Compind: a Composite indicators functions based on frontiers in R

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Background: The applicative difficulties in applying composite indicators methods derived from the production frontier analysis (for example the BoD method) have often discouraged the adoption of such methods, while having more desirable properties compared to simpler ones.

Objectives: Compind package make comparable and easily calculable composite indicators developed with a plurality of methods and supports researcher into robustness analysis through repeated simulations on subsamples of units or variables.

Methods: Compind R package contains a plurality of methods, trying to bypass this issue; in particular BoD-family available methods are:

- `ci_bod`: Benefit of the Doubt approach (BoD) is the application of Data Envelopment Analysis (DEA) to the field of composite indicators. It was originally proposed by Melyn and Moesen (1991) to evaluate macroeconomic performance.
• **ci_bod_dir:** Directional Benefit of the Doubt (D-BoD) model enhance non-compensatory property by introducing directional penalties in a standard BoD model in order to consider the preference structure among simple indicators.

• **ci_bod_var_w:** Variance weighted Benefit of the Doubt approach (BoD variance weighted) is a particular form of BoD method with additional information in the optimization problem. In particular it has been added weight constraints (in form of an Assurance region type I (AR I)) endogenously determined in order to take into account the ratio of the vertical variability of each simple indicator relative to one another.

• **ci_rbod** Robust Benefit of the Doubt approach (RBoD); Robust Benefit of the Doubt approach (RBoD) is the robust version of the BoD method. It is based on the concept of the expected minimum input function of order-m so "in place of looking for the lower boundary of the support of F, as was typically the case for the full-frontier (DEA or FDH), the order-m efficiency score can be viewed as the expectation of the maximal score, when compared to m units randomly drawn from the population of units presenting a greater level of simple indicators", Daraio and Simar (2005).

• **ci_rbod_dir** Directional Robust Benefit of the Doubt approach (D-RBoD); Directional Robust Benefit of the Doubt approach (D-RBoD) is the directional robust version of the BoD method.

*Compind* package can also support methods not based on frontier approach as:

• **ci_factor:** Factor analysis groups together collinear simple indicators to estimate a composite indicator that captures as much as possible of the information common to individual indicators.

• **ci_mean_geom:** Weighting method based on geometric aggregation; Geometric aggregation lets to bypass the full compensability hypothesis using geometric mean

• **ci_mpi** Mazziotta-Pareto Index (MPI) method; Mazziotta-Pareto Index (MPI) is a non-linear composite index method which transforms a set of individual indicators in standardized variables and summarizes them using an arithmetic mean adjusted by a "penalty" coefficient related to the variability of each unit (method of the coefficient of variation penalty).

• **ci_wroclaw** Wroclaw Taxonomic Method; Wroclaw taxonomy method (also known as the dendric method), originally developed at the University of Wroclaw, is based on the distance from a theoretical unit characterized by the best performance for all indicators considered; the composite indicator is therefore based on the sum of euclidean distances from the ideal unit and normalized by a measure of variability of these distance (mean + 2*std).

**Results and Conclusion:** *Compind* R package contains functions to enhance several approaches to the Composite Indicators (CIs) methods, focusing, in particular, on the normalisation (thanks to the normalisation and polarity function *normalise_ci*) and weighting-aggregation steps. Freely available at [http://cran.r-project.org/web/packages/Compind/index.html](http://cran.r-project.org/web/packages/Compind/index.html) it allows to build, in a very simple and consistent framework, synthetic indicators according to a plurality of methods based on frontier approach for continuous simple indicators.
Main references


