



## **CONFERENCE "DEALING WITH COMPLEXITY IN SOCIETY: FROM PLURALITY OF DATA TO SYNTHETIC INDICATORS"**

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### **ABSTRACT**

## **Quantile Composite-based Path Modeling for measuring equitable and sustainable well-being**

### **Cristina Davino**

University of Macerata - Department of Political Sciences, Communications and  
International Relations  
Piazza Strambi 1  
62100, Macerata (Italy)  
email: [cristina.davino@unimc.it](mailto:cristina.davino@unimc.it)  
Phone + 3907332582560

### **Pasquale Dolce**

University of Naples Federico II – Department of Economics and Statistics  
Via Cintia Complesso Monte S. Angelo  
80126, Napoli (Italy)  
email: [pasquale.dolce@unina.it](mailto:pasquale.dolce@unina.it)

### **Vincenzo Esposito Vinzi**

ESSEC Business School – Department of Information Systems, Decision Sciences and  
Statistics  
Avenue Bernard Hirsch  
95021, Cergy-Pontoise (France)  
email: [vinzi@essec.edu](mailto:vinzi@essec.edu)

### **Stefania Taralli**

Istat - DIQR/DCSR-ERM, Sede per le Marche  
Via Castelfidardo, 4  
60121, Ancona (Italy)  
email: [taralli@istat.it](mailto:taralli@istat.it)

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**Background:** Analysing both performance and societal progress becomes the key for a better understanding of our society and its evolution, strongly contributing to designing new long-term solutions for an economic stability. These goals can be achieved identifying new and more complex synthetic measures capable to assess performances of countries from various points of view (social, economic, financial, etc.). The requirement for developing well-being measures alternative to the classical GDP actually date back to the nineties when researches related to the measurement of sustainable and human development of countries started to play a relevant role in the political and social debate (e.g. the Human development index proposed by the United Nations among others). In 2008, former French President Nicolas Sarkozy created a Commission on the measurement of economic performance and social progress ([www.stiglitz-sen-fitoussi.fr](http://www.stiglitz-sen-fitoussi.fr)). The Commission emphasized how the society complexity makes the measurement of economic performance more difficult than in the past and that average measures are meaningless statistics in this field because they do not tell the whole story about living standards.

The paper refers to the Italian project to measure equitable and sustainable well-being, called BES ([www.misuredelbenessere.it](http://www.misuredelbenessere.it)). The analysis will focus on the set of indicators that have been selected and implemented by the “Provinces’ BES” project. The Italian study has been proposed by the National Institute of Statistics (Istat) in Italy and the National Council for Economy and Labour (Cnel) and it represents a relevant contribution to the international debate on “Gdp and beyond”. The project, called (BES) (Benessere Equo e Sostenibile - equitable and sustainable well-being) is based on the identification, at national and regional level, of a set of indicators related to 12 dimensions considered relevant to measure the BES. The “Province’s BES” is a pilot project promoted and managed by Istat in partnership with the national network of the Provinces’ Statistical Offices (Cuspi) to assess social well-being at local level according to the BES’ framework and basic concepts. It is well known that when the object of analysis cannot be directly observed and measured, a good collection of indicators is not sufficient to realise spatial and temporal performance comparisons. In this framework, synthesizing individual indicators into a single index, namely a composite indicator (CI), becomes an important challenge.

**Objectives:** Traditional approaches to the CIs’ construction focus on the average effect played by single indicators on the final CI (OECD, 2008), for all the units together (e.g. countries, consumers, etc.) and in an undifferentiated way for each component. Moreover, they fail to consider effects (in sign and strength of the relationships) of the extreme parts of the CI distribution.

The aim of the paper is to propose the use of an innovative multivariate method (Quantile Composite-based Path Modeling) to construct the BES index taking into account that the original indicators could play a different role if referred to units (Italian provinces in the proposed study) with high or low performances.

**Methods:** The main methods involved into the project are: PLS path modeling (PLSPM) and quantile regression (QR).

PLSPM (Wold, 1985) (Esposito et al., 2010) represents an important breakthrough with respect to traditional aggregation methods (such as a principal component analysis or a simple average of the original indicators) because it allows constructing complex CIs structured in several dimensions and sub-dimensions. The method is able to identify the role of each component but it is in essence based on the use of linear combinations of the indicators and of a unique system of weights that takes into account the network of relationships between the different components.

QR, as introduced by Koenker and Basset in 1978, may be considered as an extension of classical least squares estimation of conditional mean models to the estimation of a set of conditional quantiles of a response variable as a function of a set of covariates (Davino et al. 2013).

Quantile Composite-based Path Modeling (QC-PM) has been recently introduced (Davino and Esposito Vinzi, 2014, 2015) as a complementary approach to PLSPM. It aims to highlight if and how the relationships among observed and unobserved variables change according to the explored quantile of interest, thus providing an exploration of the whole dependence structure. In QC-PM all the estimation steps of a PLSPM algorithm may be carried out using a quantile approach and hence, for each quantile of interest, the method provides a set of model parameters.

**Results:** A QC-PM estimated on the BES dataset is able to: i) synthesize different partial performances (synthetic indexes for each dimension) into overall performances (the final BES index); ii) allow loadings of indicators on both partial and overall performances to vary according to different levels of the CIs; iii) allow impacts between CIs also to vary in accordance with the different levels of the CIs. For instance, subjective well-being and its related indicators may result playing a different role on provinces with high or low equitable and sustainable well-being. Such information could help decision makers to differentiating leverages in order to improve living conditions in the various provinces.

**Conclusions:** A quantile approach to PLSPM is proposed to highlight differences in the impact played by the indicators and dimensions of the BES index according to different degrees of equitable and sustainable well-being. The method is able to explore the whole distribution of the composite indicators referred to each dimension and to the BES index as a whole, thus going beyond the classical investigation of the average effects.

## **Main references**

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