

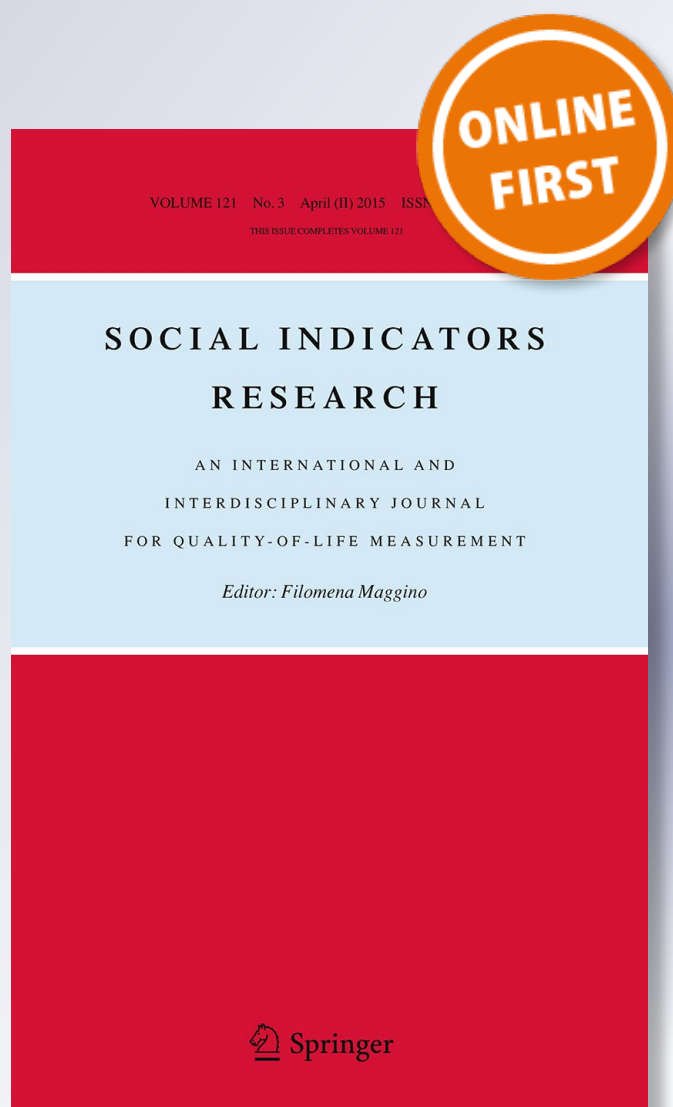
Socio-Economic Indicators for Performance Evaluation and Quality Assessment: Statistical Methods and Applications

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Socio-Economic Indicators for Performance Evaluation and Quality Assessment: Statistical Methods and Applications

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1 The Topic

This Special Issue has drawn inspiration from the Conference “Innovation & Society 2017—Statistical Methods for Evaluation and Quality” (IES2017), held at the University of Naples “Federico II” (Italy) September 6–7, 2017. The IES2017 Conference was the 8th Scientific Meeting of the “Statistics for the Evaluation and Quality of Services Group of the Italian Statistical Society—(SVQS)”. It has been organized to offer an overview of statistical approaches and methodologies on evaluation of services and to contribute to the discussion on services’ innovation evaluation, focusing on various of economic and social policies actors. To make it as useful and constructive as possible, the Conference IES2017 was open to the participation of scholars from several disciplines, experts, development policies managers dealing with the relationships among evaluation, innovation and society.

The 23 articles of this Special Issue, selected after double-blind peer reviews, concern studies with applications in different fields and with many different statistical approaches sharing the common aim stated by the Conference IES2017. From the empirical point of view, the articles can be classified in three macro-fields: Education (Centoni et al., De Iaco et al., Di Palma and Gallo, Tan et al., Mariani et al., Masserini et al., Maturo et al., Sarra et al., Vanacore and Pellegrino.); Economics (Antolini and Simonetti, Arbolino et al., Cerqueti et al., Ciavolino et al., Crisci et al., Petrella et al., Simonacci and Gallo) and Services

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(D'Ambra et al., De Simone et al., Di Palma and Gallo, Lombardo et al., Montanari and Doretti, Nissi et al., Oliveri et al.). On the other hand, considering the statistical methods used by the authors, three methodological approaches can be identified: Latent Variable Models (Centone et al., Tan et al., Maturò et al., Masserini et al., Palma et al., Ciavolino et al., Montanari and Doretti); Regression Models (Arbolino et al., Crisci et al., De Iaco et al., De Simone et al., Nissi et al., Petrella et al., Sarra et al.) and Data Analysis Models (Antolini and Simonetti, Cerqueti et al., D'Ambra et al., Di Palma and Gallo, Lombardo et al., Mariani et al., Oliveri et al., Simonacci and Gallo, Vanacore and Pellegrino). The heterogeneity of application and statistical approaches highlights the broad spectrum of data analyses and the richness of the methodologies.

2 Summary of Papers in the Special Issue

For convenience of presentation, the Special Issue IES2017 is organized in three parts, useful to orient the reader among the application macro-fields since—as stated before—statistical methods and models adopted are different or overlap in some cases. For this reason, within each part the articles are also roughly ordered with respect to application sub-field and methodological approach used.

2.1 Applications in Education

The nine articles grouped in Part I present applications in the education field, in particular at the university level, to assess students and teachers' performances, students' satisfaction of their experience and preferences for leisure-time activities, job profiles and opportunities. Various statistical approaches to data analysis are adopted: Latent Class Analysis, Structural Equation Modelling, Conjoint Analysis, Functional Analysis, Bayesian and Multilevel Logistic Regression.

In their article, *Centoni* et al. use administrative data on undergraduate students to improve the general understanding of their performance, linking it with personal student's characteristics and with degree-specific aspects; a beta inflated Latent Class Modelling (LCM) approach is employed to identify clusters of performance establishing a link with all available explanatory variables. In spite of the contention surrounding students' rating on instructors, the study of *Maturò* et al. applies the Functional Analysis of Variance (FANOVA) approach and some novel functional tools in the Item Response Theory (IRT) context. They start from the consideration that to analyze educational test, data practitioners are interested in understanding if some factors have a significant influence on the probability of correctly answering items. In their article *Sarra* et al. suggest that Educational Data Mining (EDM) enables to get insights on various higher education phenomena (academic paths, learning behaviours and dropout); they evaluate a particular latent class model, the Bayesian Profile Regression to identify students who are more likely to drop out. They use real data collected through an online questionnaire filled in by undergraduate students of an Italian University. *Tan* et al. aim at investigating how university students in Malaysia would evaluate instructors based on non-instructional factors, such as physical attractiveness and psychological factors, which in turn may affect students' perceptions towards instructors' performance. In this study, the Partial Least Squares—Structural Equation Model (PLS-SEM) approach was used to perform the path modeling analysis. *Vanacore and Pellegrino* focus on the direct assessment of the reliability of the student's

evaluation as a measurement instrument of teaching quality. An agreement-based approach is used to assess student's ability to provide consistent and stable evaluations, and the sampling uncertainty is taken under control by using non-parametric bootstrap confidence intervals for the adopted agreement coefficients. In their article *Masserini et al.* investigate whether the quality of educational services and the university's institutional image influence students' overall satisfaction with their university experience, as well as the possible consequences of these relationships on students' loyalty; a system of relationships among these constructs was formulated and tested through a Structural Equation Model (SEM) with data collected through a web questionnaire handed out to about 15,000 students enrolled in an Italian University. *Di Palma and Gallo* study preferences of leisure-time activities of a sample of high school students of a Southern Italian Region as expression of a subjective perception of time and as a result of external constraints on choices. A methodology that combines regression and multivariate analysis reformulated in a compositional framework has been adopted. To reinforce the relationship between the academic world and business, using a CAWI survey *Mariani et al.* asked to a sample of companies in Lombardia to indicate their preferences among hypothetical profiles of new graduates with different competencies. A conjoint analysis was used to identify the features of a graduate's profile that employers prefer for a potential candidate for the position of a customer relationship management assistant. The aim of the study of *De Iaco et al.* concerns in modeling the probability of working for university graduates three years after degree, taking into account the effectiveness and coherence of a degree with respect to the labour market. Using the ISTAT Italian survey data, a Multilevel Binary Logit Model is run to measure the probability of working, and a Multilevel Multinomial Model suitable to predict the probability of the possible job status is further adopted.

2.2 Applications in Economics

The 7 articles grouped in Part II present applications in the economic field, in particular to the economic systemic risk, the socio-economic nature of migration flows, the spending to improve efficiency and innovation, the perception of happiness and of economic conditions. Even in these studies, different statistical measures and approaches are adopted: from CoVaR to CUB, and from Multilevel Regression to Generalized Estimating Equation.

Petrella et al. analyze the contribution of major companies in the European stock market to systemic risk on a geographical basis; using the EuroStoxx 50 Index as a proxy for the financial system, they rely on the CoVaR and Delta-CoVaR risk measures. In their paper, *Cerqueti et al.* provide a unified view to define a measure of the reasons behind economic and social migration flows. Migration flows are here presented in the context of complex network and a socio-economic indicator is defined. *Simonacci and Gallo* model the Italian public social spending with a log-ratio methodology. This allows to study relative variation patterns among sectors; since data are collected across time, a three-way compositional approach is recommended, so that the variability of each model is kept separate. *Arbolino et al.* evaluate the role of the local administrations on Italian regional innovation performance, by using a revised version of Regional Innovation Scoreboard. In their study the authors carry out a panel data analysis and use Multilevel Logistic Regression that captures which investment is more likely to affect innovation performances within Italian Regions. *Crisci et al.* focus on what characterizes most football clubs and determines their specific economic and financial needs, with the aim to establish an efficiency measurement for football team financial resource

allocation. They use a Generalized Estimating Equation (GEE) for longitudinal count data. *Antolini and Simonetti* consider the Esterlin Paradox which is the starting point of studies on the relationship between happiness and GDP and states that after reaching a certain level of income, happiness decreases instead of increasing. They propose a definition of happiness and an appropriate methodology to analyze if people can be happy in the economic system. *Ciavolino et al.* study the influence of the economic forecast news on a latent variable named "Citizens' perception of the European economic health state"; the authors combine MIMIC (Multiple Indicators Multiple Causes) and CUB (Combination of Uniform and shifted Binomial) Models with the Partial Least Squares (PLS) approach to analyze the Eurobarometer data from year 2005 to 2014.

2.3 Applications in Services

The 7 articles grouped in Part III present applications in the services field, in particular health care, tourism, transport and justice. In these studies, various statistical models are used: Latent Markov, SEM, Panel Data, Correspondence Analyses and Data Envelopment Analysis (DEA).

Montanari and Doretto propose a performance indicator to rank a set of nursing homes based on their ability in maintaining their residents' physical conditions as good as possible. Latent Markov Models with covariates and normally distributed continuous random effects are fitted to a dataset which was gathered from a health protocol implemented in Umbria (Italy) to produce standardized six-month ahead transition matrices, upon which the aforementioned index is based. *Palma et al.* investigate the patients' perception of the health system quality and explore the relationships between doctors and long-term cancer patients. Two Structural Equation Models are proposed, the first one describes the service quality as perceived by the patients, the second describes the relationship between doctors and long-term cancer patients. The study of *De Simone et al.* analyzes the impact of Unesco World Heritage List (WHL) sites on international tourist arrivals; using dynamic panel data techniques on a sample of Italian provinces over the period 1997–2015, the authors found positive effect of WHL inscriptions on foreign visitors' attractiveness. *Oliveri et al.* consider tourist satisfaction and dissatisfaction as two distinct constructs and propose a practical methodology (4Q) for their measurement; using the Multiple Correspondence Analysis (MCA) two distinct composite indicators relating to tourist satisfaction and dissatisfaction are proposed for comparing the performance of tourist destinations over space and time, and addressing marketing strategies regarding different tourist segments. *D'Ambra et al.* define nine possible scenarios for a public train transport, by means of design of experiments, to select the scenario that maximizes the satisfaction of potential users, using a Cumulative Correspondence Analysis (CCA) and the Logistic Regression Model. *Lombardo et al.* provide a composite indicator for comparing the perceived satisfaction of public transport, using a sample of residents of a southern Italian city across three time between the years 2008 and 2012. They found that passenger's satisfaction has been identified in terms of the various quality aspects of public transport services, using features of the Ordered Multiple Correspondence Analysis (OMCA). *Nissi et al.* examine the Italian judicial efficiency and check any territorial differences, evaluating the performance of the 140 Ordinary Courts; the authors used a two stage DEA Model, and explore determinant of efficiency/inefficiency using Fractional Regression Model (FRM).

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