GINFORS (version 3): A global simulation model on the basis of WIOD and its application

Topic: 809F Environmental IO Modelling (4)
Author: Gerd AHLERT
Co-Authors: Mark Meyer, Martin Distelkamp

(1) The multi-regional input-output simulation model GINFORS permits wide-ranging ex ante as well as ex post simulation studies, particularly on globally relevant topics in areas such as global developments and resource use. In a couple of European research projects (CECILIA2050, ToPDAd, POLFREE, SimRess) the GINFORS (version 3) of the model (see Meyer et al. 2013) and the underlying MRIO database WIOD (see Dietzenbacher et al. 2013) has been applied to analyse the following questions:

- Is the assumption of free combinability of alternative climatic representative concentration pathways (RCP, see Moss et al. 2010) and shared socioeconomic pathways (SSP, see O'Neill et al. 2014) reliable?
- What decarbonizing policy mix could be able to meet the global '2 Degrees' target?
- Which alternative economic indicators for international resource productivity assessment is appropriate?

(2) In GINFORS all countries in the EU27, all OECD countries, the BRIC countries and a Rest of the World region are explicitly modeled. Its empirical modelling framework rests on national Input-Output accounts that are bilaterally interconnected by international trade at the industry level. It depicts the global economic, social and environmental relations for each country in deep product group detail (59), including the inputs of capital (fixed and intermediate), labour markets and the developments of all components of final demand depending on relative prices. The prices of all products are explained by the unit costs of the 35 sectors. The macro variables are given by explicit aggregation of the sectoral variables determining GDP as the aggregate of sectoral value added. The energy intensities for heating, mobility and electricity for the use of machinery and household appliances are explained by relative prices for each of the 35 sectors and private households in each of the 39 countries. The carrier structure also depends on their price relations. All parameters of the model are estimated econometrically.

Assuming bounded rationality of agents and imperfect markets, an iterative solution algorithm facilitates ex ante simulation studies of the non-equilibrium features of globalizing economies. From a methodological point of view, GINFORS might thus be categorised as a completely integrated dynamic simulation model. The effects of national policy measures and environmental policy measures can be extensively analysed assuming alternative global conditions; indirect international spill-over effects are modelled automatically.

(3) The GINFORS approach relies heavily on the availability of harmonised international Input-Output datasets (preferably as annual time series). The actual model version (labeled GINFORS 3) therefore represents our first GINFORS release, which has been built upon a fully harmonized annual set of national Supply and Use Tables (SUT), i.e., the outcomes of the WIOD project. Population of the different countries is exogenous and was taken from the UN medium variant forecast. The extraction prices of fossil fuels were obtained from the IEA 2012 Energy Technology Perspectives.

(4) The application of GINFORS version 3 indicates that
- (at least some of) the combinations of climatic and socioeconomic pathways prepared for the Intergovernmental Panel for Climate Change (IPCC) contain inconsistencies between the socioeconomic assumptions and the emissions in the pathway combinations,
- a holistic decarbonizing strategy - a carbon price combined with the decarbonisation of process heat especially in the power sector, electrification of land transport and improvements in the energy efficiency of buildings - is (nearly) able to meet the global 2 degrees target and the European 80%

reduction target,

- the RMI (Raw Material Input)-based productivity indicator shows advantages over the commonly reported GDP/DMC (Domestic Material Consumption) or GDP/RMC (Raw Material Consumption) indicators.

Bibliographie:

Dietzenbacher, E., B. Los, R. Stehrer, M. Timmer & G. de Vries (2013). The construction of World Input-Output Tables in the WIOD Project. Economic Systems Research 25(1), 71â€"98.

Meyer, B., Ahlert, G., Distelkamp, M. & M. Meyer (2013). Macroeconomic Modelling of the Global Economy-Energy-Environment Nexus - an Overview of Recent Advancements of the Dynamic Simulation Model GINFORS. GWS Discussion Paper 13/5, OsnabrÃ¼ck.

Meyer, B., Distelkamp, M. & T. Beringer (2014). Report about integrated scenario interpretation GINFORS/LPJmL results. POLFREE Deliverable 3.7, OsnabrÃ¼ck.

Meyer, B., Ahlert, G. & M. Meyer (2014): Assessment of environmental impacts under alternative adaptation measures. ToPDAd Deliverable 3.3, Helsinki.

Meyer, B., Meyer, M. & M. Distelkamp (2014): Macroeconomic routes to 2050 â€" choosing efficient combinations of policy instruments for low-carbon development and innovations to achieve EuropeÂ´s 2050 climate targets. CECILIA2050 Deliverable 3.2, OsnabrÃ¼ck.