

## A Cautionary Tale: Consistency in the Construction of Decision-making Indices with Endogenous Weights

**Presenter: Fernando Rios-Avila, Levy Institute**

Data reduction methodologies, latent variable analysis, and item response theory, to name a few, are methodologies typically used for the identification and constructions of indices, summarizing the information of a large set of variables researchers believe are related to a particular topic. From a theoretical point of view, these strategies allow for the construction of composite indices that may capture a single concept, which is measured using different dimensions (variables). While these methodologies vary in terms of design, they all share a similar feature. The composite index is constructed as a kind of weighted sum of some monotonic transformation of the variables researchers wish to consider to identify the concept of interest:

$$I(v_1, v_2, \dots, v_N) = \sum_{k=1}^N w_k f(v_k)$$

where  $f(\cdot)$  could be the identity function and weights ( $w_k$ ) are selected such that a particular maximization criterion is achieved. These procedures typically assign more weights to variables with higher joint correlation and less weight to variables that appear to be uncorrelated or linearly independent of other variables in the study. In other words, these procedures use the data structure itself to determine the endogenous weights, as opposed to expert opinion or normative judgments to exogenously determine those weights.

Perhaps one of the most common examples for this kind of analysis is the application of principal component analysis for the construction of multidimensional poverty measures and wealth indices. Some of the literature (Pasha 2017; Najera Catalan and Gordon 2019; Hesmati et al. 2008) argues that constructing indices using this type of methodology may be superior to the alternative exogenous weight strategies because it takes into account all available information (cross variable correlations) to determine “optimal” weights.

Dutta, Nogales, and Yalonetzky (2021) discuss the use of endogenous weights for the construction of multidimensional poverty indices in great detail. They argue that using endogenous weights may produce indices that violate monotonicity and subgroup consistency, because the endogenous nature of the weights could change individual poverty status just because the internal correlation structure changed, not because an individual’s poverty status changed. While they favor the use of exogenous weights, they acknowledge the limitations of the subjectivity of using exogenous weights.

In the framework of our question, the estimation of patriarchal views/bargaining power/empowerment indices using these strategies may be a challenge. When constructing indices for multidimensional poverty and wealth indices the dimensions under consideration usually have a clear relationship with the intended measure of interest. In contrast, when analyzing something as complex as patriarchal views, selecting variables that are capturing dimensions uniquely related to patriarchal views may not be feasible.

As a matter of fact, variables that are usually selected for this kind of analysis tend to be ambiguous with regards to what kind of information they capture. Furthermore, if these variables capture dimensions beyond the intended measure of interest, like patriarchal views, methodologies that rely on endogenous weights may provide indices that are not consistent across methods. This may

happen because each method uses different criteria to define what the optimal weights will be, or because different sets of weights and methodologies are capturing dimensions other than patriarchal views.

In general, while latent variable analysis/data reduction techniques have the potential to identify unobserved factors that are strongly related to specific topics of interest, the consistency and robustness of the constructed indices depend on the quality of the input variables used for the analysis, and their intra-variable correlations. The evidence we have from the case study for Ghana shows that, for the case of patriarchal views, available information may not be used effectively for the estimation of this type of indices. This is suggested by the lack of consistency across indices based on different methodologies.