Contents lists available at ScienceDirect

Ecological Indicators

Are the variables used in building composite indicators of well-being relevant? Validating composite indexes of well-being

Adrian Otoiu [a,*], Emilia Titan [b], Remus Dumitrescu [c]

[a] *The Academy of Economic Studies, Department of Statistics and Econometrics, Piata, Romana 6, Sector 1, Bucharest, Romania*
[b] *The Academy of Economic Studies, Department of Statistics and Econometrics, Piata, Romana 6, Sector 1, Bucharest, Romania*
[c] *University of Bucharest, 36-46 Mihail Kogalniceanu Blvd, Sector 5, Bucharest, Romania*

ARTICLE INFO

ABSTRACT

This paper explores the relevance of the variables that define well-being and human progress and makes a quantitative inquiry into the validity of three of the well-known and well-documented composite indicators of well-being: the Human Development Index (HDI), the Legatum Prosperity Index (LPI) and the Happy Planet Index (HPI). After choosing the key variables that describe most of the objective and subjective dimensions of well-being, we perform cluster analysis to come up with an optimal grouping of countries based on their multidimensional performance on well-being. A comparison of the classifications obtained with the three indexes invalidates the HPI, confirms results obtained for the HDI, and validates for the first time the LPI as a reliable measure of well-being. The optimal cluster structure yields robust results, which correct the rank discrepancies between the HDI and LPI for a large number of countries. It also proves that a robust ranking of countries based on multidimensional well-being can be achieved with a relatively small number of variables, which mitigates the risk of including variables that are not reliable and/or not available for a significant number of countries. The fact that cluster analysis generates results based on similarities between observations and not on computed values based on the aggregation of variables helps overcome problems that may occur due to the distribution of variables and increases its value as a validation method. Therefore, validation results achieved through cluster analysis are more robust and help to achieve a good check of the validity and relevance of the composite indexes, provide an objective perspective that can guide policy-makers and the public in making a fair assessment of actual levels of well-being, and avoid unfounded claims that may overstate it and delay or postpone measures to increase it.

1. Introduction

The question of whether it is possible to measure well-being is not new. Well-known economists have noted that GDP and other growth-related measures do not fully capture well-being and human progress. While helping the U.S. Department of Commerce standardize the measure of GNP, Kuznets (1934, pp. 7) observed that "[t]he welfare of a nation can scarcely be inferred from a measurement of national income". Citing Paul Erlich, Nordhaus and Tobin (1973, pp. 1) agreed that "[w]e must acquire a life style which has as its goal maximum freedom and happiness for the individual, not a maximum Gross National Product". Thus, measuring social progress has been to a significant extent the true goal of growth measures, with GDP and other economic growth measures being mostly unidimensional straightforward proxies, that are calculated using an established methodology and that have a relatively narrow but well-defined meaning.

Concerns about global warming and greenhouse gas emissions (GHG) gave a new dimension to the relevance of obtaining a true measure of well-being. Questions of whether there are limits to economic growth based on natural resources arose during the 1970s (Meadows et al., 1972) through an inquiry into the relevance and sustainability of economic growth. The work and the model built by the Club of Rome showed that mankind will only be able to face the trade-offs of a finite earth through joint consideration of present human values and long-term goals aimed at ensuring the well-being of future generations. Thus, the concept of sustainable development arose, with environmental costs related to social and economic growth being quantified and set against classic measures of economic growth.

Recent research has concentrated the efforts to achieve a common framework for obtaining overarching indicators of well-being and social progress. The Beyond GDP (2012) initiative[1] and the Stiglitz–Sen–Fitoussi (SSF) report[2] are two of the most prominent attempts to develop measures of well-being and/or human progress that incorporate several dimensions, such as life expectancy, self-assessed well-being, ecological footprint, and many others.

A key development in measuring well-being and social progress is the inclusion of both subjective and objective indicators. Research has acknowledged that while subjective indicators are important, as they aggregate the evolution of several factors considered important in well-being and social progress at the individual level (Michalos et al., 2011), they cannot account entirely for the measurement of well-being and social progress. Personal circumstances and perceived gaps between the current levels of well-being and happiness and levels achievable or enjoyed by target groups can lead to the overlooking of measurable, objective progress recorded by improvements in living conditions, eradication of poverty or prevention of environmental deterioration (Michalos et al., 2011).

Among the most comprehensive and widely known well-being and human progress indicators are the Human Development Index (HDI), the Happy Planet Index (HPI), and the Legatum Prosperity Index (LPI) (UNDP, 2012a; Abdallah et al., 2012; The Legatum Institute, 2012). The number of countries assessed and the comprehensive range of indicators that aggregate data representing several dimensions of well-being make them the most frequently used composite indicators. The rankings produced by these indices receive wide media attention, with comments and analysis by prestigious international media (The Economist, Harvard Business Review, The Wall Street Journal, Financial Times), national media (The Guardian, The Globe and Mail, The Times, The New York Times, The Guardian, The Independent, USA Today, The Daily Telegraph, Irish Times, Maclean's, The Spectator), local media (Edmonton Journal, Calgary Herald, Jerusalem Post) and many others.

These indicators have also received academic attention. Several studies have criticized and attempted to improve the HDI. Most critics have focused on the selection of indicators, high correlation between components, computational form, and component weighting (Kovacevic, 2011). Despite the media attention and public debate these indicators generate, only a handful of papers have provided an analysis of the HPI and the LPI: Tausch (2011), Tausch (2013), Ng (2007), and Pillarisetti and Van den Bergh (2013) focus on the HPI, while Vanhanen (2010) addresses the LPI.

However, no paper has attempted to make an assessment of the validity of these three well-known indicators, despite their well-developed and documented methodologies and wide attention from prestigious media. We assess the statistical relevance of the variables that are employed in building up these indicators, as well as some related indicators developed by UNDP (2012a). We use cluster analysis, a data mining technique useful for exploring synergies of variables of distinct types and developing a meaningful classification of countries (Lo Bue and Klasen, 2013), to obtain an optimal cluster structure similar to those provided by the three well-known indicators. Then, we assess the quality of this classification against the country groups produced by the three indicators using precision and recall, two measures used to show how well results of a classification can match one another.

Our results indicate the lack of significance of some indicators and strong cross-correlations among other indicators. This helps us establish a comprehensive picture of which variables should play a significant role in grouping countries on their relative levels of well-being and social progress. In addition, we achieve a comprehensive and objective validation of the three composite indicators, which is useful in ensuring that indicators maintain their relevance (Michalos et al., 2011). We also conduct a detailed analysis of the differences between the optimal cluster structure and the indicators that are validated, and we note some of the inherent weaknesses observed for the HDI and LPI.

2. Where are we now? Current level of knowledge and major question marks

2.1. What exactly do we try to measure?

Going "beyond GDP" is an exercise that involves a discussion of what defines well-being and/or human progress. Thus, as early as 1968, Gunnar Myrdal defined economic development as "the movement upward of the whole social system" (Brinkman and Brinkman, 2011), which encompasses the multiple dimensions of human progress to be reflected by several indicators. The work of Brinkman and Brinkman (2011) casts a comprehensive light on the issue and shows how GDP growth does not ensure fulfillment of basic needs of the citizens of some developed countries.

The Stiglitz–Sen–Fitoussi (SSF) report has taken stock of the existing measures as of 2008 and has made recommendations on which measures to include when assessing well-being and human progress. The report defines the following dimensions of well-being that need to be taken into account: (1) material living standards (income, consumption, and wealth), (2) health, (3) education, (4) personal activities including work, (5) political voice and governance, (6) social connections and relationships, (7) environment (present and future conditions), and (8) insecurity of an economic as well as a physical nature.

Most of the dimensions in the SSF report are incorporated in several aggregated measures, such as the Canadian Index of Well-being (CIW) and the LPI. Both indexes have a multi-dimensional structure that attempt to aggregate all dimensions of well-being. The LPI is an aggregation of eight sub-indexes: (1) entrepreneurship and opportunity, (2) health, (3) personal freedom, (4) education, (5) economy, (6) social capital, (7) governance and (8) safety & security (The Legatum Institute, 2012). The CIW accomplishes the same using the following dimensions: living standards, healthy populations, community vitality, democratic engagement, leisure and culture, time use, education, and environment.

An important issue in the measurement of well-being is the concomitant use of both subjective and objective measures of well-being. Considering an argument made by Diener, the Stiglitz–Sen–Fitoussi (SSF) report (2008) defines subjective well-being as being composed of the following:

- life satisfaction as an overall judgment about own life at a point in time;
- the presence of positive feelings or a positive affect;
- the absence of negative feelings or emotions such as feeling angry, sad or depressed.

A synthesis of the understanding of the relationship between the use of subjective and objective factors has been performed by Michalos et al. (2011). According to them, indicators of well-being and life satisfaction appear to be largely unaffected by the evolution of objective measures such as the state of the environment, poverty, and sustainability, are heavily influenced by personal factors such as life experiences, life events, and personality traits, and manifest discrepancies between real conditions and some desired/reference conditions. Among the contributions that support these conclusions, it is worth mentioning those of Stevenson

---