A new methodology for evaluating units through composite indices: The $\sigma - \mu$ efficiency

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Extended abstract

Performance measurement through the use of composite indicators has met with a huge popularity in recent years ([5]). According to [2], departing from the current practice of aggregating different dimensions via a composite index (usually based on an arithmetic mean), is feasible through the use of Stochastic Multiattribute Acceptability Analysis (SMAA) [4]. SMAA considers the "whole space" of weights for the considered dimensions, so that instead of one well-defined single ranking, a probability that a unit attains a given ranking position, or a probability that a unit is preferred to another one are considered. In this contribution, in the space of weight vectors, we consider the overall performance distribution for every unit, focusing on its mean value μ and its standard deviation σ. The mean value is clearly supposed to be maximised, while the standard deviation is supposed to be minimised, because the greater it is, the more unstable and volatile is the overall performance measured by the composite index. Thus we define a unit as "$\sigma - \mu$ efficient" if there is no other unit with a greater mean value and a smaller standard deviation, with one of the two inequalities being strict. In

this perspective, in order to determine a robust ranking for the units evaluated, as inspired by the use of Data Envelopment Analysis [1], the relative distance from the efficient mean value-standard deviation frontier is considered. To test the reliability of the proposed methodology, it is benchmarked against already well-established approaches in the literature. More specifically, for an illustrative example, we use the dataset from the 2017 World Happiness Report [3]. According to the report, an effort is made to explain the overall happiness according to 6 variables that capture 6 socio-economic dimensions respectively. We use these to construct a composite index with the proposed methodology along with other well-established approaches in the literature. Results exhibit that first, the ranking based on the proposed methodology is very consistent, and second, it can explain the variation in the overall happiness sufficiently.

Keywords
Composite index; Stochastic Multiattribute Acceptability Analysis; $\sigma - \mu$ efficiency; Data Envelopment Analysis

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