

Tools – The SUPREMA model family

MAGNET

The Modular Applied GeNeral Equilibrium Tool (MAGNET) model is a multi-regional, multi-sectoral, applied general equilibrium model of the world economy based on neo-classical microeconomic theory (Nowicki et al. 2009, Woltjer and Kuiper, 2014). It is an extended version of the standard GTAP model (Hertel 1997). MAGNET focusses, among others, on impact assessment of agricultural policies, climate change impact and related policies, trade and land use change developments.

The core of MAGNET is an input–output model, which links industries in value added chains from primary goods, over continuously higher stages of intermediate processing, to the final assembly of goods and services for consumption. On the production side, MAGNET uses a multilevel sector specific nested CES (constant elasticity of substitution) production function, allowing for substitution between primary production factors (land, labour, capital and natural resources) and intermediate production factors, and for substitution between different intermediate input components (e.g. energy sources, and animal feed components). Primary production factors are region specific. Their prices are determined endogenously to meet the “aggregated supply equals aggregated demand” equilibrium condition. Similarly, prices of goods in each region adjust to assure that both national and international demand and supply are equal.

On the consumption side, one household per region is distinguished. It distributes its income across savings and (government and private) consumption expenditures according to fixed budget shares. Private consumption expenditures are allocated across commodities according to a non-homothetic dynamic CDE (constant difference of elasticities) expenditure function which allows for changes in income elasticities when PPP (purchase power parity)-corrected real GDP (Gross domestic product) per capita changes. Government expenditures are allocated across commodities according to fixed shares. The commodities consumed by firms, government and households are CES composites of domestic and imported commodities. The MAGNET model includes bilateral trade between all regions of the model and accounts for trade barriers between regions via tariffs. The imported commodities are differentiated by region of origin using Armington elasticities.

MAGNET includes several extensions towards better representation of the agricultural sector. It includes, among others, substitutability of land between sectors, imperfect mobility of labour between agricultural and non-agricultural sectors, endogenous land supply, biofuel sectors, modulation of the CAP from first to second pillar measures and agricultural production quotas. Agricultural commodities are present in MAGNET mostly as aggregates with a few exceptions. For example, cereals sector is modelled as other coarse grains and wheat, and oilseeds are aggregated into one generic commodity. There are aggregates for fruits, vegetables and nuts, for other crops, for non-ruminant meats and for dairy products, whereas rice, raw milk, poultry eggs, poultry and pork meats are modelled as separate commodities. Agricultural activities simulated in-



clude producer, market and export prices, total production, areas per activity, crops and animal yields, domestic uses, import, export, fertilizer use, GHG emissions a number of other indicators.

MAGNET can be used for comparative-static simulations as well as for long-term projections (till 2050 and, sometimes, 2100). The long-run scenarios are built in recursive-dynamic manner by updating the MAGNET database in several consecutive, mostly 10-year long, time steps. This approach uses a set of exogenous assumptions on developments in population, GDP, land productivity and capital over time.

References:

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- Woltjer, G., M. Kuiper, A. Kavallari, H. van Meijl, J. Powell, M. Rutten, L. Shutes, A. Tabeau (2014). The MAGNET model - Module description. Agricultural Economics Research Institute (LEI), LEI Report 14-057. The Hague, Netherlands.