METHODS

Evaluating strategies for sustainable development: fuzzy logic reasoning and sensitivity analysis

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Abstract

Sustainable decision-making involves political decisions at the local, regional, or national levels, which aim at a balanced development of socio–environmental systems. A fundamental question in sustainable decision-making is that of defining and measuring sustainable development. Many methods have been proposed to assess sustainability. Recently, a model has been developed, called Sustainability Assessment by Fuzzy Evaluation (SAFE), which uses fuzzy logic reasoning and basic indicators of environmental integrity, economic efficiency, and social welfare, and derives measures of human (HUMS), ecological (ECOS), and overall sustainability (OSUS). In this article, we perform sensitivity analysis of the SAFE model to identify the most important factors contributing to sustainable development. About 80 different indicators are tested and classified as promoting, impeding, or having no effect on the progress toward sustainable development. The proposed method is applied to the Greek and American economies. The conclusion is that there is no unique sustainable path and, accordingly, policy makers should choose different criteria and strategies to make efficient sustainable decisions for each country.

Keywords: Sustainable development; Decision-making; Indicators of sustainability; Fuzzy logic

1. Introduction

Sustainable development is nowadays the goal, in words at least, of most politicians and decision makers. Since the publication of the Brundtland report in 1987 [World Commission on Environment and Development (WCED), 1987], the concept of sustainability has gained increasing attention among policy makers and scientists which culminated during the 1992 Earth Summit held in Rio de Janeiro. Among the results of the Earth Summit, Agenda 21 is a comprehensive list of actions needed to achieve sustainable development [United Nations Conference on Environment and Development (UNCED), 1992]. Leaders from over 150 states committed themselves to undertaking actions which will render future development sustainable but without the scientific tools to guide policy making towards a sustainable path (HMSO, 1994). Decisions leading to sustainable development ought to be based on good science and adequate information. Thus, data are needed about environmen-
The Earth Summit in 1992, an increasing number of researchers and international organizations began to consider “social sustainability”, “economic sustainability”, “community sustainability”, and even “cultural sustainability” as parts of the human dimension of sustainable development (Hardoy et al., 1992;
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