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S-time-distance perspective: providing new insights of the current crisis from BTS and GDP data

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Abstract

Improved governance needs not only statistical data and indicators but also widely understandable statistical measures that are used in the measurement, analysis, presentation and semantics of discussing these issues. A novel generic statistical measure S-time-distance is expressed in time units and is readily understood by policy makers, managers, media and general public, thus a useful presentation tool for policy analysis and debate.

The benefits of the new S-time-distance view can be seen in comparisons, benchmarking, target setting and monitoring for various macro and micro levels. A new view of the information using levels of the variable as identifiers and time as the focus of comparison and numeraire could be applied also to the business and consumer tendency surveys indicators.

This particular application will deal with the description of the current economic crisis with selected indicators from the Business Tendency Surveys and GDP for EU and selected countries. The GDP developments in the crisis will be an example of a hard indicator and some indicators from the BTS will be examples from the qualitative data. The paper will indicate the possibilities that S-time-distance method could be also applied to these types of data bringing about new knowledge and better understanding of the situation. In this phase the descriptive characteristics of the method will be emphasized while the generic characteristics of the S-time-distance concept can be utilized also in more complex undertakings.

Keywords: S-time-distance, economic crisis, ESI, GDP

JEL Classification: C10, E30, D83

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1. Introduction

This paper is predominantly methodological. It should serve the purpose to illustrate by simple examples of some results on the selected topic how the time distance approach can in general contribute a new complementary understanding to the indicator analysis across many years, many indicators and many fields of concern.

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 indispensable elements from which the perceptions are formed and the decisions are being made. 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.

In empirical research the art of handling and understanding of different views of data is crucial for discovering the relevant patterns. Time distance in general means the difference in time when two events occurred. We define a special category of time distance related to the level of the analysed variable (e.g. Sicherl 1973, 2004a, 2004b, and 2007a). The 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 variable X.

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. 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.

Empirically, the perceptions of the degree of disparity may be very different in static terms and in time distance. 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. As different statistical measures may lead to different perceptions about the situation the broader conceptual and analytical framework leads to new conclusions and semantics important for policy considerations (for a number of examples see www.gaptimer.eu).

The results and conclusions based on the two-dimensional analysis add a new dimension and new insights for benchmarking, gap analysis, monitoring targets, plans, budgets, projections and scenarios, while none of the earlier results are lost or replaced. The intention is to complement rather than replace the conventional static measures of disparity and provide the two-dimensional measurement of the gap as input into an assessment of a broader dynamic notion of the overall degree of disparity. Gap timing 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 for policy use over a very large domain of issues due to an added dimension of measurement and analysis.

This paper concentrates only on a brief overview of some examples of using the time distance measure for selected hard and soft indicators in describing the current crisis. A more complex substantive analysis can only be undertaken if the additional insights provided by the method would apply across a number of hard indicators and many available survey indicators.

2. Methodology: S-time-distance as a special category of time distance[1]

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 graphical terms, the usual way is to compare the time series in the vertical dimension, i.e. for a given point in time. The 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 (see e.g. Sicherl, 1973, 2004a).

Time distance in general means the difference in time when two events occurred. We define a special category of time distance, which is related to the level of the analyzed variable. The suggested 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 variable X. 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.

In the analysis of time series the idea of time distance is a generic concept like static difference and the growth rate over time. Time has until now been used in comparisons mainly as location information, i.e. as a coordinate in a parameter frame forming a coordinate system that is used to organize (or index) a set of variables. In other words, it has played the role of a descriptor, subscript or identifier. The new approach offers new avenues for detecting additional information content, without replacing the existing views. If we choose to interchange in the database the roles of the level of the variable and time, a given level of the variable becomes a descriptor or identifier and time becomes a numeraire in which certain distances between the compared units and time series can be expressed and measured.

The comparison of 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.

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

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

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

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

and arrives at static distance like $\Delta Xij(t) = Xi(t) - Xj(t)$. 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

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

[1] This section is based on Sicherl (2004b), available on www.iariw.org. The shorter versions are available also in Sicherl (2006 and 2007). For more see also http://www.gaptimer.eu/overview_of_the_methodology.html.

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

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

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

where

$$X_i(t_i(X_L)) = X_L \text{ and } X_j(t_j(X_L)) = X_L.^{1} \quad (5)$$

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

$$S_{ij}(X_L) = -S_{ji}(X_L) . \quad (6)$$

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 the levels of the variable and time subscripts. This is a confirmation of the statement that time distance provides an additional (n+1) dimension of the 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 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. S-time-step as a measure expressed in units of time is defined as

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

$$S_i(\Delta X_L) = (t_{XL+\Delta X} - t_{XL})/\Delta X. \quad (7)$$

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.

Using linear approximation, the relationship between S-time-distance and S-time-step for a selected ΔX_L is

$$S_{ij}(X_{L2}) = S_{ij}(X_{L1}) + S_i(X_{L2}-X_{L1}) - S_j(X_{L2}-X_{L1}) \quad (8)$$

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 to define an appropriate statistical measure for operational use. In this paper we apply the time distance approach in a limited way to the international comparisons across EU27 and selected countries. In this domain S-time-distance plays a role of a generic concept like static measures of disparity or growth rate.

However, this generic approach can be usefully applied as an important analytical and presentation tool to a wide variety of substantive fields at macro and micro levels. For extensions to measuring deviations between estimated and actual values in regressions and models, forecasting, error in timing and causality, monitoring, and business cycle analysis see Sicherl (1994, 1997), to variables other than time Sicherl (1999). Granger and Jeon (1997, 2003) extended it to comparisons of leading and lagging indicators and used the time distance as a criterion for evaluating forecasting models[2].

[2] 'As Sicherl (1973, 1993) proposes, for a given level of the lagged or leading indicator, a time distance measures distance in time between the indicator and the indicated variable. Observed time distance is a dynamic measure of temporal disparity between the two series, intuitively clear, readily measurable, and in transparent units which are comparable across a pairing of indicators and indicated variables. 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).

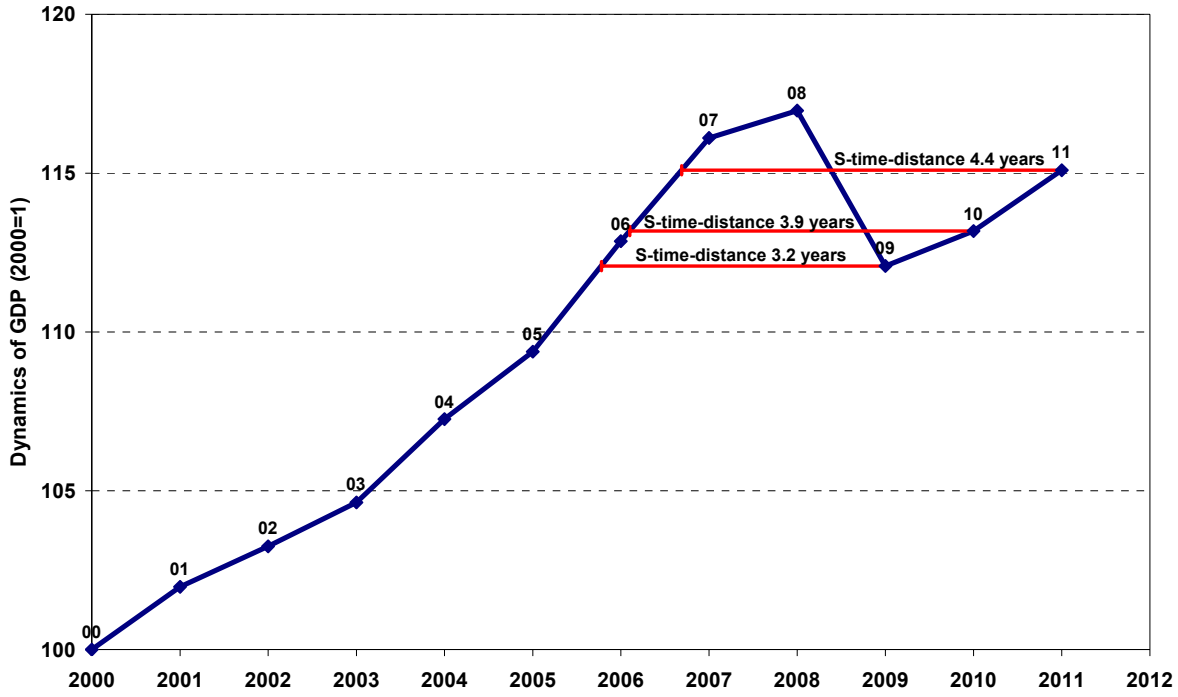
3. The severity of the crisis based on yearly values and forecast by Eurostat

There are several useful ways of describing economic development over time. It seems that the prevailing one is that using growth rates of the respective magnitudes or indicators in percentage changes. This has advantages and disadvantages. On the one hand it is simple to understand a time series of yearly (or quarterly) growth rates over time; on the other, they refer to changing base values so it may not be easy to grasp the change over a period of time.

We shall pay more attention to the levels to look at the situation in the current crisis in the time distance perspective in two time frames: the immediate 5 year period 2007-2011 and the longer past historical reference. For yearly values of GDP the peak year was 2008, for two EU aggregates and for selected countries the Eurostat forecasts for the next three years are evaluated in two dimensions: static index (2008=100) and S-time-distance. For the latter we estimate how many years will the level of GDP in years 2009, 2010 and 2011 expect to fall back according to Eurostat forecast.

In the last decade GDP in the EU27 has been increasing until the peak in 2008 when it was hit by the crisis[3]. This has severely damaged the European economy and society and the GDP level forecast for 2011 is still not expected to recover to the peak 2008 level (data from Eurostat 2010a). Figure 1 shows the dynamics of GDP for EU27 in the last decade and for the years 2009-2011 the decrease in GDP in shown in two dimensions: decrease in the static index in comparison with 2008 and in the S-time-distance lag indicating how many years earlier the same levels of GDP were already achieved in the past.

Figure 1. Dynamics of GDP for EU27 in the last decade



Source: Own calculations based on Eurostat data and forecast

[3] It should be mentioned that even before 2009 in the EU there was a time delay behind the Lisbon target of 3% GDP growth rate. This is the S-time-distance application for measuring implementation of targets (Sicherl, 2010a).

Static index shows that GDP for EU27 fell in 2009 to 95.8 from the 100 in the peak year 2008. From the selected countries in Table 2 (and from all EU countries) in 2009 only Poland GDP continued to grow. This is one way to take into account levels and not to discuss grow rates only. The second way to express the fall back in levels is to use time distance measure and to express it as the level in the past to which the current and forecast levels are compared. This is easy to understand and as we will see in Figures 2 and 3 it is comparable across indicators from different domains.

Since we are in this downward case looking backwards in the past we could use time distance method for a special case for analyzing time series on itself. Figure 1 indicates that S-time-distances for EU27 would amount to 3.3 years for 2009, 3.9 years for 2010 and to 4.4 years for 2011. Alternatively, Table 2 shows which past levels of GDP are forecast for 2010 and 2011. The exceptions are Poland for all three analysed years; USA reached the 2008 level in 2010 and France in 2011. For other countries the S-time-distances indicate an additional semantics to indicate the severity of the crisis in GDP by countries (or by sectors, etc.)

Table 2. How many years would the level of GDP in years 2009, 2010 and 2011 fall back according to Eurostat forecast

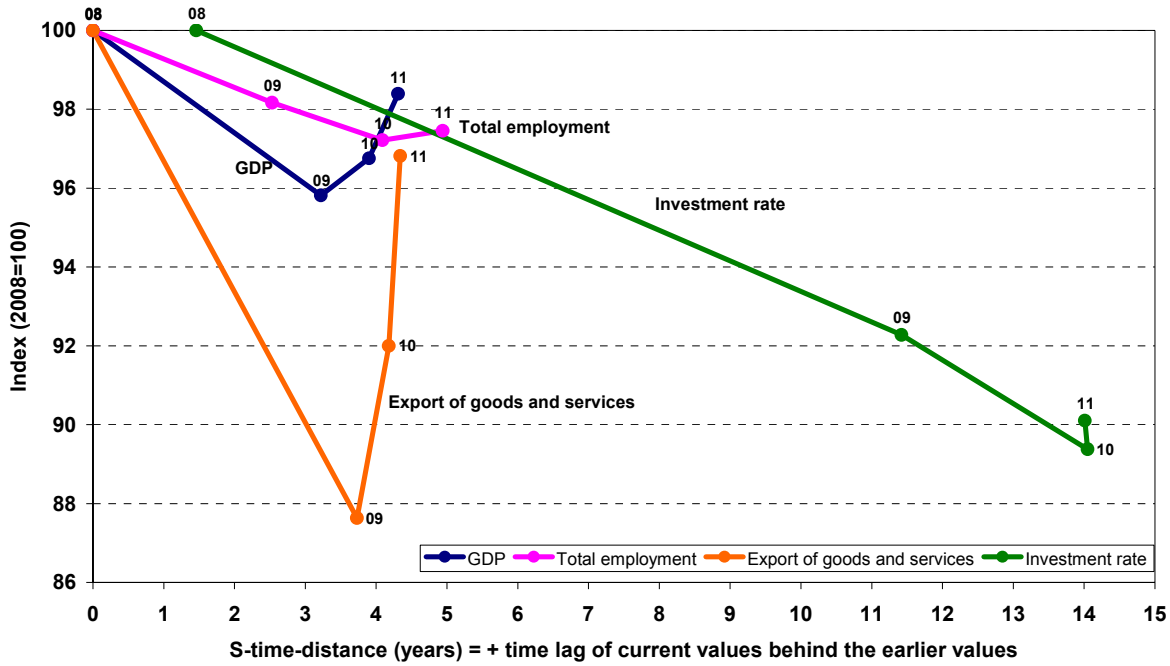
	S-time-distance (years) of fall back in the current crisis			Which past values of GDP are forecast for 2010 and 2011			Index (2008=100)		
	2009	2010	2011	2009	2010	2011	2009	2010	2011
EU27	3.2	3.9	4.3	2005.8	2006.1	2006.7	95.8	96.8	98.4
EU15	3.4	4.1	4.5	2005.6	2005.9	2006.5	95.8	96.7	98.2
Germany	3.4	4.0	4.4	2005.6	2006.0	2006.6	95.1	96.3	97.8
France	3.1	3.5	0.0	2006.0	2006.5	2011.0	97.4	98.7	100.1
Italy	8.2	8.0	7.1	2000.8	2002.0	2003.9	95.0	95.8	97.1
Poland	0.0	0.0	0.0	2009.0	2010.0	2011.0	101.7	104.5	107.9
UK	3.7	4.3	4.5	2005.3	2005.7	2006.5	95.1	96.2	98.3
USA	3.0	0.0	0.0	2006.0	2010.0	2011.0	97.6	100.3	102.8
Japan	5.1	5.1	5.4	2003.9	2004.9	2005.6	94.8	96.7	98.2

Source: Own calculations based on Eurostat data and forecast

Such additional insight into the current crisis provided by the time distance methodology can be done for many indicators and units across different domains. Here we shall demonstrate one such possibility for analysis of decrease of four indicators for EU27 in the current crisis in two dimensions: decrease in index and delay in S-time-distance for the period 2008-2011 in Figure 2 (and for the USA in Figure 3).

We are comparing four selected indicators: GDP, total employment, exports of good and services, and investment rate (gross fixed capital formation as percentage of GDP). For EU27 we can see that all four indicators (in real terms) are still expected to stay below the 2008 levels. The conclusions based on decrease in static indexes and on S-time-distances as the time lag of current values behind the earlier values can be different. For 2009 the decrease in the index was about 2% for total employment, 4% for GDP, 8% for investment rate and 12% exports of goods and services. In S-time-distance terms the values for 2009 were between 2.5 and 3.7 years for total employment, GDP and export of goods and services, while for investment rate the S-time-distance lag behind earlier years amounted to more than 11 years. In static terms the largest decrease in 2009 was for export of goods and services, while the S-time-distance clearly shows that in historical terms the greatest fall back was in the investment rate.

Figure 2. Analysis of decrease of four indicators for EU27 in the current crisis in two dimensions: decrease in index and delay in S-time-distance



Source: Own calculations based on Eurostat data and forecast

Figure 3. Analysis of decrease of four indicators for USA in the current crisis in two dimensions: decrease in index and delay in S-time-distance

Source: Own calculations based on Eurostat data and forecast

For EU27 in 2010 the situation for GDP and export of goods and services started to get improved, while total employment and investment rate continued to decrease. For 2011 it is expected that S-time-distances for GDP, export of goods and services, and total employment would be between 4.3 and 4.9 years; while static indexes for these three indicators would be around 2.5% below the 2008 values. There is an interesting difference between the situation EU27 and the USA as shown in Figures 2 and 3. In the USA it is expected that in 2010 the 2008 levels of GDP and export of goods and services will already be achieved, while the total employment is expected to start increasing in 2011.

On the other hand, investment rate for EU27 would still be around 10% below 2008 value and about the level attained 14 years ago (about 1997 level). This shows clearly how debt crisis has weakened the possibility of higher growth rate in the near future. The same conclusion holds for the USA. Its investment rate in 2011 is expected to be about 13% below the 2008 value at a level before 1994 resulting in S-time-distance of about 17 years. For Japan the fall in investment rate for the period 2009-2011 is very much pronounced as it falls to the levels not achieved after 1980.

S-time-distance for investment rate for EU27 is about 14 years, showing that Triad countries have in the current crisis fallen back to the levels in past century which could not be perceived by looking only at the static indexes. Except for the possibilities for better utilisation of the existing capacity their medium term growth capabilities are severely impaired by the financial crisis.

4. The severity of fall in the crisis based on quarterly values of GDP and monthly values Economic Sentiment Indicator (ESI)

In order to better understand the impact of the current economic crisis in EU countries, we used S-time-distance perspective on GDP and ESI data. S-time-distance perspective was firstly applied to GDP and ESI separately in order to understand the performance of each individual data series and secondly S-time-distances of GDP and ESI were compared in order to test their consistency and possible explanatory performance.

The Directorate General for Economic and Financial Affairs (DG ECFIN) conducts regular harmonised surveys for different sectors of the economies in the European Union (EU) and in the applicant countries. They are addressed to representatives of the industry (manufacturing), the services, retail trade and construction sectors, as well as to consumers. These surveys allow comparisons among different countries' business cycles and have become an indispensable tool for monitoring the evolution of the EU and the euro area economies, as well as monitoring developments in the applicant countries (European Commission, 2010a).

Business and consumer surveys provide monthly judgements and anticipations concerning diverse facets of economic activity in the different sectors of the economy: industry, services, construction and retail trade, as well as consumers. In order to be able to track overall economic activity, European Commission has been calculating the broader Economic Sentiment Indicator (ESI) since 1985, summarising developments in all five surveyed sectors.

Each confidence indicator is calculated as the simple arithmetic average of the (seasonally adjusted) balances of answers to specific questions chosen from the full set of questions in each individual survey. Based on the complete set of balance series underlying the individual confidence indicators, the ESI combines judgements and attitudes of producers and consumers by means of a weighted aggregation of standardised input series. Roughly speaking, the

Economic Sentiment Indicator can be viewed as a summary of the five sector-specific confidence indicators (European Commission, 2007, p. 15-16)[4].

The performance of the ESI, which summarises the attitudes and judgements of a large number of economic actors, should be compared with the performance of a reference variable which is also all-inclusive, recording movements in the economy as a whole. Corresponding to the broad scope of the ESI, the obvious reference variable is GDP growth, tracking the movements of the economy as a whole. GDP growth is therefore the obvious choice for testing the explanatory performance of the composite indicator. (Ibid. p. 21)

In general, business and consumer tendency surveys present many advantages as a source of short-term economic information. They collect information which is easier for enterprises and consumers to supply because the answers are not based on precise records and the returns can be submitted more quickly. In the work of OECD tendency surveys cover a wide range of variables selected for their ability to monitor the business cycle and include information on variables not covered by quantitative statistics, e.g. capacity utilisation and views on overall economic situation (OECD, 2010).While ESI is the EU indicator (referred to as "economic sentiment indicator" that is almost totally based on qualitative series while the OECD indicator includes both qualitative and quantitative statistical series (OECD, 2003, p.67). In this paper we shall look at the example of GDP and ESI to demonstrate the additional time distance view of GDP and a BTS indicator. The methodology can be extended to a number of other variables, both on the side of hard data indicators and on the side of BTS indicators.

The data series used in this section for the calculation of static decline and S-time-distance were the following:

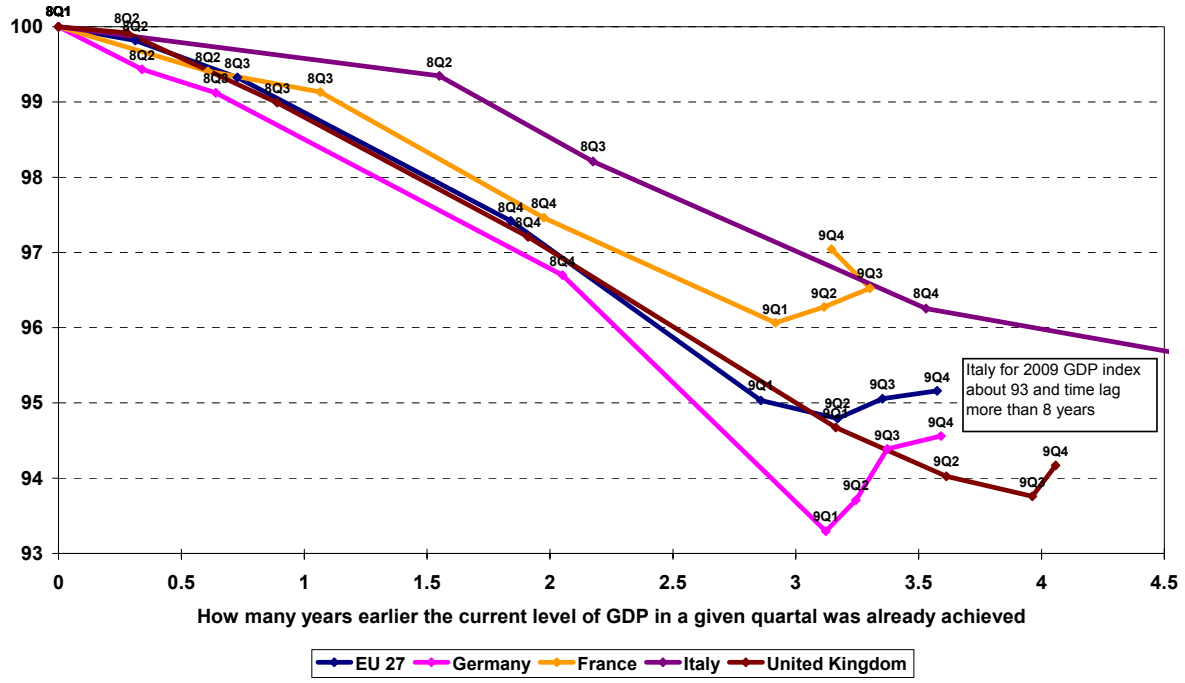
Gross Domestic Product (GDP) on quarterly basis, in millions of euro, chain-linked volumes recorded at constant prices, with 2000 as reference year (at 2000 exchange rates) and seasonally adjusted, Eurostat (2010a)

Economic Sentiment Indicator (ESI), on monthly basis, seasonally adjusted, a summary of the five sector-specific confidence indicators, European Commission (2010b)

The calculation of S-time-distances was done in two steps. In the first step, S-time-distances were calculated for GDP and ESI separately. In the second step, performance and S-time-distance for ESI was compared to the performance and S-time-distance for GDP, therefore to a reference variable which is also all-inclusive, recording movements in the economy as a whole. Since different sectors, that is industry, services, consumers, construction and retail trade are used for the computation of this composite indicator, GDP is a common choice for testing the explanatory performance of the composite indicator in a number of empirical analysis. In the analysis we included EU27 and selected EU countries - Germany, France, Italy, Poland, and United Kingdom.

4 The Economic Sentiment Indicator is made up of the 15 individual components of the confidence indicators in industry, services, construction and retail trade, as well as consumers. In different sectors, different weights are used for the computation of the composite indicator; Industry (40 %), Services (30 %), Consumers (20 %), Construction (5 %), Retail trade (5 %). The given weights have been determined according to two criteria, namely "representativeness" of the sector in question and tracking performance vis-à-vis the reference variable. The weights are standardised. Values greater than 100 indicate an above-average economic sentiment, whereas values below 100 indicate a below-average position. Assuming approximate normality, the imposed standard deviation of 10 implies that in about 68% of the cases the ESI will be within the range of 90 to 110 (Ibid. p. 19-20).

Figure 4. The decline of GDP in the current crisis in two dimensions: static index and time distance lag



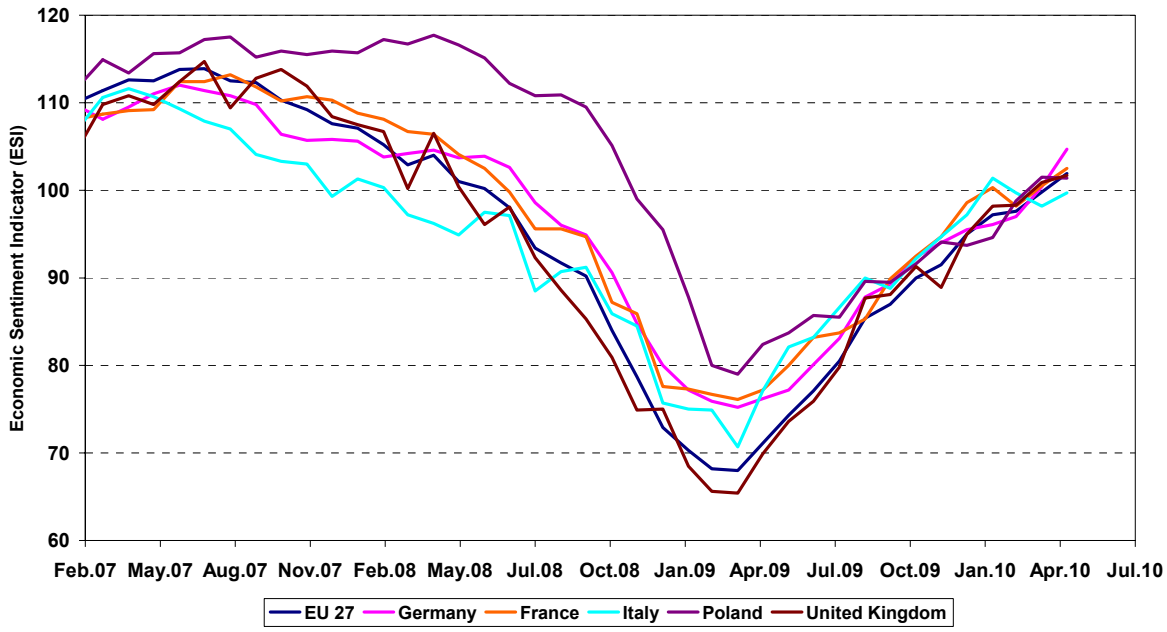
Source: Own calculations based on Eurostat data

GDP data in Figure 1 show that in the last decade GDP in the EU27 has been increasing until the peak in 2008 when it was hit by the crisis. Quarterly data show that in EU27 GDP reached its highest point in first quarter 2008, followed by the decline of GDP that hit the lowest point in second quarter 2009. In most of the selected countries, GDP grew to its highest point in the first quarter 2008, while it hit the lowest point in the first or second quarter of 2009 or even later in the same year.

According to S-time-distance perspective of GDP, in its lowest point in the second quarter of 2009, the economy of EU27 contracted to the level of the second quarter of 2006. The level of GDP in EU27 in the last quarter of 2009 was already achieved 3.6 years ago. S-time-distance perspective shows this lag for selected countries in the last quarter of 2009: Germany fell back to the level of 3.6 years ago, France 3.1 years ago, Italy to the level of 9 years ago, and United Kingdom 4.1 years ago.

Monthly Economic Sentiment Indicator (ESI) in Figure 5 shows that in EU27 reached its highest point in June 2007, followed by the decline of ESI due to the current crisis that hit the lowest point in March 2009. In most of selected countries, ESI grew to its highest point in second or third quarter of 2007, while the lowest point was reached in all selected countries in March 2009. The coincidence of this movement for the selected countries is very high. The very interesting case is that of Poland. In Poland the GDP continued to grow but the ESI was falling as well as in other countries though with a different shape. Obviously the decline in ESI was more influenced by observing what was happening in Europe and in the world rather than the situation in the country. This means that for Poland ESI was not a good predictor of what will happen in the country.

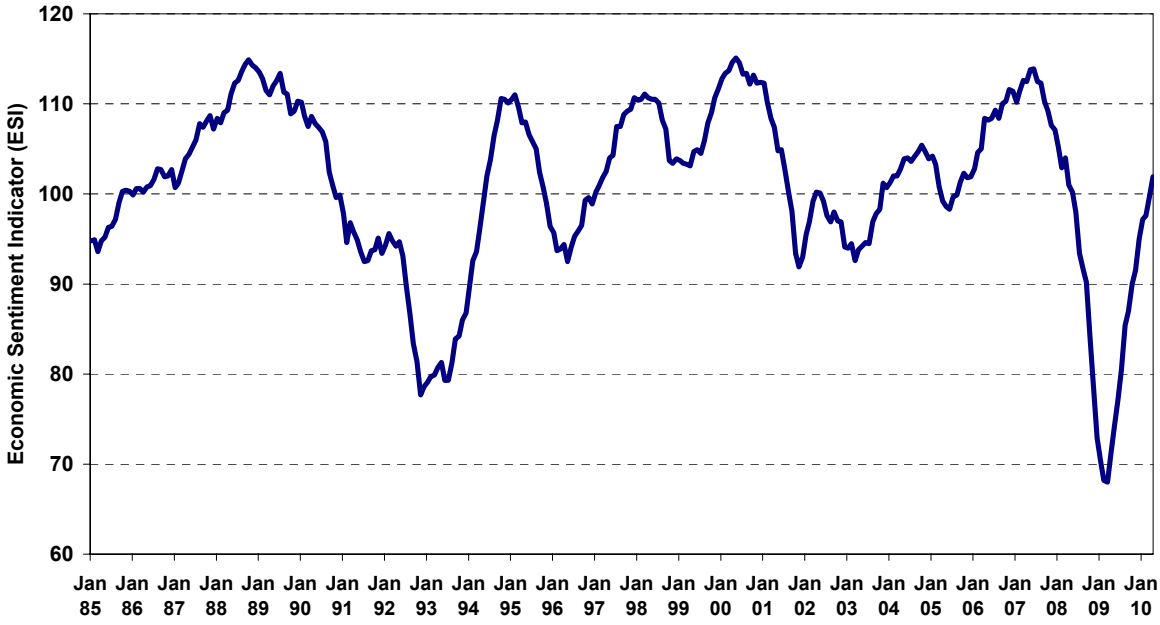
Figure 5. Dynamics of ESI for EU27 and selected countries for the period 2007-2010



Source: European Commission (2010b)

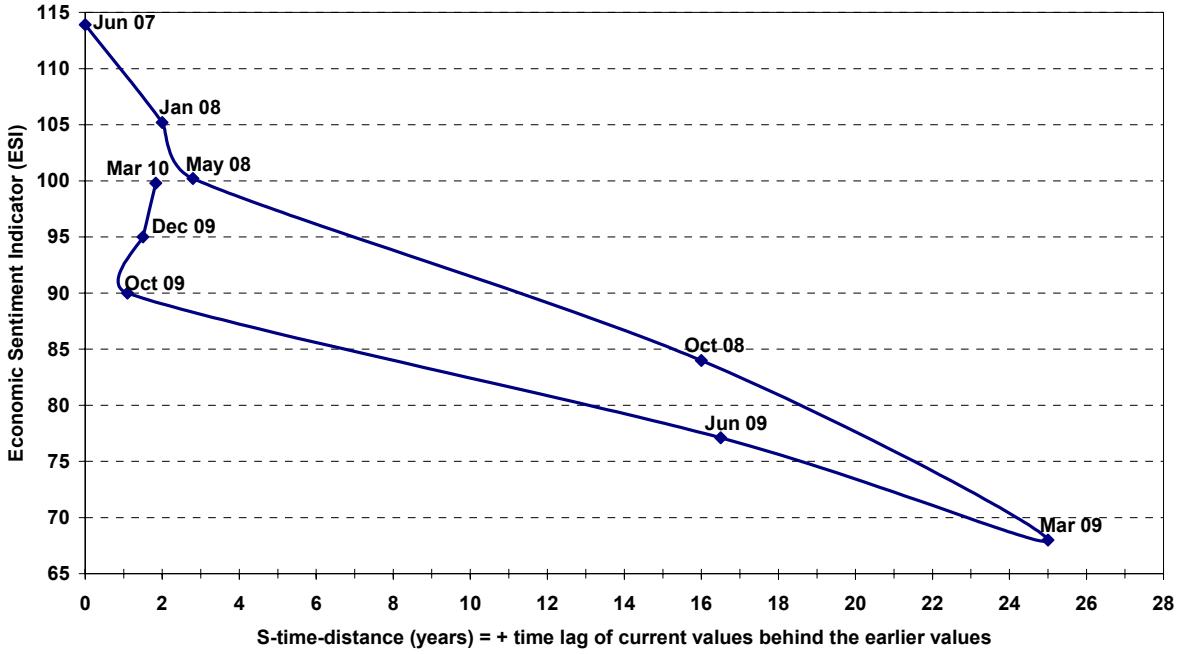
Figure 5 shows the movement of ESI for the most interesting period for EU27 and for 5 selected countries. As ESI has been collected from 1985 Figure 6 shows the long term development which allows us to compare the severity of the fall in ESI in the current crisis with the past history. The conclusion is clear: the minimum level of 68 in March 2009 is the lowest level in 25 years of the known history (next lowest level was 78 in November 1992).

Figure 6. Development of ESI for EU 27 (1985-2010)



Source: European Commission (2010b)

Figure 7. The decline of ESI in the current crisis for EU27 in two dimensions: static index and time distance lag



Source: Own calculations based on European Commission (2010b)

Comparison of Figure 7 and Figure 4, which compare the fall of ESI and the fall of GDP in the current crisis in the two dimensions, indicates that the volatility is much higher for ESI than for GDP. This conclusion holds for both measures, i.e. for the decrease in the ESI level and for the S-time-distance lag of the current levels behind the earlier values. Especially time distance measure provides a clear perception that the current crisis is far away from the "usual cyclical behaviour". Figure 7 shows that ESI for EU27 fell from its peak in June 2007 at 113.9 to less than 85 already by October 2008, which is to the level attained in September 1992 16 years ago; this fall is much greater than the fall in GDP. In March 2009 the minimum of ESI declined to the value of 68 and the S-time-distance is shown to be at least 25 years. So in the current crisis economic sentiment reached its lowest level in at least the last two and a half decades.

It is quite clear that ESI has much higher volatility than GDP notwithstanding the methodological difference that the construction of ESI tends to keep its value in a certain range while change in GDP is not constrained at all. So we should clearly distinguish two possible uses and interpretation of ESI. One is the use of ESI (or other BTS indicators) for explaining or predicting growth rates (or some other measures) of GDP (or some other hard indicators) for short term analysis and forecasting. This is not our main concern here beyond bringing into picture new measures and semantics. The second interpretation of ESI (or similar indicators) as a subjective indicator could be that besides expectations it also indicates subjective perception of people as consumers about their position over time which should be also a warning to politicians that they have to take into account.

S-time-distance provides a quick and easily understandable comparison of various data series that are difficult to compare due to different units of measurement, such as GDP and ESI. While the unit of GDP is volumes in millions of euro, indicator ESI is as a summary of the five sector-specific confidence indicators, where each sector-specific confidence indicator is calculated as the simple arithmetic average of the balances of answers to specific questions and it therefore combines judgements and attitudes of producers and consumers by means of a

weighted aggregation of standardised input series. In time, GDP data (measured in millions of EUR) is therefore usually constantly growing, while ESI is usually within the range of 90 to 110.

The comparison of S-time-distances for GDP and ESI in the current crisis in Table 3 shows for the selected countries their respective maximum, minimum for both GDP and ESI and the difference in time when they occurred for the two indicators. ESI for EU27 started to decline after June 2007, while GDP started to decline after first quarter of 2008, this means 8 months later than ESI. Similar values were attained in the selected countries with the exception of Poland where no decrease in GDP was observed. In the current crisis ESI was in this case good forward warning of the events to come (except for Poland) which was not properly taken into account by the governments and many businesses.

There is a great coincidence for the selected countries as the minimum of ESI was achieved in March 2009 for all of them. For Germany, Italy and United Kingdom the same conclusion holds as for EU27, i.e. that this was the lowest level of ESI in the whole time series from 1985 on (for France such low level was earlier attained in June 1993). So for these countries the time comparison with the past using S-time-distances on the ESI time series itself the current crisis was felt as the most pronounced crisis in the current history. Similar analysis could be performed for a number of indicators of business and consumer surveys.

Table 3. Time points for minimum and maximum values of ESI and GDP in the period 2007-2009

	ESI (monthly)		GDP (quarterly)		Difference ESI-GDP (years)	
	max	min	max	min	max	min
EU 27	Jun 07	Mar 09	Feb 08	May 09	-0.7	-0.2
Germany	May 07	Mar 09	Feb 08	Feb 09	-0.8	0.1
France	Jul 07	Mar 09	Feb 08	Feb 09	-0.6	0.1
Italy	Mar 07	Mar 09	Feb 08	May 09	-0.9	-0.2
Poland	Mar 08	Mar 09	no decrease in GDP			
United Kingdom	Jun 07	Mar 09	Feb 08	Aug 09	-0.7	-0.4

Source: Own calculations based on Eurostat (2010a) and European Commission (2010b)

While the peak values of ESI for the selected countries was attained around June 2007 (in Italy three months earlier, Poland is not relevant for this comparison), the minimum was for all of them in March 2009. For GDP the comparison between maximum and minimum is different; maximum for all of them was in the first quarter of 2008, while the minimum and turnaround in 2009 was not.

The comparison when the minimum values for ESI and GDP were attained in the recovery phase is different; here ESI acts in several cases more as a coincident indicator than as a leading indicator. The time lag between the change in ESI and GDP is much smaller and even the sign is not the same for all selected countries. However, the trend for recovery is indicated by ESI for all countries at least until April 2010. The latest value for ESI in May 2010 shows for EU27 first small drop in ESI[5] since its upward tendency after March 2009.

[5] In May, the Economic Sentiment Indicator (ESI) declined, moving back to 100.0 (-1.9 points) in the EU. It should be noted that the latest developments in the ESI are influenced by the change of classification of economic activities that was implemented for the business surveys in May, leading to a break in the series. The results for this month are based on the NACE Rev.2 classification, while data up to April 2010 are based on NACE Rev.1. Internal checks, however, indicate that the changeover has affected the level, making interpretation more difficult. This level shift did not, on the whole, affect the direction of the change, but only its magnitude (European Commission 2010a).

There is another measure in the time distance methodology that can bring about some additional information about the interrelationship between ESI and GDP. In the methodological section besides S-time-distance another measure S-time-step was defined (see equation 7), which specifies how much time (years, quarters, months, weeks, and days, etc.) has evolved between two levels of an indicator. 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. Here we shall not use this exact definition since the countries start from different initial value of ESI but we shall use a similar concept to measure the time evolved between the maximum and minimum values of ESI and GDP for the selected countries in the period 2007-2009 analysed above.

Table 4. Time from the maximum to the minimum values in the period 2007-2009

	ESI		GDP	
	months	years	months	years
EU 27	21	1.8	15	1.3
Germany	22	1.8	12	1.0
France	20	1.7	12	1.0
Italy	24	2.0	15	1.3
Poland	12	1.0	no decrease in GDP	
United Kingdom	21	1.8	18	1.5

Source: Own calculations based on Eurostat (2010a) and European Commission (2010b)

Table 4 shows that the continued trend of fall in ESI was going on for 21 months for EU27 (slightly more for Italy where it started earlier), the decline from 113.9 to 68 was considerably greater in absolute terms than an earlier decline in ESI from 114.9 to 77.7 between October 1988 and November 1992, which lasted longer. The fall from the maximum and minimum for GDP in the current crisis was less also in time, 15 months for EU27, about a year for Germany and France and 18 months for UK.

Even for the possible narrower role of ESI as a representative of BTS and CS in analysing and/or predicting movements in the rate of growth of GDP this analysis indicates that more attention needs to be paid to levels and time, which can bring about additional information for a more thorough analysis and understanding of the situation. In the declining phase ESI offered a leading warning of about 8 months, showed a continued trend of fall of about 21 months; while in the recovery phase its position as a coincident indicator or as a leading indicator is mixed.

5. Conclusions

The first conclusion is methodological. The novel generic S-time-distance concept and statistical measure offers interesting new ways of analyzing and presenting time series data. It provides new information and perceptions from existing data. The time perspective, which without any doubt exists in human perception when comparing different situations, is systematically introduced both as a concept and as a quantifiable measure in statistical and comparative analysis.

S-time-distance measure is a measure with clear interpretability that delivers a broader concept to look at data and to compare situations, including benchmarking and monitoring. This innovation opens the possibility for simultaneous two-dimensional comparisons of time series data: vertically (standard measures of static difference) as well as horizontally (Sicherl time distance). Empirically, the degree of disparity may be very different in static terms and in time distance. Since S-time-distance is expressed in time units, it is intuitively understood by policymakers, professionals, managers, media and the general public, facilitating their subjective

perception about the position in this additional dimension. The intention is to complement rather than replace the conventional static measures and to provide the two-dimensional measurement of the gap. No earlier results are lost or replaced but overall conclusions might change due to an added dimension of measurement and analysis.

In this paper we are dealing with the illustrations how the time distance methodology might help the description of the current economic crisis with ESI as the selected indicator from the Business Tendency Surveys and GDP as a hard indicator for EU and selected countries. These conclusions could provide a base from which an outline of a complex substantive analysis could be developed by the corresponding international and national organisations.

In general terms the perceptions of the situation do not depend only on the available data but the resulting decisions, behaviour and actions undertaken are also influenced by the statistical measures that are used in the measurement, presentation and semantics of discussing these issues. In the Chapter 2 we define the statistical measure S-time-distance as a special category of time distance related to the level of the analysed variable measuring the distance (proximity) in time between the points in time when the two series compared reach a specified level of the variable X. In the empirical part we wish to illustrate on the example of the selected aspects of the current crisis how the time distance approach can in general contribute a new complementary understanding to the indicator analysis across many years, many indicators and many fields of concern.

In Chapter 3 we look first at GDP data on yearly values and forecast by Eurostat to analyse the severity of the crisis in the two dimensions: decrease in the static index from the peak in 2008 and the S-time-distance lag indicating how many years earlier the same levels of GDP were already achieved in the past. The latter indicates that for EU27 this would amount to 3.3 years for 2009, 3.9 years for 2010 and to 4.4 years for 2011. Alternatively, this means that the forecast level for 2011 would be lower than that achieved in 2007. Similar values are obtained for the selected countries; the exceptions are Poland for all three analysed years; USA is expected to reach the 2008 level in 2010 and France in 2011.

Next we are comparing the situation across four selected indicators: GDP, total employment, exports of good and services, and investment rate (gross fixed capital formation as percentage of GDP). For EU27 all four indicators (in real terms) are forecast to stay below the 2008 levels. In static terms the largest decrease in 2009 was for export of goods and services, while the S-time-distance clearly shows that in historical terms the greatest fall back was in the investment rate. In the USA it is expected that in 2010 the 2008 levels of GDP and export of goods and services will already be achieved, while the total employment is expected to start increasing in 2011.

On the other hand, S-time-distance measure clearly shows how debt crisis has weakened the possibility of higher growth rate in the near future. In 2011 the investment rate for EU27 would still be around 10% below 2008 value and about at the level attained 14 years ago (about 1997 level). For the USA the investment rate in 2011 is expected to be about 13% below the 2008 value at a level before 1994 resulting in S-time-distance of about 17 years. For Japan the fall in investment rate for the period 2009-2011 is very much pronounced as it falls to the levels not achieved after 1980. For investment rate Triad countries are expected to fall back to the levels in past century which could not be perceived by looking only at the static indexes. In terms of S-time-distance this is the greatest fall back to earlier situations and their medium term growth capabilities are severely impaired by the financial crisis.

Chapter 4 introduces analysis on the basis on quarterly values of GDP and monthly values of Economic Sentiment Indicator (ESI). In methodological terms there is an important conclusion that time distance methodology can be usefully applied also to indicators based on qualitative judgements. ESI as an example was chosen for several reasons. ESI is harmonised, calculated by the DG-ECFIN of the European Commission for all EU countries, a composite indicator that encompasses all BTS and CS, freely available also for its components, etc. This is important for small research organisations like SICENTER (www.gaptimer.eu or www.sicenter.si)

so that they can start the analysis without a lot of effort to collect data and check their comparability. However, the wide range of possible analysis across results of these surveys and relating them to the respective hard indicators means that such considerable undertaking needs outside financing and might be best undertaken by international and national institutions.

Time distance methodology provides additional views also on qualitative indicators like ESI. As the political and professional orientation moves 'Beyond GDP' so the analysis of ESI becomes more important for broader analysis of the situation in the economy and society than for its possible role in analysing and/or predicting movements in the rate of growth of GDP. The much greater decline of ESI than of GDP might be a sign that the economic sentiment goes considerably beyond GDP and include also the additional problems related to the decrease in the investment rate and employment as indicated in Figures 2 and 3.

In most of selected countries, ESI grew to its highest point in second or third quarter of 2007, while the lowest point was reached in all selected countries in March 2009. The coincidence of this movement for the selected countries is very high. The very interesting case is that of Poland. In Poland the GDP continued to grow but the ESI was falling as well as in other countries though with a different shape. Obviously the decline in ESI was more influenced by observing what was happening in Europe and in the world rather than the situation in the country. This means that for Poland ESI was not a good predictor of what will happen with GDP in the country.

As ESI has been collected from 1985 we can compare the severity of the fall in ESI in the current crisis with the past history. The conclusion is clear: the minimum level of 68 in March 2009 is the lowest level in 25 years of the known history (next lowest level was 78 in November 1992). . Especially the time distance measure provides a clear perception that the current crisis is far away from the "usual cyclical behaviour".

Comparing maximum and minimum values of ESI and GDP in the period 2007-2009 shows different development in the declining and recovery phases. ESI for EU27 started to decline after June 2007, while GDP started to decline after first quarter of 2008, this means 8 months later than ESI. In the current crisis ESI was in this case good forward warning of the events to come (except for Poland) which was not properly taken into account by the governments and many businesses. The comparison in the situations when the minimum values for ESI and GDP were attained in the recovery phase is different; here the position whether ESI was a coincident indicator or a leading indicator is mixed.

In the declining phase ESI offered a leading warning of about 8 months, showed a fall of about 21 months from the maximum in June 2007 to the minimum levels in March 2009, while the fall in quarterly GDP from first quarter of 2008 lasted about 15 months. In the current crisis ESI showed much higher volatility than GDP. As mentioned before, this may indicate that much greater decline of ESI than of GDP might be a sign that the economic sentiment goes considerably beyond GDP and include also problems related to the decrease in the investment rate, employment and other conditions.

One is the use of ESI (or other BTS indicators) for predicting or explaining growth rates (or some other measures) of GDP (or some other hard indicators) for short term analysis and forecasting. This is not our main concern here beyond bringing into picture new measures and semantics, which can be used also for this purpose. The second interpretation of ESI (or similar indicators) as a subjective indicator could be that besides expectations it also indicates subjective perception of people in business or as consumers about their position over time which should be also a signal and a warning to politicians that they have to take into account.

The examples show that more attention needs to be paid to levels and time, which can bring about additional information for a more thorough analysis and understanding of the situation. An obvious extension would be to repeat such analysis for the ESI components, i.e. available BTS and CS, by domains and sectors as well as for a number of the hard indicators for which the relationships with the former would be useful to test and analyse. Similarly time distance

methodology could be tested also on types of indicators like OECD composite leading indicators. There are lessons that can be learned from comparisons across indicators and countries and lessons from a more detailed analysis within a given country.

One should mention that the generic characteristics of the S-time-distance concept can be utilized also in more complex research like comparisons of leading and lagging indicators and using the time distance as a criterion for evaluating forecasting models done by Granger and Jeon (1997, 2003). This is not our concern here, yet it is an indication how much broader could be the range of possible applications of the S-time-distance methodology beyond the immediate extensions within the components of BTS and of GDP suggested above. One of them is also how to interpret changes over time for composite indicators as against changes over time of its components. The main message is clear: seeing with new eyes creates new knowledge and better understanding (Sicherl, 2010b).

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