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Weighting Schemes

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Synonyms

Composite index construction; Subjective weighting

Definition

Weighting schemes are systems of weights applied to social indicators or measures of subjective well-being used in the construction of composite indices of domains of well-being and overall well-being/quality of life (WB/QOL). Usually, the weights refer to individuals' subjective weighting of various domains or aspects of life or to some transformation thereof.

Description

Two major approaches to the conceptualization of alternative weighting schemes are (1) the weighted average model of subjective judgments (Hagerty & Land, 2007) and (2) the weighted product model (Munda & Nardo, 2003; see also Nardo et al., 2005).

Defining individual i's importance weight (preference, judgment) for domain k as w_{ik} and overall well-being/quality of life (WB/QOL) judgment as Q_i, an algebraic representation of *weighted average model (WAM)* to predict i's WB/QOL judgments is

$$Q_i = \Sigma_k w_{ik} x_k,\quad w_{ik} > 0,$$

where w_{ik} is individual i's the weight for the kth domain and the summation is over the total number of domains used to make judgments of WB/QOL (Hagerty & Land, 2007).

Using similar notation, the *weighted product model (WPM)* can be written as

$$Q_i = \Pi_k\left[(x_k)^{w}{}_{ik}\right], w_{ik} > 0,$$

where the product is taken over the total number of domains. Note that the weighted average model can be viewed as a logarithmic transformation of the weighted product model.

Zhou, Ang, and Zhou (2010) developed a multiplicative optimization extension of the WPM by application of Data Envelopment Analysis (DEA)-type methods to determine the values of weights of individual indicators in a composite index such as the life expectancy at birth, education (a normalized index of mean years of schooling of adults aged 25 and expected years of schooling for children of school going age), and Gross National Income per capita indicators used to calculate the Human Development

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Index. The DEA method originally was developed for efficiency analysis in economics and management science (Charnes, Cooper, Lewin, & Seiford, 1994; Charnes, Cooper, & Rhodes, 1978; Land, Lovell, & Thore, 1993). It transforms a multiplicative optimization problem into a series of linear programming problems (Danzig, 1963) in which weights for composite scores are determined by internal comparisons of each of a set of entities with each other with respect to their efficiency in producing outputs (e.g., consumer products) from given levels of inputs (e.g., labor, capital).

Zhou et al. (2010) applied DEA to calculate two sets of weights for the component indicators of a composite QOL index – a set of "best" weights for each entity calculated in comparison to the "best practice" entity or entities on each specific indicator and a set of "worst" weights calculated in comparison to the "worst practice" entity or entities on each specific indicator. They then calculated composite index scores for each entity being compared as weighted averages of logarithmic transformations of the two sets of weights, and, in the absence of a preference for one set of weights or the other, suggested equal weighting as a fairly neutral choice. Zhou et al. suggested that this extension of the WPM can provide an alternative to subjectively determined weights for composite indices. In an empirical application, Zhou et al. showed that the ranks of most of 27 countries in the Asia and Pacific region given by the conventional Human Development Index remain unchanged when they are ranked by composite indices based on the multiplicative optimization method.

Cross-References

► Composite Index Construction
► Human Development Index
► Subjective Weighting

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