

Introducing Physical Constraints into Economic Models

Topic: EXIOPOL: Latest progress and preliminary results of work on a global, detailed MR EE SUT/IOT database

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During the last decade, environmentally extended methods for multi-regional input-output (MRIO) analysis have advanced significantly. One important limitation, however, has been the absence of a comprehensive database of factor flows for industrial use and especially of factor stocks – of not only labour and capital, but also natural resources, namely arable land, fresh water, biomass, fossil fuels, and minerals such as phosphates. As the stock data become available, they can be put immediately to use in models of the world economy as physical constraints on factor flows.

The state of the art regarding accounting methodologies for quantifying these categories of environmental flows and stocks varies considerably. For instance, while there are extensive data on worldwide resource extraction and use, information on stocks of materials and arable land are substantially incomplete. By contrast, data on available water reserves are far more comprehensive than data on water withdrawals. However, even when stock data are available, as in the case of water, consistent definitions and conventions for making these data useful for economic modelling are often lacking.

This present paper describes the most critical challenges to the compilation of factor stock and flow data for economic modelling purposes. We describe existing data sources and identify the key assumptions necessary to systematically quantify stocks and flows of natural resources. The paper shows how standardising such definitions and conventions can facilitate the integration of both resource flow and stock data into MRIO models using the example of the World Trade Model (WTM). The WTM is an MRIO model developed for scenario analysis in the context of global sustainable development. One of its distinctive features is that it requires estimates of factor stocks and flows in physical units, utilising the size of endowments to constrain the volumes of sectoral production and to calculate scarcity rents on fully utilised factors of production.