Chapter 6
Methodological Challenges in Building Composite Indexes: Linking Theory to Practice

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ABSTRACT

Composite indicators are emerging in several fields and disciplines as appealing method to synthesize a multitude of information, in a compact, single, and unique way. The process of aggregating heterogeneous information is itself very challenging and exposed to numerous threats. The chapter deepens on the methodological challenges that scientists, analysts, and final users must be aware of for a correct interpretation of the composite indexes. By mean of a worked example on the construction of composite indicators for food security, the chapter concludes that while different normalization and weighting approaches do not alter composite indicators, data imputation and aggregation methods are the most crucial steps: different methods convey very different results. For instance, the adoption of different aggregation procedures may largely alter the rankings based on composite indicators. In sum, the analysis shows that the index construction decisions matter and comment on policy and practical implications for the construction of composite indicators.

INTRODUCTION

Composite indicators are emerging in several fields and disciplines as appealing method to synthesize a multitude of information, in a compact, single, and unique way (Santeramo et al., 2012; Caracciolo and Santeramo, 2013; Dobrota et al., 2015; Mahadevan and Hoang, 2015; Santeramo, 2015a, 2016; Santeramo and Shabnam, 2015; Alam et al., 2016; Maricic et al., 2016). The process of aggregating heterogeneous information is itself very challenging and exposed to numerous threats. The chapter deepens on the methodological challenges that scientists, analysts, and final users must be aware of for a correct interpretation of the composite indices. The added value of this chapter is it builds on a worked example: the construction of composite indicators for food security. Food security is one of the most debated topic,

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the main theme of the world EXPO 2015, and the first of the Millennium Goals. Needless to say, there has been much debate on food security (Wheeler and von Braun, 2013; Hertel, 2016). Numerous indicators of food security have been proposed aiming at establishing the level of food security at country level. Such a variety of indicators and the lack of consensus on how to evaluate policies (and outcomes) aimed at reducing food insecurity, have pushed international organizations to adopt composite indices to synthesize the information. From a practical point of view, the construction of composite indices consist of several steps: indeed, each choice is able to influence the composite indicator (Nardo et al., 2005a).

The chapter is intended to achieve two goals:

- First, I aim at providing a helicopter view of the process of building composite indicators, from the analyst point of view;
- Second, I provide a practical example of how heterogeneous information are synthesized in a single index and highlight the warnings that should be clear to analysts, policymakers, and audience, when computing, examining or reading results from composite indicators.

The chapter is divided in different sections. The methodological section, which follows the present section, presents the steps required to build a composite indicator; the worked example on Food Security puts the theory into practice; the paragraph is followed by a digression on how policymakers and the large audience should interpret composite indicators; the final section concludes with suggestions for future research.

In particular, the worked example provides insights on the challenges faced by analysts called to measure food security. The debate is hot as attested by the large number of articles published on this issue, and the large number of indicators on food security (Gabbert and Weikard, 2001; Carletto et al., 2013; Aurino, 2014; Cafiero et al. 2014**;**Santeramo, 2015a, 2015b; Svedberg, 2011; Carman et al., 2016; Ames et al., 2016). I provide a practical example by computing several composite indices for food security by using data provided by the Food and Agricultural Organization. I evaluate a set of techniques that are adopted in the construction of composite indicators. In particular I assess the relevance of methods to impute, homogenize, weight and aggregate data in order to compute composite indices are compared and the relevancy of the choices to be made will be discussed. I conclude that while different normalization and weighting approaches do not alter composite indicators, data imputation and aggregation methods are the most crucial steps: different methods convey very different results. In sum, I show that the index construction decisions matter. The last two sections go beyond the methodology and focus on the implications of my findings for practitioners, policymakers, and audience. In particular, I discuss how we should interpret the result of composite indices in order to minimize the impact of discretionary choices.

All in all, the chapter guides the reader to understand how theory and practice match (or not) when we synthesize composite/complex information into single indicators.

BACKGROUND AND METHODOLOGY

The process of building a composite indicator is challenged in many ways and in particular previous assessments of strategic objectives have been incorrectly conducted due the use of "indicators that were not systematically SMART [that is Specific, Measurable, Achievable, Relevant and Time-bound] and were often focusing on outputs and activities" (FAO, 2013). Moreover, composite indicators are inher-