

Time Distance Analysis and Socio-Economic Risk-Analysis. New Tools for Comparative Analysis

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Within the last decades of European integration in general, problems of disparities across the European Union and between the EU and candidate countries have stood at the core of political assessments and decision making. Moreover, in the current wave of European Enlargement, two related and inter-linked questions have occupied the interest and the imagination of policy-makers, the media and the academic community likewise. The first question is related to “disparities in time”, the second one to “socio-economic disparities”. Both questions can be phrased in the following way:

- Which are the expected time-horizons for the Central and Eastern European nations and cohesion countries to “catch up” with the current EU-developmental levels in key areas of science, technology, economy or education?
- Which are the current levels of socio-economic inequalities in living conditions which characterize candidate and cohesion countries and which separate them from the EU-averages?

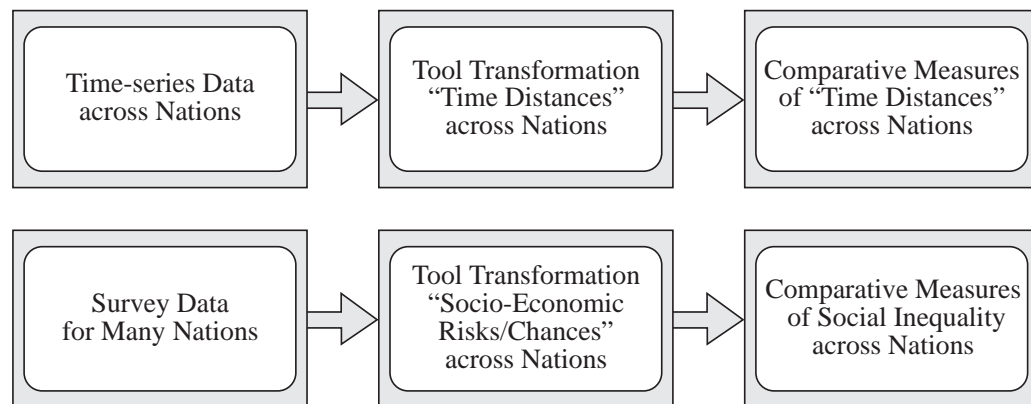
Surprisingly, European comparative research is currently only ill-equipped to deal with both core problems. With respect to “time-distances”, no readily available procedure is at hand which would yield substantial insights into time-distances in domains like GDP per capita, information and communication technology (ICT) infrastructures, private consumption per capita or in many other areas of vital concern for the processes of European Enlargement. For the second issue of socio-economic disparities, comparative research is faced with the problem of huge data sets on living conditions which, however, cannot be compared directly since the underlying items and indicators have been measured in different ways. Thus, despite large quantities of data, many comparative issues on socio-economic inequalities and disparities cannot be answered.

The tools which will be introduced in the course of this article are devoted to both currently deficient directions of comparative research outlined above.¹ Moreover, the two tools for comparative analysis share an important common element. They are able to utilize existing data sets and extract new information and essentially new perspectives, based on the vast amount of data which have been accumulated over the last decades. Thus, these tools will enlarge the platform for cross-country comparisons substantially. Diagram 1 presents a short overview of the two groups of tools which will be presented within this articles.

¹ On the first tool, namely time distance analysis, see Sicherl 1978, 1980, 1989, 1992, 1994, 1997, 1998, 1999a, 1999b, 1999c, 1999d, 2000a, 2000b, 2001a, 2001b, on socio-economic risk analysis see Müller 1998, 1999, 2000.

Following Diagram 1, the first tool is able to transform existing time-series data and provides basic information on inherent “time distances”. More concretely, given long-term time series data for core socio-economic macro-domains both for amore developed European country A (like Netherlands, Germany, etc.) and for a less developed Eastern European state B (like Hungary, Slovenia etc.), the first tool is able to give a well-defined measure for the time-interval between B and A for a given level of the indicator.

Diagram 1: Data Transformations via New Tools for Comparative Analysis



The second tool transforms existing micro-data on individual living conditions and attitudes into a new vertical scale which captures the basic structures of socio-economic disparities and inequalities. By using a newly developed multi-dimensional aggregation procedure, the second tool provides a new perspective for a multi-dimensional integration of living standards and offers essential insights into the amount of socio-economic disparities within a country or across two or more countries.

In this way, these new instruments will contribute substantially towards an improvement of cross-country macro-comparisons across time and across essential micro-comparisons across a multiplicity of socio-economic dimensions.

1. Time Distance Analysis

1.1 Introducing Time Distance Analysis

In this section a short example will be presented which demonstrates vividly the usefulness and even the counter-intuitive content of “time distance analysis”. The starting point is given by Table 1 which reproduces the index of GDP per capita for three different regions A, B and C in Europe between the years 1974 and 1992. In addition to these three regions, the average values for a larger group of regions (including A, B. and C) have been calculated for

the period from 1974 to 1992 and set as 100 so that region C lies considerably above the average value and region B and C are substantially below the average value.

Table 1: Disparities of GDP per capita for three European Regions (Average Value = 100)

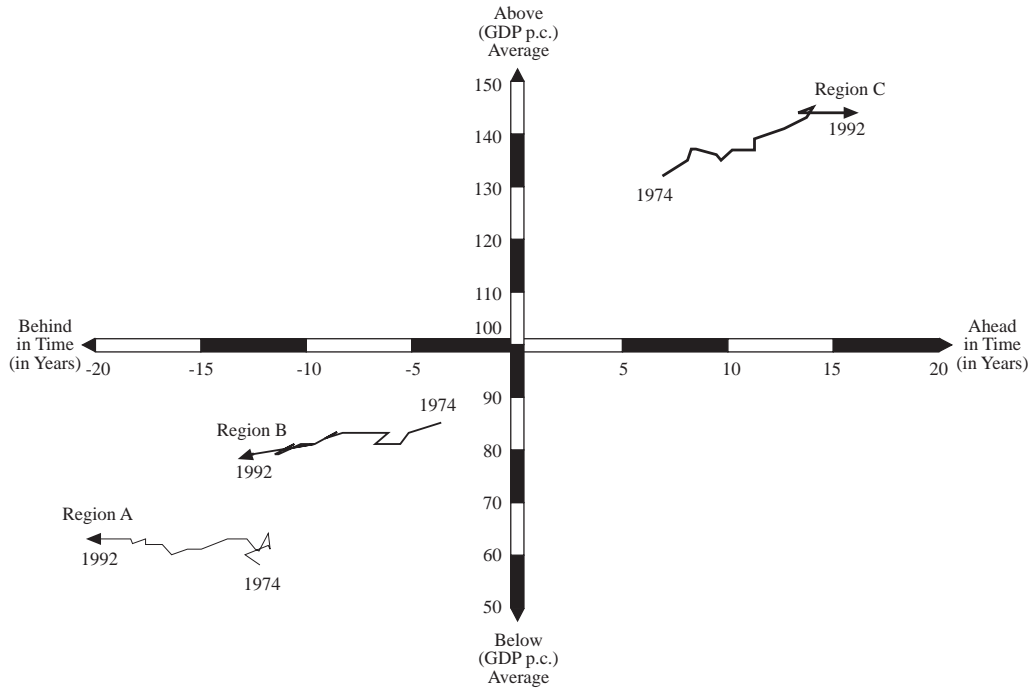
YEARS	REGION A	REGION B	REGION C
1974	59	85	132
1974	60	83	135
1976	62	82	137
1977	61	81	137
1978	64	81	136
1979	61	83	135
1980	61	83	137
1981	63	83	137
1982	63	83	137
1983	61	82	139
1984	61	83	141
1985	60	81	142
1986	62	81	143
1987	62	79	145
1988	63	79	144
1989	62	81	144
1990	63	80	144
1991	63	81	144
1992	63	79	144

The basic impression one gets from Table 1 is a “no change-view” and the grounded conviction that the relative distances in GDP per capita between region A, B and C are almost constant, with region A in a position of slightly “catching up”, region B in a position of slightly increasing its relative degree of backwardness and with region C moving modestly ahead.

Shifting now to time distance analysis, the picture, extracted from the absolute values of the same data as presented in Table 1, changes dramatically. Diagram 2 shows convincingly that the time-distances between region A, B, and C have changed drastically over the period from 1974 to 1992. In time horizons and time distances, region C has more than doubled its “lead position” and, surprisingly and even counter-intuitively, even region A has significantly fallen behind in its time distances. Thus, Diagram 2 demonstrates very clearly that in terms of time distances, the data from Table 1 are far from their surface appearance of “no change” or “small changes” only. The time distances, exhibited via Diagram 2, make it clear that

regions A and B on the one hand and region C on the other hand are drifting significantly apart.

Diagram 2: Time Distances for the Three Regions of Table 1



Obviously, the differences between Table 1 and Diagram 2 are striking and bewildering. It seems almost inconceivable that Diagram 2 represents the data content of Table 1. Nevertheless, it can be safely argued that the content, underlying Diagram 2, can be extracted from the absolute values of GDP p.c. for the three regions of Table 1.

1.2 Constructing a New Tool for Time Distance Analysis

Time distance analysis requires a radical shift in perspective with respect to time series data. Under the conventional perspective, comparisons are made on the basis of absolute or relative values of a given socio-economic indicator for each point in time, i.e. the main emphasis lies in the differences between two time series data at each point in time respectively. The new perspective on time series, which for obvious reasons can be characterized as “dynamic” or ‘temporal’ , has its main focus on the horizontal differences in time for each level of two socio-economic indicators. Under the new focus, time distance measures the differences in time for each level of the indicator. The observed distance in time (the number of years, quarters, months, etc.) is used as a dynamic (temporal) measure of disparity between two time 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. It is remarkable

that the notion of time distance, which can be in principle developed from the same information, has not been developed theoretically and as a standard statistical measure.

Time-distance as a statistical measure has two important advantages. One big advantage is that it is defined in standardized units - time - which means that everybody understands the notion of the time lead or time lag between two compared units for a given level of the indicator. This makes it not only a transparent analytical measure but also an excellent presentation and communication device, which is of great importance for its practical use and of considerable influence on public opinion. The second big advantage of this approach is that the results and conclusions based on the two-dimensional analysis add new information and new insight, while none of the earlier results are lost or replaced.

The basic requirement for time distance analysis lies in the availability of time series data for two or more regions, countries, economic or social groups. Moreover, the time series data have to cover a long-term period for the more advanced region and a shorter period for the less advanced regions since one needs a long-term time series for the more advanced region in order to find the corresponding values necessary for generating the time distance value.

More generally, time distance analysis can be performed most fruitfully in the case of medium-term and long-term upward trends and of considerable differences in overall development. Here, time distances can be used to discuss the time horizons (in years) of the starting degree of disparities and the time horizon which are to be expected to reach specific target values under different policy scenarios. From this, it follows quite obviously that time distance analysis must play a crucial analytical role in the debate about cohesion issues and the EU-Enlargement. Here, the basic insights offered from time distance analysis can and will be of vital concern and core interest both for the scientific community at large and for economic and political decision making at the national as well as at the international level.

1.3 Some Theoretical Background for Time Distance Analysis

Time distance is a generic concept like growth rates or static degree of disparity. On the theoretical level the novel time distance approach provides a new view of the information: it uses level of the variable(s) as identifiers and time as the focus of comparison and numeraire. In this capacity it can be used beyond the application here that is focused on comparisons between countries and regions. Since from countless existing sets of data (vectors of values with time subscribes) an additional theoretically universal and practically relevant measure for comparative analysis can be obtained, it is evident that an expanded conceptual and analytical framework for comparative analysis is necessary.

There are several layers of potential use of the time distance concept and statistical measure. At the theoretical level, it can be shown that in time series analysis in addition to the disparity (difference, distance) in the indicator space at a given point in time, in principle there exists a theoretically equally universal disparity (difference, distance) in time when a certain level of the indicator is attained by the two compared units. In empirical research the art of handling and understanding of different views of data is crucial for discovering the relevant patterns. Time distance perspective might be one of such important additional views at perceiving and understanding different situations. In the policy field it has the advantage that time is one of the most important reference frameworks in a modern society and that the time perspective no doubt exists in human perception when comparing different situations. Thus time distance can be a very useful presentation and communication tool easily understood by policy makers, media and general public. As such it might have considerable influence on how experts and the general public will form their perception about a given situation, and thus on public opinion.

In the policy field its application reaches significantly beyond its obvious helpful role as a statistical measure and a presentation and communication tool by providing new hypotheses and policy perspectives in a dynamic framework that cannot be adequately dealt without the new concept. Both questions of the overall degree of disparity, which is simultaneously analyzed in the static and in the time dimension, and of the convergence and divergence have in the empirical examples produced new conclusions and raised important new policy questions. For instance, for the analysis of convergence and of the degree of cohesion in the EU the new policy angle is that it is also important how fast and not only how much faster will the less developed countries (regions) and the potential member countries grow in the future. The broader concept relates performance and efficiency in a novel way to the broader notion of the overall degree of disparity.

The European value added component of time distance methodology is not based only on its generic characteristics, but also on its relationship with the mainstream of the European development model paradigm. Lundvall (2000) concluded that in emerging knowledge based economies there is a need for reintegrating the strategies of firms, social partners and policy makers. We may add that under the new circumstances of accelerated change there is also a need that the conceptual and statistical framework employed to deal with the problems of benchmarking, convergence and interrelationships between growth, efficiency, inequality and social exclusion reaches beyond the conventional predominately static approach to provide a broader dynamic framework for policy analysis and debate. In the Lisbon Strategy Europe is proclaiming to strive for both higher growth and more cohesion. Obviously the nexus between growth and inequality is in the European development model paradigm again at the forefront of economic and social policy considerations. The time distance framework with the new perspectives on relationship between growth and inequality is thus a novel way of addressing with one of the most important strategic issues in the European society.

1.4 Main Research Objectives for Time Distance Analysis

The paradigmatic examples for time-distance analysis can be focused on two crucial issues for which practically very little knowledge has been accumulated so far.

- First, time distance analysis is able to address the problem of different dynamic types of socio-economic processes. In particular, the analysis can be focused on those counter-intuitive processes that can be characterized by one of the following two asymmetric features. On the one hand, one can observe socio-economic processes which exhibit small distances in static absolute or relative values, but long distances in time. (Type I-processes) Conversely, socio-economic processes are identifiable which can be described by large distances in static, absolute or relative values but by small distances in time. (Type II-processes)
- Second, another essential focus for time distance analysis lies in the problem of different global patterns of development. Here, one can distinguish distinct periods or stages which are characterized by a general convergence or divergence pattern across Europe or even globally.

As can be seen from Diagrams 3 and 4, the time-distance analyses which have been performed so far offer substantial insights into different dynamic types of socio-economic processes. Above all, Diagrams 3 and 4 clearly demonstrate that Type I and Type II-processes are not to be qualified as an empty class. Apparently, technological processes like the rapid global diffusion of ICT-utilization (Information and Communication Technology) as well as ICT-equipment follows a Type II-trajectory. Likewise, essential social indicators like life expectancy can be characterized as a Type I-process. Despite seemingly marginal absolute differences in life expectancy, the time-distances, necessary for catching up to the EU-averages, become strikingly long. To conclude the contents of Diagrams 3 and 4, the core performance indicator for economic systems clearly qualifies as a Type III-process where one can observe a more symmetrical relation between distances in absolute or relative values and in time. Small absolute differences are accompanied by small time-distances and long distances in time imply large relative (absolute) differences as well. The subsequent list provides some preliminary hints, based on substantial amounts of time-distance analyses, that the universe of socio-economic processes can be distributed across the three different dynamic types.

- Type I-processes: social performance indicators (life expectancy), several structural science indicators
- Type II-processes: Technology indicators for the ICT-complex as well as for some other domains of technology and knowledge diffusion
- Type III-processes: Many economic processes like GDP p.c., output in manufacturing, etc.

Turning to the second crucial issue for paradigmatic examples in time distance analysis, namely to the problem of periods of divergence and convergence, at least one preliminary answer can be given with the help of Diagram 5. Here, a global configuration, including the United States and selected European Union countries (France, Greece, Spain and Portugal) has been selected for the period between 1966 and 1998 and their relative position compared with France in two dimensions. Following Diagram 5, a strikingly clear pattern can be identified which shows a general trend towards convergence in time-distances for the period between 1966 and 1973 and a clear trend towards divergence in time-distances for the years between 1973 and 1998.

Diagram 3: Three Dynamic Types of Socio-Economic Processes

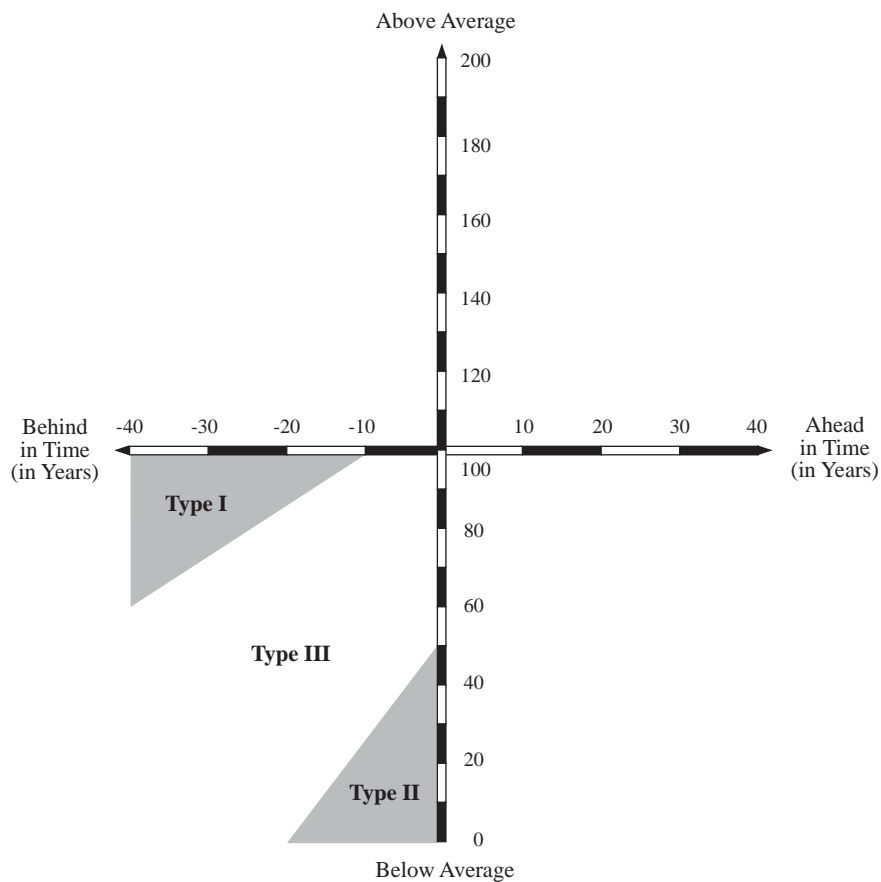
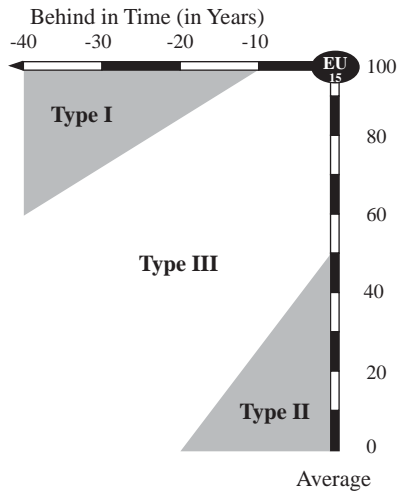


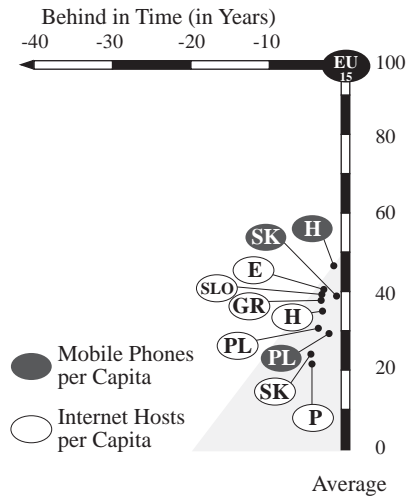
Diagram 4: Three Dynamic Types and Paradigmatic Examples

A, The Domains for the Three Types

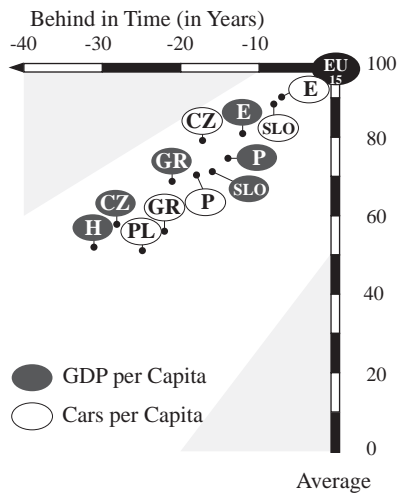


B. Type II: Technology-Indicators

(Mobile Phones p.c. and Internet Hosts p.c.)



C: Type III - GDP p.c.



D: Type I – Life Expectancy

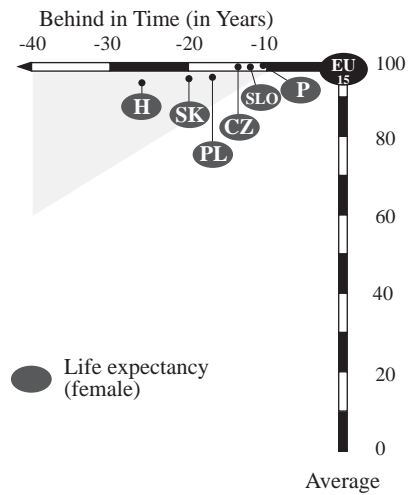
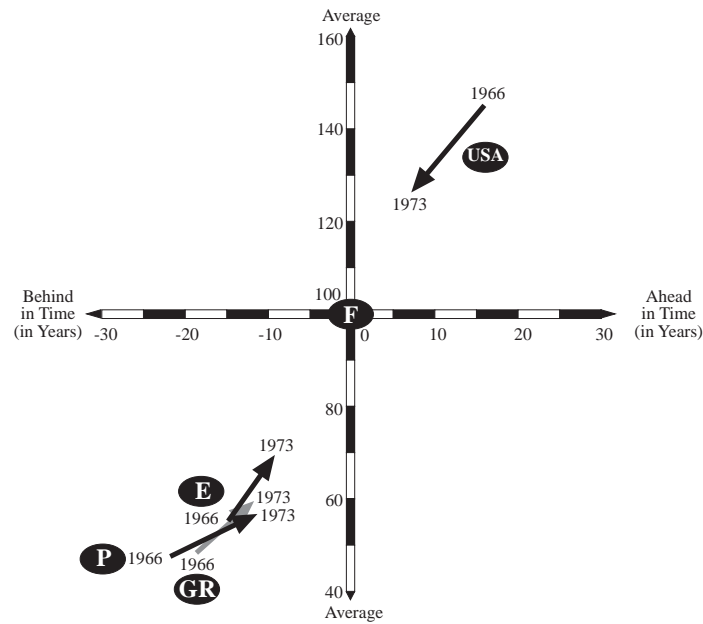
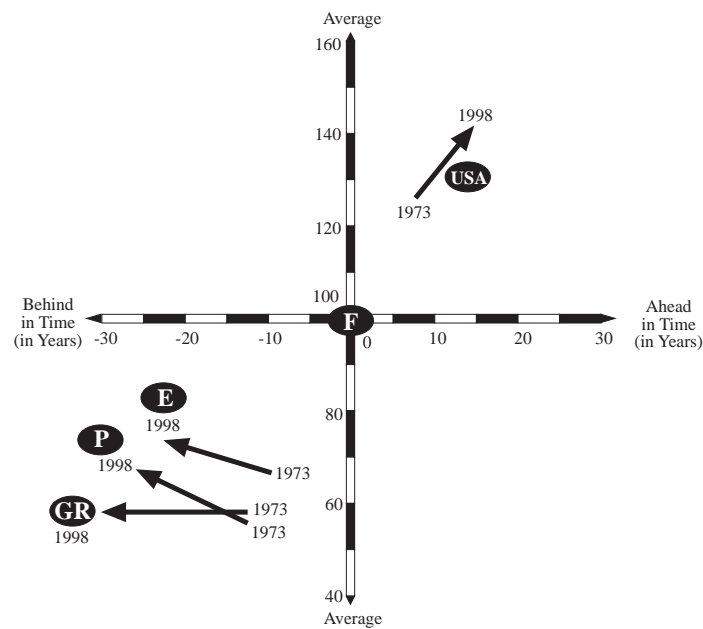


Diagram 5: Phases of Convergence and Divergence

A: Convergence between 1966 and 1973



B: Divergence between 1973 and 1998



2 Multi-Dimensional Analysis of Socio-Economic Disparities within and across Nations

While time-distance can be utilized for problems of societal changes and societal dynamics in the medium, long and in the very long run, the second transformation of existing data into something new and valuable for the purpose of comparative research can be employed most fruitfully for analyses at a particular point in time. Moreover, while time distance analysis in the project has a focus on time series of development indicators at the aggregate level, the second tool uses primarily conventional micro data as they are collected through national surveys, welfare surveys and the like although the new tool can be extended to macro-data as well. Thus, the second new instrument which has been labeled as socio-economic risk analysis assumes a truly complementary position to the time distance-framework, introduced so far.

Table 2: The Complementarity between Time-Distance-Analysis and Socio-Economic Risk-Analysis

		TIME	
		DIACHRONIC	SYNCHRONIC
DATA	MICRO-DATA		Socio-Economic Risk-Analysis
	MACRO-DATA	Time Distance-Analysis	

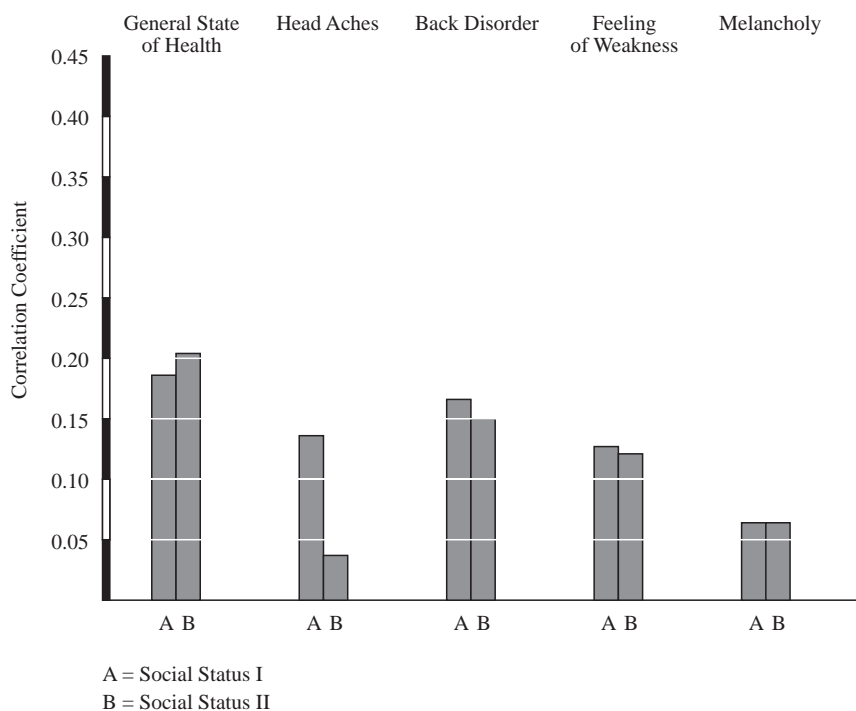
Like in the case of time-distance analysis, a striking and somewhat surprising example will be presented which demonstrates the usefulness of socio-economic risk analyses for the overall issue of disparities.

2.1 Introducing Socio-Economic Risk-Analysis

Following the two ground breaking books by Ulrich Beck (1986) on “Risk Society” and Richard Wilkinson on “Unhealthy Societies” (1996), one is confronted with the assertion of new forms of inequality and disparities (Ulrich Beck) on the one hand and of strong linkages between inequality and the state of individual health on the other hand (Richard Wilkinson). Still, current approaches on risk-society, inequality and the state of health suffer from the fact that they concentrate either on a very small set of core indicators like income, income distribution, qualification, status or occupation or on larger indicator sets of “life style

indicators” which, however, do no longer qualify as a measurement of vertical inequality. Thus, in previous research on the linkages between socio-economic risks, inequality and health one was able to identify significant, albeit rather weak linkages as can be seen from Diagram 6 (next page). Here, a representative social survey (N=2000) from an EU-member country which included a large module on health and health behavior as well has been analyzed in greater detail. For the variable “social status” in Diagram 6, several indices have been tested and the indices with the highest degree of correlations with health indicators have been selected for Diagram 6.²

Diagram 6: The Established Linkages between Socio-Economic Living Conditions and Health



Following Diagram 6, one can easily recognize three different patterns.

- First, a moderate link between the overall state of health and overall socio-economic conditions.
- Second, still weaker links between ailments and overall socio-economic conditions.

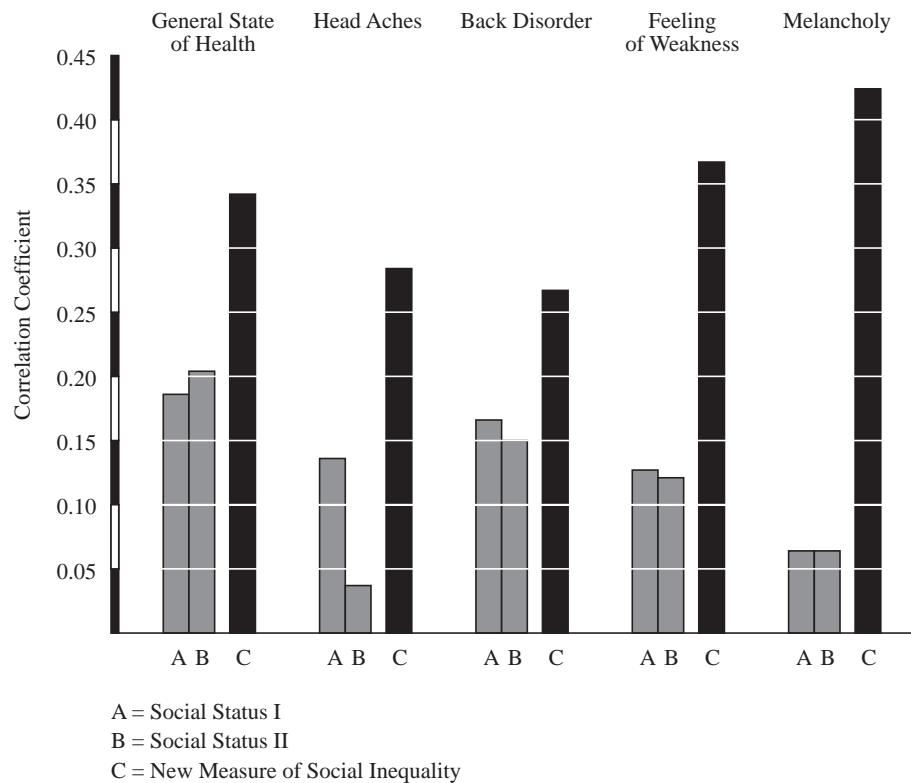
² These two indices consisted of combinations between personal income and level of education (social status I) and between household income and level of education (social status II).

- Third, no significant linkages between mental states like depression, feelings of weaknesses and overall socio-economic conditions.

Consequently, all three patterns belong to the conventional wisdom when studying the impact and the effects of risk-societies, inequalities on the status of health, ailments and mental disorders.

In contrast, a new approach on socio-economic risk-analysis has been developed which uses a comparatively large set of socio-economic indicators from existing social surveys as its starting point and transforms them step by step in an unusual and novel way into a new vertical dimension. Surprisingly, the correlations between this new type of risk and inequality measure and health indicators are far higher than for the traditional indicators and indices.

Diagram 7: The New Linkages between Socio-Economic Living Conditions and Health



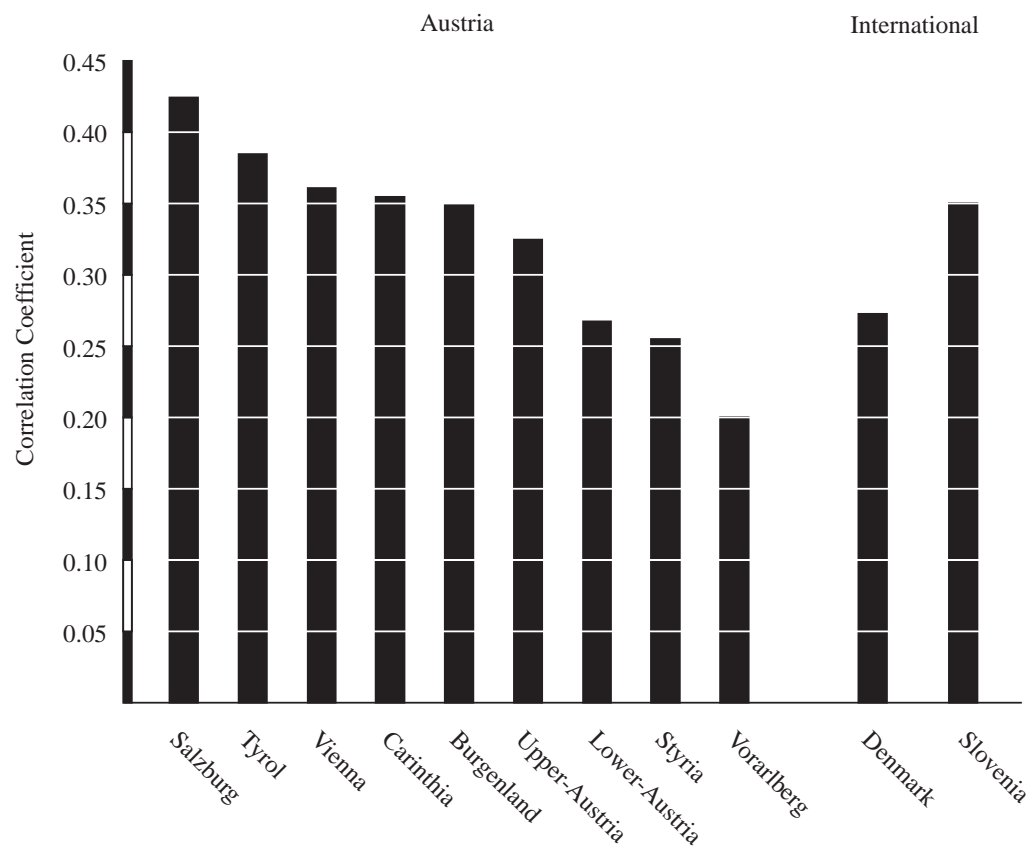
From Diagram 7, three strikingly different patterns emerge.

- First, a strong link between the overall state of health and the new measure for socio-economic risks.

- Second, significantly stronger links between ailments and the new indicator for socio-economic risks and inequalities.
- Third, highly significant linkages between mental states like depression, feelings of weaknesses and the new risk and inequality indicator.

Consequently, these three new patterns have not become part of the conventional wisdom when studying the impact and the effects of socio-economic living conditions on the status of health, ailments and mental disorders. Moreover, Diagram 8 makes it abundantly clear that these patterns can be found in different social surveys with strikingly similar numerical values.

Diagram 8: The New Linkages between Socio-Economic Living Conditions and the General State of Health in Denmark, Slovenia and within Austria

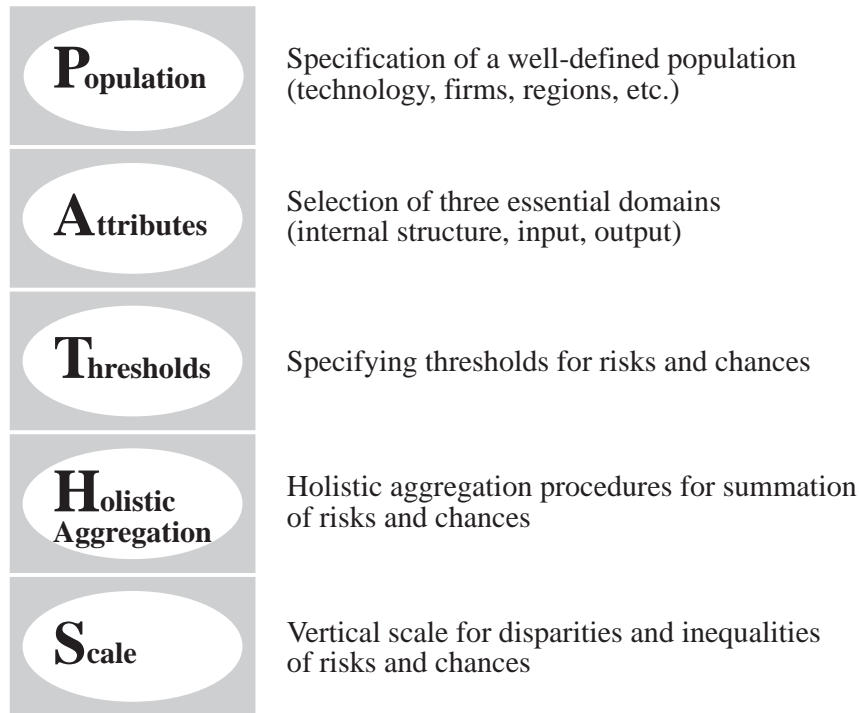


2.2 Constructing a New Tool for Socio-Economic Risk Analysis

In essence, five analytical steps must be performed in order to transform a given data set from a social survey into the new risk and inequality indicators. Moreover, this new path

towards socio-economic risk analysis and inequality can be presented in a highly systematic and operational manner, as exhibited by Diagram 9.

Diagram 9: Five Steps towards a New Scale for Social Inequality or Disparity

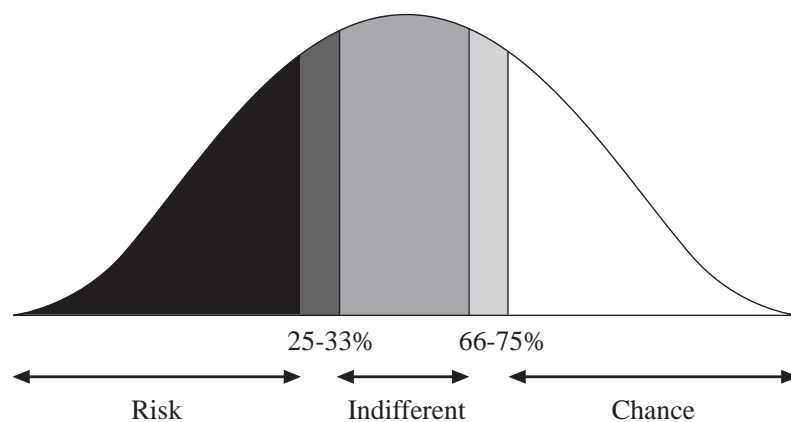


The first step, according to the “PATHS-Diagram” above, lies in the specification of a well-defined population which is usually given by representative surveys on living conditions and attitudes. The second step is essential for the data transformation since it requires the specification of broad domains of living conditions as well as essential features which characterize internal resources or the cognitive-emotional structure of individuals. In its most general way, a large number of socio-economic indicators have to be selected which characterize essentially a “micro-environment” of individuals or households. Essentially means, that broad domains like living conditions, working conditions, civil settings, resources as well as internal attitudes or coping strategies have to be included. It is important that within step 2 a comprehensive multi-dimensional array must be constructed which captures vital aspects of individuals, their living standards and their day to day routines.

In step three, the “essential threshold-step” according to Diagram 9, the overall distribution for each of the indicators is used to define a lower threshold value, defined as “socio-economic risk” and an upper threshold, defined as “socio-economic (life) chance”. Given an indicator like “personal income”, the lowest quarter up to the lowest third of the distribution should be qualified as a position of “socio-economic risk”, the domain from 25 – 75% as

“indifference position” and the upper quarter as a position of “socio-economic chance”. Likewise, the indicators for education, housing conditions, working conditions, on the civil environment (e.g., social networks) on coping abilities or on life-satisfaction can be transformed into a distribution dependent risk/indifference/chance position as well, specifying the thresholds for risks and chances distribution-dependent within the range of 25 to 33%, as depicted in Diagram 10.

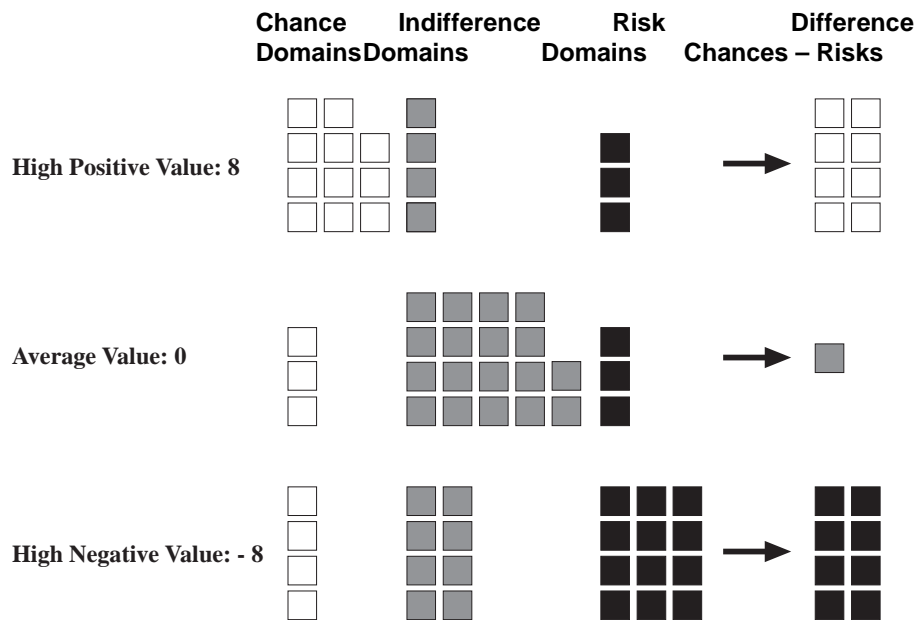
Diagram 10: Specification for Socio-economic Risks and Chances



The fourth step in the “PATHS-specification” assumes, then, a new aggregation procedure which simply sums up the overall number of risk positions and chance positions for a given individual. Diagram 11 shows three examples how the risk/indifference/chance positions of three different individuals can be transformed into a single value on a vertical scale. Thus, Diagram 11 exhibits the hypothetical case of three individuals who on the basis of the previous specification steps occupy very different positions along the new vertical scale. The first individual enjoys a relatively high position (+8), due to a large amount of chance-positions, whereas the third individual exhibits a cumulation of socio-economic risk positions and obtains, thus, a high negative value (-8). In this manner, each respondent in a survey can be assigned a single value, depending on the differences between positions of socio-economic chances and socio-economic risks.

More generally, the aggregation procedure leads to a new overall socio-economic risk measure which, despite the integration of multiple dimensions for living conditions, can be interpreted in terms of inequalities, too. Thus, for a total number of N indicators, the new scale of socio-economic risk and inequality ranges from $-N$ to $+N$. $-N$ is reserved for individuals with a maximum number of socio-economic risk positions (maximum degree of socio-economic risks/inequality) and $+N$ is occupied by those individuals with life chances across all indicators (maximum degree of socio-economic life-chances)

Diagram 11: A New Aggregation Procedure



Formally, the new research design starts from a large number of socio-economic living conditions and attitudes, transforms each value into a risk/indifference/chance value (-1, 0, +1) and calculates the differences between the sums of socio-economic risks and socio-economic life chances. At the end, a single value for each individual or household has been obtained which lies within the range of $-N$ up to $+N$ and which can be interpreted as a measure of socio-economic risk accumulation or, alternatively, as vertical inequality. When applying the new measure to existing health data, all the new and surprisingly powerful patterns could be generated which have been summarized in Diagram 6, 7 and 8. Thus, with the new tool on multi-dimensional data integration of individual living conditions, valuable new insights can be gained on the dimension of social inequality, social exclusion and, finally, of socio-economic disparities within a country.

2.2 Main Research Objectives for Socio-Economic Risk Analysis

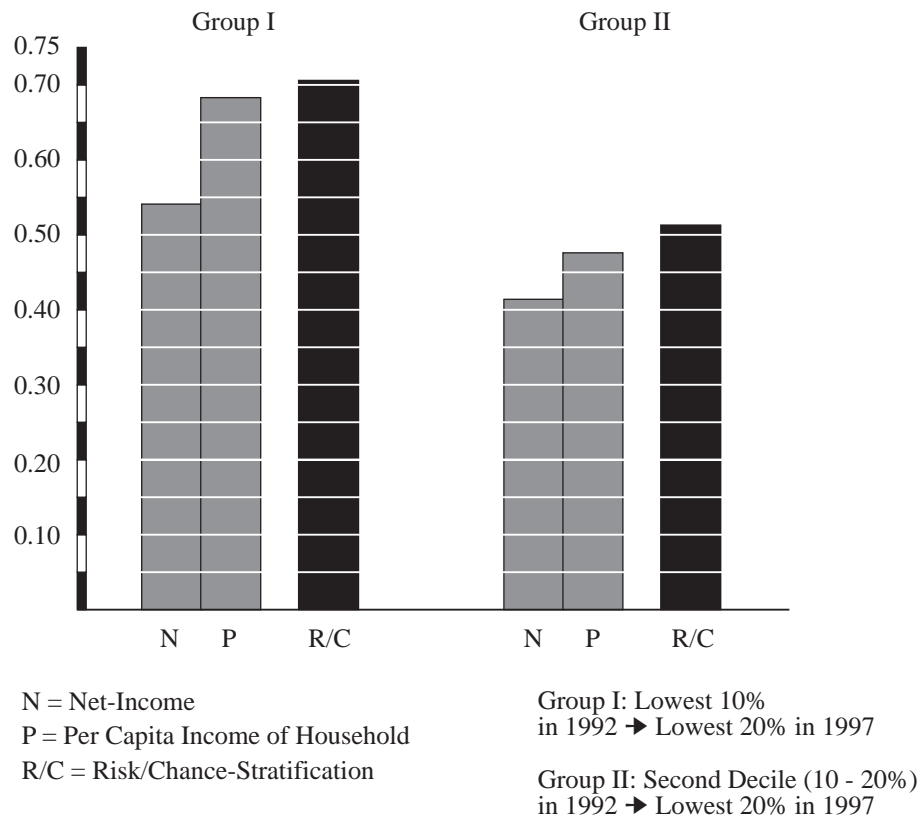
The paradigmatic examples for socio-economic risk analysis are focused on two crucial issues which, so far, are not particularly well understood, despite being constantly analyzed.

- First, socio-economic risk-analysis can address the problem of health and socio-economic risks across Europe in a most comprehensive manner. In particular, the analysis will be focused on two related issues. On the one hand, can the significant linkages between socio-economic risks and health, broadly defined, which have been identified for four countries be extended to a much broader range of countries?

In particular, can one use the new tool for socio-economic risk analysis for the group of the ten CEEC-candidate countries, too? In other words, are these newly detected patterns between socio-economic risks and health stable across Europe?

- Second, another essential focus for socio-economic risk-analysis lies in extending the domain of applications to panel-data as well and to demonstrate the relative stability in time for populations, situated in configurations of multiple risks. Thus, the focus of analysis is able to move from survey data to panel data and to show for a variety of EU-countries that configurations of multiple risks across Europe are relatively difficult to overcome. As can be seen from Diagram 12, socio-economic risk analysis offers strong hints that, based on data from the German Socio-Economic Panel, situations of multiple risks exhibit an even higher degree of stability than personal income or household income over time and are to be qualified, thus, as relatively stable structural positions.³

Diagram 12: The Stability of Socio-Economic Risk Positions in Relation to Personal Income and Per Capita Household-Income



³ This result is highly counter-intuitive because all underlying indicators, used for the socio-economic risk scale, have very low degrees of retention rates only.

In this manner, two new tools for comparative analysis have been developed which could become an important element for a comprehensive monitoring of the ongoing processes of European Enlargement and, more generally, for the global development dynamics both at the micro and at the macro-levels

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