

ROBUSTNESS ASSESSMENT FOR COMPOSITE INDICATORS WITH R

Luis Huergo¹, Ralf Münnich², Michaela Saisana³

¹*University of Tübingen, Germany, luis.huergo@uni-tuebingen.de*

²*University of Trier, Germany, ralf.muennich@uni-tuebingen.de*

³*Joint Research Centre of the European Commission, Italy, michaela.saisana@jrc.it*

February 27, 2006

Composite indicators of countries performance are regularly used in benchmarking exercises or as policy-relevant interdisciplinary information tools in various fields such as economy, health, education or environment. They are calculated as weighted combinations of selected indicators via underlying models of the relevant policy domains. Yet, composite indicators can equally often stir controversies about the unavoidable subjectivity that is inherent in their construction. To this end, it is important that their sensitivity to the methodological assumptions be adequately tested to ensure that their methodology is sound and not susceptible to bias or significant sensitivity arising from data treatment, data quality [1,2], aggregation, or weighting [3,4].

In this presentation we use a combination of uncertainty and sensitivity analysis, coded in R programming language, to study how variations in the country scores derive from different sources of variation in the assumptions entailed in a composite indicator measuring the Knowledge Economy in the European Union. We focus on four major sources of uncertainty: (i) variation in the indicators' values due to imputation of missing data [5, 6], (ii) selection of weights, (iii) aggregation method (linear or geometric), and (iv) exclusion of one indicator at-a-time. The "UASA package" for the R statistical environment implements global variance-based sensitivity analysis for non-correlated input.

The aim of the analysis is to help gauge the robustness of the composite indicator scores, to increase the transparency in the development of the composite indicator, to identify the countries that improve or decline under certain methodological assumptions, and to help frame the debate around the use of such Index.

The discussion of the results is extended to re-assess the usefulness of combined sensitivity and uncertainty analysis to make quality judgments of composite indicators and how it can be formalized into a broader quality framework for knowledge performance measures and control policies.

The work is part of the project KEI (Knowledge Economy Indicators; cf. <http://kei.publicstatistics.net>) which is financially supported by the European Commission within the 6th Framework Programme under policy orientated research.

More information on composite indicators can be found at: <http://farmweb.jrc.cec.eu.int/ci>

References

- [1] Davison, A. C., Münnich, R., Skinner, C. J., Knottnerus, P. und Ollila, P. (2004): The DACSEIS Recommended Practice Manual. DACSEIS deliverable D12.3, <http://www.dacseis.de>.
- [2] Magg, K., Münnich, R., Wiegert, R., Åkerblom, M., Schmidt, K. (2006): Quality Concepts – State-of-the-Art. KEI deliverable 3.1. To appear.
- [3] Saisana M., Saltelli A, Tarantola S. (2005): Uncertainty and sensitivity analysis techniques as tools for the quality assessment of composite indicators, *Journal of the Royal Statistical Society A*, 168(2), 307-323.
- [4] Saltelli A, Tarantola S., Campolongo, F. and Ratto, M.(2004): *Sensitivity Analysis in Practice. A Guide to Assessing Scientific Models*, John Wiley & Sons publishers.
- [5] Laaksonen, S., Rässler, S., Skinner, C., Oetliker, U. und Renfer, J.-P. (2004): Imputation and Non-response. DACSEIS deliverable D11.2, <http://www.dacseis.de>.
- [6] Rubin, D.; Little, R. (2002): *Statistical Analysis with Missing Data*, Wiley & Sons.