political will for reform and lack of co-ordination at various levels, but there were also two omissions in the preparation of the strategy. One was the over-optimistic assessment of the European position and lack of clarity about the degree of change needed; the other was the deficiency in the EU communication strategy that not enough attention has been paid to raising public awareness of the issues and challenges involved. Probably it was a victim of the lack of co-ordination between politicians and professionals in dealing with the usual conflict between desirability and feasibility.

[8] It is exactly this specification of deviations between actual and estimated values in S-time-distance analysis that was used by the Nobel Prize winner Professor Clive Granger for the extension of the time distance concept as a criterion for evaluation of forecasting models. Hopefully this could be sufficient evidence of the generic capability of the S-time-distance method.

Figure 1: A comparison of European and US economies based on time distances

A Comparison of European and US Economies Based on Time Distances



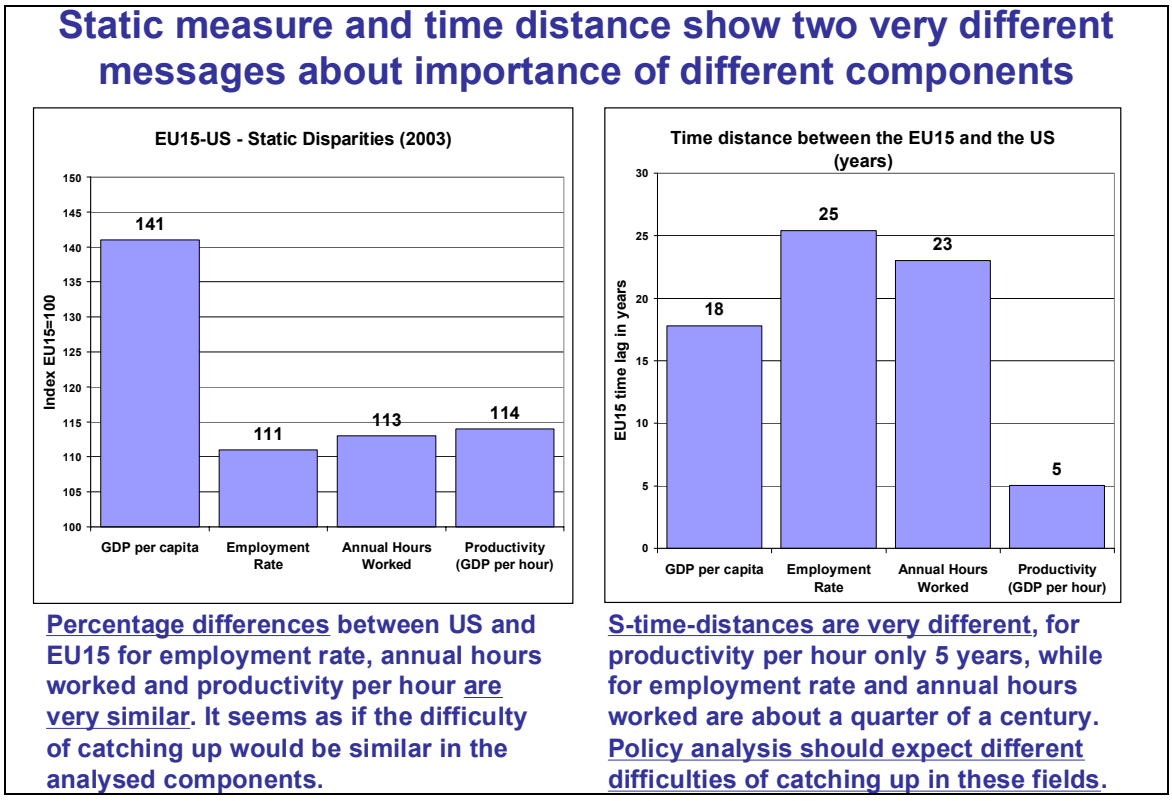
Source: P. Sicherl, A Comparison of European and US Economies Based on Time Distances, EUROCHAMBRES, Brussels, March 2005

The fact that comparisons should be made in two dimensions has been verified by the world-wide media interest in my analysis for the EUROCHAMBRES Spring Business Forum. The static ratio of 1.41 does not catch much attention, while the time gap of about two decades obviously produced a different perception of reality. The same will be true for comparing within the EU.

If Commission services would had used the time distance estimate of the lag of EU15 behind the USA, for GDP per capita the time lag in 2000 could had been established at about 15 years. To cut a lag of 15 years to nothing in a decade demands a very large difference in the growth rate of GDP per capita in favour of EU15 over that in the USA. This growth rate in the EU15 would have to be 3.3 percent higher than in the USA to achieve that. In the 1990's the GDP per capita in the USA grew at about 2.2 percent per year. If this rate would continue in the following decade, the EU15 respective growth rate would have to be about 5.5 percent per year to converge with the USA GDP per capita in 2010.

This was also clearly inconsistent with the Lisbon 1 target that GDP in the EU15 would grow at about 3 percent per year. Such an obvious gap between desirability and feasibility (5.5 percent needed yearly increase against projected 3 percent) has been damaging to the credibility of the program. Had there been more attention paid to a communication strategy to involve the men on the street by explaining the starting position and the target setting by raising awareness of and explaining them to the general public, such mistakes could had been prevented.

Figure 2: Static measures and time distance show two very different messages about importance of different components, EU15 and USA (2003)



The first graph confirms the general conclusion that the time distance view adds a new perspective with clear interpretability[9] complementing, and not replacing the existing measure(s). The second graph shows the consequences of different growth rates for the analysed indicators.

If the gap is expresses in terms of time distances the situation looks quite different. The time lag is 18 years for GDP per capita, 25 years for employment rate, 23 years for annual hours worked and only 5 years for GDP per hour. This new perspective indicates that the difference in employment rate and hours of work are much more difficult to change in a short period. Not that one would need 25 years to get to the employment rate of the US; this result is an accumulation of past performances. It is important to emphasize that S-time-distance is used here as a statistical measure based on the statistical facts for the past developments and should *not* be interpreted as the time needed for the EU15 to catch up with the US. The future depends especially on the future European performance in providing jobs, but one should realise that the rate of growth of employment is usually much lower than that of productivity.

A very important relationship is that, ceteris paribus, time distance is a decreasing function of the magnitude of the growth rate of the indicator. We can illustrate the different possible perceptions of what happened to the degree of disparity in the case when the rate of growth of an indicator

[9] For instance, for GDP per capita for the EU15 and US are compared in such a way that for any level of the EU15 one searches in the time series for the US in which year the same level was achieved and subtracts the two times involved (level for EU15 in 2003 equals level of the US in 1985, S-time-distance being 18 years as time lag for the EU15 or -18 years as time lead for the US for that level of the indicator).

increases from one period to another, but is for simplicity reasons the same for the two compared units (e.g. from 1 per cent to 4 per cent). Even the direction of change will be completely different:

1) Relative static measures will stay unchanged.
2) Absolute static differences will increase.
3) Time distance will decrease.

There is no inconsistency in these statements if one recognises that there are multiple aspects or views of disparity for a given indicator (Sicherl 1989). However, if one does not use explicitly the broader framework outlined here, there is a possibility that in political debate and policy formulation *various interest groups would intentionally look only at the measure which will suit their particular interest*. Those who would like to argue that disparities increased, would peak absolute static measure, relative static measure would be used to claim that there has been no change, and time distance to show that this aspect of disparity decreased. Obviously, one should take into account all these aspects simultaneously.

Without a more complex subjective evaluation of various options there is no unique judgement about societal progress. We can conclude that the addition of S-time-distance measure without any doubt increased the 'objective' elements on the basis of which people could understand the situation better and form their own perception in line with their preferences. Comparing across many indicators and fields of concern is the essence of quantitative work in forming perceptions assessing the overall "position" and "progress". It has been shown that comparing across indicators S-time-distance in many cases produces different and sometimes very surprising new qualitative conclusions.

This is an advantage deriving from a broader theoretical framework explained earlier which additionally exploits some information on the time dimension that is present in existing databases but neglected by the present state-of-the-art. In this framework overall degree of disparity between two units for a given indicator is a weighted combination[10] of static and time distance measures, the perception depending on the subjective weights given to these components.

Such additional complementary perspective is also important for the nexus between growth and inequality which is in the European development paradigm again at the forefront of economic and social policy considerations. Thus the European value added component of time distance methodology is not restricted to its generic characteristics for statistics and econometrics, but is related also to the policy debate of strategic issues. If people take into account also S-time-distance as one element of their subjective evaluation of the (overall) degree of disparity, a new set of hypotheses about the possible interrelationships between the growth and cohesion in the Lisbon strategy follow. Factors that influence the magnitude of overall and sector growth rates also influence the overall degree of disparity via time distance (Sicherl 1992).

Thus a very important policy conclusion arising from this framework for the analysis of the degree of cohesion and convergence in the EU is that the degree of disparity and thus cohesion will depend

[10] The value judgment that people attach to the time dimension of disparities and to the static dimension of disparity is an open question for interdisciplinary research. However, it may be safe to assume that a situation with 50 per cent static difference and time distance of 10 years is preferable to the situation with the same static difference and time distance of 40 years indicated in the example above. As mentioned before, the conventional analysis based on only ratios, percentage differences, Gini coefficients or Theil indexes alone does not distinguish such situations as different degrees of disparity.

also on how fast, and not only how much faster than the average, will the less developed regions (countries) and the potential member countries grow in the future. Space does not allow further elaboration of these strategic issues beyond the statement that in the dynamic world of today it is hardly satisfactory to rely only on static measures of disparity which are insensitive to the magnitudes of the growth rates and take into account only differences in the growth rates between the units. This conclusion shows that the S-time-distance as a dynamic (temporal) measure of disparity offers a perspective that can be quite distinct from that provided by static measures (Sicherl 1992) and that all of them should be studied simultaneously.

The concept of the time dimension of disparity is by no means an unfamiliar notion in everyday business and political discussions or in sports. A question can be posed whether policy makers and professionals in the social sciences, which for this type of analysis use mainly conventional static measures of disparity (like absolute or relative static differences, coefficient of variation, standard deviation, or Gini coefficient and Theil index) should not look for a broader dynamic conceptual and analytical framework suggested here to complement their analysis and discussion of policy options. It is closer to the dynamic reality and to the way in which people perceive disparities and react to them; it also offers improved semantics for analysis and policy debate.

5 MONITORING LISBON AND GROWTH AND JOBS STRATEGY IN THE TIME DIMENSION[11]

The position of the Commission is that in building a methodological framework for assessing progress with the implementation of the Growth and Jobs Strategy whenever possible the qualitative assessment will be accompanied by a quantification drawing on available quantification techniques. The S-time-distance is a new quantification technique with clear interpretability that is now available to complement other techniques and with your help we can elaborate its value added for a broader perception of the situation and for policy debate.

Here we shall demonstrate the usefulness of time distance measure for the monitoring process. We use the two-dimensional example of monitoring the implementation of Lisbon 1 targets in the period 2001-2004. This will serve two purposes. First it will show the implementation performance of Lisbon 1 for EU15. Second, it will be an example how the Lisbon 2 targets could be monitored in two dimensions when the results for 2005 and 2006 would become available.

The methodological background is presented in Figure 3 and explained in the Section 4.1. Table 2 illustrates the methodology of monitoring in two dimensions and presents the results for the period 2001-2004. For the implied path to target of 3 percent share of R&D in GDP in 2010 one can simply use a linear interpolation between the starting actual 1.94 percent in 2000 and the final point 3 percent in 2010 (or any more specific path to target). The deviations are described in two dimensions: percentage deviation and S-time-distance. For S-time-distance minus sign denotes that the actual value is ahead of path to target and plus sign means how many years (or months, etc.) actual values is lagging the same value on the path to target line.

[11] This section is based on my invited presentation at the 2nd Meeting of the EPC Task Force on Structural Indicators, Brussels, September 7, 2006 (Sicherl 2006b).

The numerical results in Table 2 show that by 2004 little progress towards the Barcelona target was achieved. The actual value for 2004 was more than 17 percent below the value on the implied path to target. This is one way to express the degree of underperformance over the four year period. S-time-distance presents another complementary way of comparing path to target with actual performance in the time dimension. The actual for 2004 was at the level which was projected to be attained in the first months of 2001. To be at a 3.9 years lag behind the path to target for the period of duration of 4 years simply means that by 2004 practically no continuous progress towards Barcelona target was achieved. In other words, if Lisbon 2 targets are to be taken seriously a very different performance in the second part of the decade is needed.

Figure 3: S-time-distance as a statistical measure of deviation

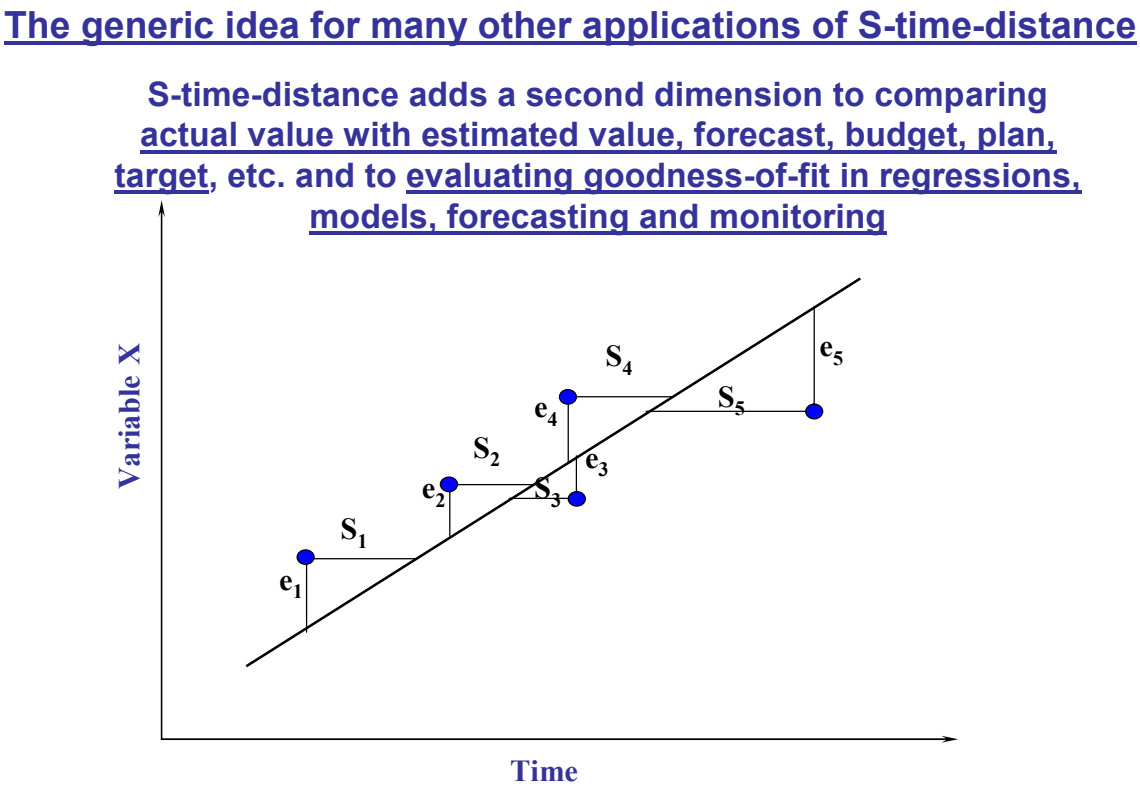


Table 3 shows the results of monitoring the Lisbon 1 target also for employment rate and GDP growth. For the employment rate the path to target was calculated by assuming the 70 percent employment rate target in 2010 and for GDP growth rate of 3 percent per year, using the same methodology and procedure as explained for Table 2.

Comparison across three important indicators of implementation of Lisbon 1 targets shows two major conclusions. First, according to both monitoring measures used the underperformance has been considerably larger for the indicator share of R&D in GDP than for the indicators growth rate of GDP and employment rate. The performance expressed as delay in time was nearly 4 years for the share of R&D in GDP and nearly 2 years for the other two analysed indicators. S-time-distance expressed in standard units – time – brings a very clear and practical message about the situation.

Table 2: Monitoring attainment of Barcelona Target for EU15 in two dimensions

	Share of R&D in GDP (%)		Monitoring deviations of actual from path to target in two dimensions	
	Implied path 1 to target 3%	Actual EU15	Percentage deviation of actual from path to target	S-time-distance deviation of actual from path to target (in years)
2000	1.94	1.94	0.0%	0.0 years
2001	2.05	1.98	-2.7%	0.5 years
2002	2.15	1.98	-7.5%	1.5 years
2003	2.26	1.97	-12.3%	2.6 years
2004	2.36	1.95	-17.5%	3.9 years
2005	2.47			
2006	2.58			
2007	2.68			
2008	2.79			
2009	2.89			
2010	3.00			
S-time-distance in years: - actual ahead of path to target, + actual behind the path to target				

Table 3: Monitoring deviations of actual values from the path to target in two dimensions

	Percentage deviation of actual from path to target			S-time-distance deviation of actual from path to target (in years)		
	Share of R&D in GDP (%)	Employment rate (%)	GDP Level	Share of R&D in GDP (%)	Employment rate (%)	GDP Level
2000	0%	0%	0%	0 years	0 years	0.0 years
2001	-2.7%	-0.1%	-1.1%	0.5 years	0.1 years	0.4 years
2002	-7.5%	-0.8%	-2.9%	1.5 years	0.8 years	1.0 years
2003	-12.3%	-1.7%	-4.7%	2.6 years	1.6 years	1.6 years
2004	-17.5%	-2.0%	-5.3%	3.9 years	2.0 years	1.9 years
S-time-distance in years: - actual ahead of path to target, + actual behind the path to target						

We have now available two 'objective' measures in benchmarking and monitoring to form a subjective perception of the magnitude of the gap for a given indicator as well as across more indicators. Decision makers, professionals, interested groups and general public might attach different subjective weights to various elements on basis of which they will form their perception and action. The first question is how they weight importance of different domains like employment or GDP; the second question for a given indicator is what subjective weights are given to the gap in static percentage terms and to the time distance gap. These are questions beyond the purpose of this paper.

This paper offers a blueprint of an improved extended monitoring system that could be used across countries and regions as well as across indicators. Table 4 is the example for Austria as one of the 25 country tables for this indicator. For 2005 the value of the share of R&D in GDP for Austria is already available by Eurostat, it is 2.35. The implied path to the Lisbon 2 target is linear extrapolation for each country from its actual value in 2004 to the proclaimed target in 2010 (in the same way as the extrapolation for EU15 new target was done in Table 2). Austria is thus very close to the track. Such tables and the accompanying procedures could be prepared in advance.

Table 4: A template for monitoring deviations of actual values from the path to target in two dimensions, against NRP specified targets at appropriate level: national, EU and sub-national, Austria, Lisbon 2 target

	Share of R&D in GDP (%)		Monitoring deviations of actual from path to target in two dimensions	
	Implied Lisbon 2 path to target 3%	Actual	Percentage deviation of actual from path to target	S-time-distance deviation of actual from path to target (in years)
2005	2.38	2.35	-1.4%	0.3 years
2006	2.51			
2007	2.63			
2008	2.75			
2009	2.88			
2010	3.00			
S-time-distance in years: - actual ahead of path to target, + actual behind the path to target				

When the values for 2005 and later for 2006 become available for other countries and other selected structural indicators, the innovation with the expanded monitoring system in two dimensions as an additional presentation tool could be in place. Such table as for Austria would be *multiplied by 25 and by the number of indicators* analysed. These results can be then *compared first across indicators for a given country and also across countries for a given indicator*. They can be used also as input for processing with statistical and mathematical models.

If in statistical offices and other EU bodies would care to assess the S-time-distance measure by the same eight criteria applied for selection of structural indicators like 1. Easy to understand, 2. Policy relevant, 3. Mutually consistent,… 6. Comparable between countries, etc. (Munoz 2004), then for this application in monitoring implementation of EU and NRP strategies S-time-distance would pass the test with flying colours.

6 MONITORING UN MILLENNIUM DEVELOPMENT GOALS IN THE TIME DIMENSION

This section demonstrates with brief examples that S-time-distance can be used also as a new easily understandable generic method for monitoring the implementation of the Millennium Development Goals on the world scale. The numerical examples are meant to demonstrate the generic capability of the S-time-distance to be applied across practically the whole set of 8 goals, most of the targets and the many corresponding indicators for which data are available. The road to implementation of the MDG on the national and sub-national levels is naturally related to many qualitative issues, but the time distance measure can be a simple understandable analytical and presentation tool to help in the quantitative phases of evaluation and in planning further policy action and future target setting.

6.1 A numerical example for evaluating progress towards implementation of the goal to reduce under-five mortality using S-time-distance measure

We are comparing the actual value for the under-five mortality rate in 2003 for Developing Regions and for China against the respective average path to Millennium Development Goal (MDG). Table 5 presents the preparation of the information from which the two time series needed for calculation of S-time-distances. The calculation of the average path to target is calculated in the following way. It follows under Goal 4 the Target 5 specification of the MDG to reduce the under-five mortality

rate by two-thirds between 1990 and 2015. The 1990 value of 105 for Developing Regions is used to calculate the target 2015 value according to the above specification, i.e. the proposed value of 35 for 2015. The corresponding values for China are 49 in 1990 and 16.3 for 2015.

Table 5: Numerical example of monitoring progress in reducing under-five mortality (path to target calculated as average absolute rate of decrease)

	DEVELOPING REGIONS		CHINA	
	Actual	**Path to target**	**Actual**	**Path to target**
1990	**105.0**	**105**	**49.0**	**49**
1991		102.2		47.7
1992		99.4		46.4
1993		96.6		45.1
1994		93.8		43.8
1995		91.0	**46.0**	42.5
1996		88.2		41.2
1997		85.4		39.9
1998		82.6		38.5
1999		79.8		37.2
2000		77.0	**40.0**	35.9
2001		74.2		34.6
2002		71.4		33.3
2003	**88.0**	68.6	**37.0**	32.0
2004		65.8	**31.0**	30.7
2005		63.0		29.4
2006		60.2		28.1
2007		57.4		26.8
2008		54.6		25.5
2009		51.8		24.2
2010		49.0		22.9
2011		46.2		21.6
2012		43.4		20.3
2013		40.6		18.9
2014		37.8		17.6
2015		**35**		**16.3**

Source: actual values from UN Millennium Development Goal Indicator Database, path to target average absolute rate of decrease assuming the reduction by two-thirds between 1990 and 2015.

In both cases the 2003 values for under-five mortality rate are too high compared to the linear path to target, which means that not enough progress toward reducing child mortality has been achieved until 2003. The actual values showed positive sign of S-time-distance, which means time lag of implementation behind the path target. The example of China demonstrates that S-time-distance should not be understood as a time needed to reach a target. In 2003 the time lag for China was 3.8 years, while in 2004 it was only 0.2 years. In 2004 is practically already on the line to target; in one year the time delay behind the path to target was decreased from 3.8 years to 0.2 years.

6.2 The assessment of progress towards implementation of the MDG using S-time-distance measure can be done for many indicators and many countries

The specification of MDG was very practical in the sense that the targets for MDG were specified mostly in relative terms. This meant that the targets are specific for each country and indicator and

in each country is then in monitoring the implementation of the Millennium Development process predominantly concerned with its own results against their targets. In this way the disparities in absolute levels of the indicators are in the monitoring process not an issue of immediate concern.

Table 6: **Monitoring implementation of the Millennium Development Goals in the time dimension across selected goals for one unit, for the aggregate for Developing Regions and for China as a country example**

		S-time-distance (years)	
		DEVELOPING REGIONS	CHINA
Goal 1. Eradicate extreme poverty and hunger			
Indicator 1	Population below $1 PPP per day	**-0.8**	**-13.2**
Indicator 2	Prevalence of underweight children under-five years of age	**5.4**	**-13.8**
Goal 2. Achieve universal primary education			
Indicator 6	Net enrolment ratio in primary education	**8.2**	**N/A**
Goal 4. Reduce child mortality			
Indicator 13	Under-five mortality rate	**6.9**	**0.2**
Indicator 14	Infant mortality rate	**7.2**	**2.2**
Goal 7. Ensure environmental sustainability			
Indicator 30 t.	Proportion of population with sustainable access to an improved water source, total	**-1.8**	**2.3**
Indicator 30 r.	Proportion of population with sustainable access to an improved water source, rural	**-1.4**	**4.2**
Indicator 31 t.	Proportion of population with access to improved sanitation, total	**-6.2**	**0.4**
Indicator 31 r.	Proportion of population with access to improved sanitation, rural	**4.0**	**2.7**

S-time-distance (years) = Time (actual) - Time (path to target)
S-time-distance (years) = - time lead (progress better than path to target), + time lag (progress worse than path to target)

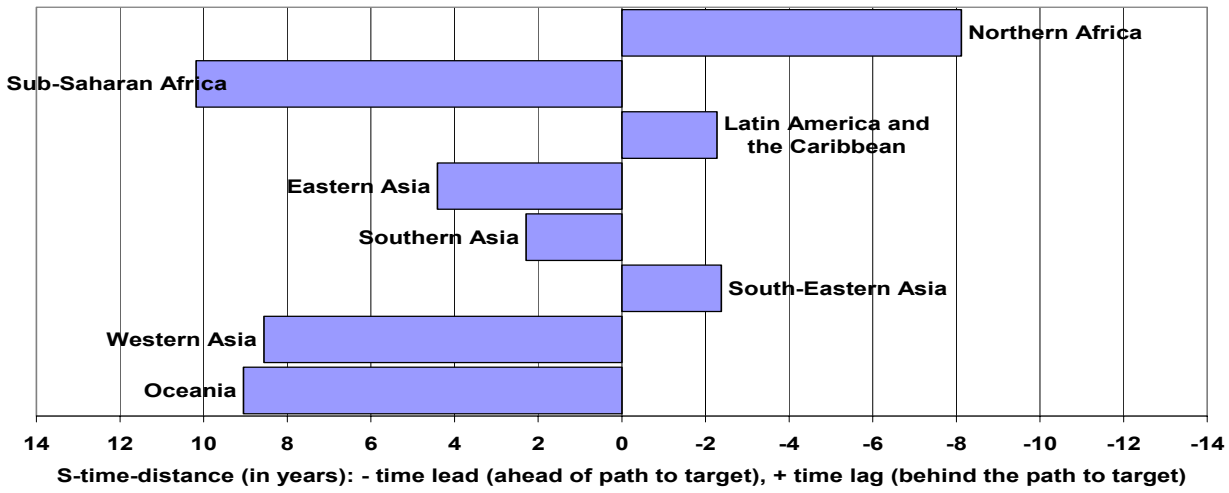
Own calculations from data based on UN Millennium Development Goal Indicator Database.

The evaluation of implementation of the MDG by S-time-distance can be thus done for many MDG targets and over many units, like countries, regions as well as sub-national units like urban-rural, gender or socio-economic groups and regions within countries for the cases where data and policy targets exist. For instance, in a forthcoming paper we shall show that for the indicator infant mortality the implementation of MDG country targets can be for 2004 calculated for as many as 113 countries.

Table 6 shows the results for selected indicators from four MDG for a highly aggregated Developing Regions and for China as an example for the use on national level that can be repeated for more than 100 countries and many more indicators. . For the aggregate 4 of the 9 analysed indicators for around 2002 the actual values were ahead of path to target; for 5 were behind the path to target. With respect to the Goal 1 to eradicate extreme poverty and hunger the 2001 value of indicator 1 was ahead of the path to target by about 1 year, a very important achievement after about a decade into implementation of the MDG. However, indicator 2, the prevalence of underweight children still showed a delay of about 5 years behind the path to the MDG target. China has shown extraordinary results for indicators 1 and 2 in eradicating poverty so that by 2001 they have nearly reached the target for 2015 (S-time-distance is about -13 years). Also on other analysed indicators, though slightly behind the path to target, China seems to be well on the track

for achieving MDG targets with some additional effort. Figure 4 is an example of regional performance.

Figure 4: Monitoring progress in reducing under-five mortality in the time dimension, REGIONS for 2003



For our purpose to demonstrate the capability of S-time-distance measure for monitoring implementation of MDG there is no need to go into further in-depth quantitative and qualitative analysis of these results. This would be done by potential users which can incorporate S-time-distance results as a complementary tool in their work.

7 CONCLUSIONS

The perceptions of well-being and societal progress are subjective and the resulting decisions, behaviour and actions undertaken are influenced not only by available statistical data and indicators but also by the *measures that are used in the measurement, analysis, presentation and semantics of discussing these issues* as indispensable elements from which the perceptions are formed.

Time distance measure is one of such measures with clear interpretability that delivers a broader concept to look at data to understand and compare situations. A new generic statistical measure S-time-distance is suggested to open a new view in many aspect of time series analysis with important technical and policy implications.The novel time distance methodology provides a new insight to many problems, an additional statistical measure, and a presentation tool for policy analysis and debate expressed in time units, readily understood by policy makers, media and general public. It can provide several benefits for analyzing, presenting and using key indicators in decision-making:

1. *Better utilization of information leading to new insights from existing data and to a different perception of the situation*. 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. *S-time-distance concept enables additional exploitation of data and visualization for time related databases and indicator systems.* 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.

2. Since S-time-distance is *expressed in time units, it is intuitively understood by policymakers, professionals, managers, media and the general public*, thus facilitating them in building their subjective perception about their position in this additional dimension.

3. *Empirically, the degree of disparity may be very different in static terms and in time distance, which leads to new conclusions and semantics important for policy considerations.*

4. It is not a methodology oriented only towards some specific substantive problem, but *it represents an additional view to many problems and applications*. Expressed in standardized time units it is *comparable across variables, fields of concern and units of comparison*. Beyond that, on the scientific side, the fact that the Nobel Prize winner C. Granger extended the S-time-distance measure to econometric forecasting is an evidence of the *generic capability of the idea*.

5. *The fact the time distance measure has the capability to deliver new perspectives from existing data and influence public opinion has been verified recently on an example of world interest* by the comparison of European and US economies based on time distances. This added perception was extensively reported in the world press.

6. *As an excellent presentation and communication tool* S-time-distance can be very useful for different levels of decision makers and interest groups for describing the situations, challenges and scenarios, *for proactive discussion and presentation of policy alternatives to policy makers, media, the general public and mobilizing those participating in or being affected by the programs*.

7. *In the Lisbon process* a possible application for the *evaluation of the magnitude of the gap in benchmarking analysis* was demonstrated for the case of unrealistic target setting for Lisbon 1. Such gaps have been damaging to the credibility of the programme. If more attention had been paid to explaining with understandable measures the starting position and the target setting by raising awareness of the challenges to the general public, such mistakes could had been prevented.

8. *In such a situation it is thus even more important that a continuous monitoring system is to be put in place. This paper offers an improved extended monitoring system that could be used across indicators as well as across countries***.** Example for Austria shows that the innovation with the expanded monitoring system in two dimensions as an additional presentation tool could be in place when the values for 2005 become available for other indicators and other countries to measure implementation towards their own NRP targets. *Monitoring Lisbon and Growth and Jobs Strategy targets in the time dimension is an excellent presentation tool, intuitively understood by policymakers, professionals, managers, media and the general public, which can also facilitate the broad participation in the Lisbon process.* In addition it was demonstrated that S-time-distance can be very practical as well as a new easily understandable generic method for monitoring the implementation of the UN Millennium Development Goals on the world scale.

9. It is important to emphasize that *the benefits of this new view in comparisons, competitiveness issues, benchmarking, target setting and monitoring* for economic, employment, social, R&D and environment indicators at the world, OECD, EU, country, regional, city, sector, socio-economic groups, company, project, household and individual levels *could be immediately applied to many indicators from a wide variety of substantive fields using existing data and indicator systems from international, national, regional, business and local sources*.

REFERENCES

Council of the European Union (2006), Contribution of the Competitiveness Council to the Spring European Council 2006, 7281/1/06, REV 1, Brussels, 14 March 2006.
Giovannini, E: (2005), 'Foreword' in Statistics, Knowledge and Policy, Key indicators to inform decision making, OECD, Paris
Granger, C.W.J., Jeon, Y. (1997), Measuring Lag Structure in Forecasting Models – The Introduction of Time Distance, Discussion Paper No. 97-24, University of California, San Diego.
Granger, C.W.J., Jeon, Y. (2003a), A time-distance criterion for evaluating forecasting models, International Journal of Forecasting, Vol. 19, pp. 199-215.
Granger C.W.J., Jeon Y. (2003b), Comparing forecasts of inflation using time distance, International Journal of Forecasting, Vol. 19
Hall J. (2005), Measuring Progress – An Australian Travelogue, Journal of Official Statistics, Vol. 21, No. 4
Johnston D.J. (2005), Statistics, knowledge and progress, OECD Observer, March
Michalos A.C. (2003), Observations on Key National Performance Indicators, Paper presented at the Forum on Key National Indicators, Washington, D.C. February
Munoz P.D. (2004), Indicators for EU Policy Making, OECD World Forum, Palermo 10-13 November
Pisany-Ferry J. and Sapir A. (2006), Last Exit to Lisbon, Bruegel Policy Brief, Issue 2, March, Bruegel, Brussels.
Sicherl, P. (1973), Time Distance as a Dynamic Measure of Disparities in Social and Economic Development, Kyklos, XXVI, Fasc. 3
Sicherl, P. (1989), Methods of Measuring Disparity between Men and Women, A Technical Report, United Nations International Research and Training Institute for the Advancement of Women, Santo Domingo
Sicherl, P. (1992), Integrating Comparisons across Time and Space: Methodology and Applications to Disparities within Yugoslavia, Journal of Public Policy 12, 4
Sicherl, P. (1993), Integrating Comparisons Across Time And Space, Methodology and Applications to Disparities within Yugoslavia, Studies in Public Policy, No. 213, Centre for the Study of Public Policy, University of Strathclyde, Glasgow
Sicherl, P. (1994), Time Distance as an Additional Measure of Discrepancy between Actual and Estimated Values in Time Series Models (International Symposium on Economic Modelling, Washington D. C., The World Bank), Sicenter, Ljubljana.
Sicherl, P. (1997), Time Distance Measure in Economic Modelling. (International Symposium on Economic Modelling in London, University of London, July 23–25), SICENTER, Ljubljana
Sicherl, P. (1999), A New View in Comparative Analysis, IB Revija, 1/1999
Sicherl, P. 2002. Time Distance: A Missing Link in Comparative Analysis. The XV. World Congress of Sociology. July 9, Brisbane.
Sicherl, P. (2004a), Time-distance Analysis: Method and Applications, eWISDOM, Vol. 2a.
Sicherl, P. (2004b), Comparing in Two Dimensions: A Broader Concept and a Novel Statistical Measure of the Time Dimension of Disparities, European Societies 6(2).
Sicherl, P. (2004c), Time Distance: A Missing Link in Comparative Analysis, 28th General Conference of the International Association for Research in Income and Wealth, Cork, Ireland, August 22-28 2004, http://www.iariw.org
Sicherl, P. (2005), A Comparison of European and US Economies Based on Time Distances, EUROCHAMBRES, Brussels.
Sicherl P. (2006a), The Intertemporal Aspect of Well-being and Societal Progress, Paper prepared for OECD/JRC Workshop on Measuring Well-being and Societal Progress, 19-21 June, Milan
Sicherl P. (2006b), Monitoring Lisbon and Growth and Jobs Strategy Targets in the Time Dimension, Paper presented at the 2nd Meeting of the EPC Task Force on Structural Indicators, Brussels, September 7
Whitman, W. (1973 [1945]) 'On the Beach at Night Alone', in Mark van Doren (ed.), The Portable Walt Whitman, The Viking Press, New York

MERJENJE NAPREDKA DRUŽB

POVZETEK

Ljudje subjektivno ocenjujejo blaginjo in napredek, zato na njihove odločitve in dejanja ne vplivajo le statistični podatki in indikatorji, temveč tudi *mere, uporabljene za analizo, prezentacijo in semantiko* kot nujen element za dojemanje položaja. Predlagana nova generična statistična mera S-časovna-distanca odpira nov vidik pri analizi časovnih vrst s pomembnimi tehničnimi in političnimi posledicami. Metodologija časovne distance prinaša nove poglede na mnoge probleme, novo generično statistično mero, kakor tudi orodje za prezentacijo v diskusijah o alternativnih politikah, izraženo v enotah časa, ki jih intuitivno razumejo tako politiki, gospodarstveniki, mediji in celotna javnost. Ta metodologija se lahko takoj koristno uporabi pri številnih indikatorjih na gospodarskem, socialnem, znanstvenem in okoljskem področju, na ravneh od svetovne, EU, nacionalne, regionalne, pa do mikro ravni podjetja, gospodinjstva in posameznika, na podlagi obstoječih podatkovnih baz. Empirični primeri so povezani z lizbonsko strategijo. Prikazan je konkreten predlog spremljanja uresničevanja te prenovljene strategije in Nacionalnih reformnih programov z vsem lahko razumljivo metodo časovne distance. Primeri kažejo, da bi to metodo lahko uporabili tudi za spremljanje akcije Združenih narodov Millennium Development Goals na svetovni ravni.