Investigating the effects of using GRAS algorithms for long-term projections

Topic: Input-Output Theory and Methodology (5)
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Research question:
The GRAS family are state-of-the-art algorithms for balancing input-output tables. They are furthermore often used for projecting these as well. Said algorithms find a new matrix that deviates the least from a given matrix and complies with given row and column sum vectors. Its core aim is thus the preservation of the underlying structure. Advantages of the GRAS algorithms are their zero and sign preservation. Disadvantages are potential arbitrary changes of important input coefficients. Comparisons have shown that the GRAS algorithms perform better than other methods for projections over short and medium terms. Valderas-Jaramillo et al., 2019, for example compared the SUT-RAS and SUT-EURO methods on annual tables over a time span of 5 years and concluded that the SUT-RAS method is to be preferred if the necessary information is available.
In this paper we investigate the effects of using GRAS algorithms for long-term projections by applying them on historic national input output tables and using measures of goodness of fit (e.g. the Weighted Absolute Percentage Error (WAPE)) to compare these projections against the existing data. The strength of the GRAS algorithms â€“ the preservation of the underlying structure- may actually become a disadvantage, when projecting over longer stretches of time. In long-term projections, structural changes or changes in technology play a more prominent role, which potentially puts into question the core assumption of structural preservation. That is to say, unless the intention of the projections explicitly is to isolate specific changes or developments while keeping the underlying structure constant.
Eurostat, 2008, outlined that the use of exogenous data improves RAS-type projections. Thus, possible ways to improve projections -such as the use of other exogenous data like time series data for extrapolation and combining the GRAS algorithms with other projection methods- are furthermore explored.
Based on the differences resulting from the different approaches, we suggest best practice recommendations for situations where long-term projections coincide with expected large system changes.

Novelty of the research:
Comparisons between GRAS algorithms and other methods for projections have mostly been made for short and medium-time horizons. While GRAS algorithms have been used for long-term projections, the authors are not aware of studies looking specifically into the effect of using GRAS algorithms in the context of long-term projections.
This work is motivated by the need to make long-term scenarios for emissions of greenhouse gases in a consumption-based perspective. This need was identified by a cross-party committee on climate change in Sweden that called for improved methods and data in this area (MiljÃ¶mÃ¥lsberedningen, 2022). The current paper is a part of a larger project in which strategic policy scenarios for both Sweden and Luxembourg will be developed and target-fulfilling transformative scenarios and pathways, where consumption is in line with climate targets, will be evaluated.

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