LEI
WAGENINGEN UR

Report to the GTAP Advisory Board 2011

The Agricultural Economic Research Institute (LEI) has been a member of the GTAP consortium since November 1996. We use GTAP for a variety of research activities related to international trade in agri-food products. The following presents a summary of our activities over 2010/2011.

People

In the course of 2010 Ignacio Perez left LEI to join the OECD, while Hans Kremers joined the team. We currently have nine researchers involved in CGE-related work: Lindsay Chant, Hans Kremers, Marijke Kuiper, Myrna van Leeuwen, Hans van Meijl, Jeff Powell, Martine Rutten, Andrzej Tabeau and Geert Woltjer. Jeff Powell started a PHD in 2010 to enhance the representation of the Biobased economy in MAGNET. In addition John Doornbos and Barbara van Hout develop dedicated software tools for MAGNET. The annex contains an overview of the team with their main interests.

Strategy – from LEITAP to MAGNET

The sizeable group of researchers involved with GTAP work makes it worthwhile to exploit potential economies of scale, overcoming limits posed by project-driven research as done at LEI. Significant investments continued in 2010/2011 to convert the LEITAP model in a modular CGE model dubbed MAGNET: Modular Applied GeNeral Equilibrium Tool. MAGNET has the standard GTAP model at its core with all extensions added in a modular fashion. This implies that new team members can start working with the plain GTAP model, switching on extensions one-by-one as their understanding of the model progresses. It also eases tailoring of the model specification to research questions and testing of sensitivity of results to both functional forms and data aggregations (in addition to more standard sensitivity tests of closure and parameters). Furthermore, it facilitates maintaining a single model while team members work different on modules.

The model is developed using a versioning system with a production version as the trunk and development branches for different modules. Dedicated software tools are used to develop the model code (Gtree), assist in database adjustment, choice of model structure and scenario construction (DSS) and for analyzing results (GEMSE-Analyst).

MAGNET is designed as a suite of programs to prepare data, choose a model structure, run the CGE model and analyze results in a structured and transparent manner. It this encompasses not only the CGE model itself, data and scenario preparation as well as tools for scenario analysis are key elements of the system.

All database adjustments (both changes to the standard GTAP database as well as adding extra data needed by model extensions) are done at the disaggregated GTAP level (114 regions and 57 sectors) in a SAM format using GEMPACK code. This increases transparency and replication of database adjustments. After adjustments the SAM is converted back into the standard GTAP database format. Adjusting data at the disaggregated level maintains flexibility of the model, allowing any aggregation needed for a specific research questions.

Starting from the adjusted database the user chooses a model aggregation (regions and sectors) and which modules to activate for which regions (the annex contains a schematic overview of the currently available modules). MAGNET allows, for example, production structures to vary by region with some regions having an elaborate production structure capturing energy substitutions while other regions maintain the standard GTAP two-level production structure. In case of limited data for certain regions a more simple model structure can thus be used, avoiding the need to guesstimate data.

To aid work on baseline a module has been developed which aggregates baseline data from different sources to the chosen model aggregation and periods. This allows for fast comparison of for example GDP projections from different sources. Model results are analyzed both with standard tools like AnalyzeGE as well as software developed at LEI (GEMSEAnalyst) which allows easy comparisons between different scenarios.

To consolidate and develop MAGNET various meetings are organized to exchange information: weekly coffee meetings for quick updates, monthly MAGNET days away from the office to jointly work on the model, and an annual Noordwijk meeting of several days. The day meetings allow researchers to step back from the day-to-day project issues and work jointly on issues of longer term strategic relevance. In 2010 a Noordwijk meeting was again organized with Peter Dixon and Maureen Rimmer (visting LEI for the third time) to work on ORANGE (a Monash type CGE model of the Dutch economy) and the LEITAP baseline.

CGE-related research in 2010/2011

Model development
▪ *Land supply*
  o Alternative specification of the land supply function developed jointly with Peter Dixon and Maureen Rimmer to improve performance when the land asymptote is shocked
▪ *Including biofuel sectors into the database.*
  o IEA data used to introduce ethanol and biodiesel data in the version 8 database
  o Biofuels trade data, also based on IEA sources, will be incorporated into MAGNET
  o Biofuels byproducts will also be modeled
▪ *Fully-flexible production structures*
  o Production structures are now fully flexible - both the positions of aggregates (like value-added) and real inputs is now fully governed by choice parameters; can thus construct any desired region and sector-specific production tree
▪ *Production quota*
  o Specification of quota over sectors and regions with production quota by endogenizing the accompanying production tax and using the complementarity statement
  o Quota are implemented using the GTAP data (assuming quota are currently binding) or using external data (in which case they have to be matched with the GTAP database)
▪ *Bilateral Tariff Rate Quota (BTRQ)*
  o Specification of BTRQ over sector, source and destination countries with BTRQ by endogenizing the associated bilateral import tax and using the complementarity statement
  o Explicit calculation of quota rents, with the possibility to reallocate rents to exporters depending on the method of administration, and adjustment of regional income and welfare
  o BTRQ may be implemented using the GTAP base data (assuming that bilateral imports are currently on quota) or by matching external data to the GTAP database for which a procedure has been written
▪ *Data implemented for dynamic international capital markets*
  o Using GTAP-DYN accounting system wealth data and international investment data are used to calibrate the international dynamics. International dynamics is based on the decision to invest domestically or abroad, and if abroad where to invest abroad. Based on relative profitability
▪ *CET for dynamic country specific import elasticities*
▪ *A downscaling module*
  o Downscaling data from EU countries in MAGNET to NUTS2 level.

Data and model management software
▪ *DSS (Dynamic Steering System)*
  o DSS system to steer the adjustments of the database; all adjustments are coded in separate modules and users can choose the necessary adjustments for their analysis
  o DSS system for model structure under development to guide users through the large number of possible MAGNET model structures
  o DSS system to create baseline data and baseline scenario definition.
  o DSS system to manage downscaling of data
▪ *Baseline data*
  o Baseline data from different sources are made consistent with the GTAP database; after defining the number and length of periods in the baseline all available data are aggregated to the model aggregation (regions and sectors) and chosen periods
▪ *GEMSE analyst - interface for quickly analyzing and displaying results*:
  o Developed 64bit version

- o Adjusted to read downscaled data

Linking of models
- ▪ *EUruralis*
    - o Linking LEITAP with biophysical models. In EUruralis LEITAP is linked with the biophysical IMAGE model of PBL and the land allocation model CLUE-s of WUR-LAD. See, www.eururalis.com
- ▪ *OECD Environmental Outlook.*
    - o Netherlands Environmental Assessment Agency and LEI are involved in preparing the input for OECD Environmental Outlook. In the baseline and policy scenario's the IMAGE and LEITAP models are linked.
- ▪ *Dutch Prospect Study*
    - o In the Dutch Prospect study (Ministry of EL&I, forthcoming), ORANGE is linked with the agricultural partial equilibrium model AGMEMOD (for arable and livestock sectors), the CGE model HORTUS (for horticultural sectors) and LEITAP (for world market prices)
- ▪ *The Economics of Ecosystems and Biodiversity (TEEB) assessment.*
    - o In a contribution to the UNEP project, Netherlands Environmental Assessment Agency and LEI have quantitatively analyzed a number of sector based options to reduce global loss of biodiversity. The project explore the standard between IMAGE and LEITAP models.
- ▪ *Scenar2020 II*
    - o LEITAP is linked with agricultural partial equilibrium models (ESIM, CAPRI)

Bioenergy
- ▪ The chemical sector in ORANGE has been split into a 'chemical-fossil based' industry and a 'chemical-biobased' industry.
- ▪ Paper on global biofuel initiatives will be presented at GTAP conference (together with vTI, Martin Banse et al.)
- ▪ In the Dutch Bebasic and knowledge infrastructure Biobased economy projects the economic MAGNET model will be linked to bottom up analyses of Copernicus institute (Andre Faay) and to environmental models (van Vuuren).
- ▪ A study will be undertaken to the macro economic impacts of the biobased economy for Malaysia.

Future of agriculture (food prices)
- ▪ *Dutch Prospect Study*
    - o In the Dutch Prospects study (forthcoming) ORANGE is used to provide a baseline outlook for the Dutch agrifood complex in 2025 in terms of value added, employment, energy use and GHG.
- ▪ *Comparison of alternative approaches for long-term scenarios for agricultural markets and trade*
    - o In the project long term projection for agricultural markets and trade made by LEITAP, IMPACT ENVISAG, Projections are based on the same set of assumptions and are developed by LEI, IFPRI and World Bank. OECD/TAD/PTA is leading the project.
- ▪ *Common Agricultural Policy:*
    - o In 2010 an impact study on the Dutch proposal for the future of the CAP ("Houtskoolschets") is performed for the Dutch government. The work is presented during the High level CAP conference in Scheveningen, Netherlands. In the study money is shifted from first pillar to measures that enhance competitiveness, valuable areas and ecosystem services.

ORANGE – a CGE model of the Netherlands
- ▪ A first version of a national CGE model for the Netherlands (ORANGE) has been built and a simple baseline has been calibrated. Then, the ORANGE model was used to examine the impact of a shift towards biobased inputs in the Plastics industry in the Netherlands. This model can in the future be linked to LEITAP
- ▪ In 2011, an improved version of a baseline outlook of the Dutch agri-food complex to 2025 has been developed. The model has been linked with information from AGMEMOD (arable and

livestock markets, macroeconomy), HORTUS (horticultural markets), LEITAP (world market prices) and IO analyses (to measure direct and indirect impacts).

LEITAP/MAGNET - related publications

Banse, M.A.H.; Meijl, J.C.M. van; Woltjer, G.B. (2010) Biofuel Policies, Production, Trade and Land Use In: The biobased economy: biofuels, materials and chemicals in the post-oil era / Langeveld, H., Sanders, J., Meeusen, M., . - London : Earthscan,

Banse, M.; Meijl, H. van; Tabeau, A.A.; Woltjer, G.B.; Hellmann, F.; Verburg, P.H. (2011) Impact of EU biofuel policies on world agricultural production and land use (not published yet, online available) Biomass and Bioenergy .

Banse M., A. Tabeau, H. van Meijl and G. Woltjer, "Modelling the Consequences of Increasing Bioenergy Demand on Land and Feed Use" conference paper, 114th Seminar of the EAAE Structural Change in Agriculture: Modeling Policy Impacts and Farm Strategies, Humboldt-Universität zu Berlin, April 15 - 16, 2010.

Chant, Lindsay and Andrzej Tabeau, "Do Biofuel Policies and Meat Consumption Preferences Influence Food Security and Emissions in Developing Countries?", paper prepared for presentation at the 119th EAAE Seminar 'Sustainability in the Food Sector: Rethinking the Relationship between the Agro-Food System and the Natural, Social, Economic and Institutional Environments', Capri, Italy, June, 30th – July, 2nd, 2010

Chant, Lindsay and Andrzej Tabeau, "Do Biofuel Policies and Meat Consumption Preferences Influence Food Security and Greenhouse Gas Emissions in Developing Countries?", Report for the Competing Claims Project (BO-10-011-009)

Helming J.F.M., A. Pronk, G. Woltjer (2010), Stabilisation of the grain market by the flexible use of grain for bioethanol. LEI-rapport 2010-039, Den Haag. To access the paper, visit http://www.lei.wur.nl/UK/publications+en+products/LEI+publications/default.htm?id=1130

Helming, John, Sander Jansen, Hans van Meijl, Andrzej Tabeau, "Impact assessment of post 2013 CAP measures on European agriculture", Houtskoolschets project report

Hermans, C.M.L.; Geijzendorffer, I.R.; Ewert, F.; Metzger, M.J.; Vereijken, P.H.; Woltjer, G.B.; Verhagen, A. (2010), Exploring the future of European crop production in a liberalised market, with specific consideration of climate change and the regional competitiveness Ecological Modelling 221 (18). - p. 2177 - 2187.

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Neumann, K.; Verburg, P.H.; Elbersen, B.S.; Stehfest, E.; Woltjer, G.B. (2011) Multi-scale scenarios of spatial-temporal dynamics in the European livestock sector Agriculture, Ecosystems and Environment 140 (1-2). - p. 88 - 101.

Nowicki, P., M. van Leeuwen, H. Bos, L. Chant, K. Molenveld and A. Tabeau (2010) Influence of the biobased economy on agricultural markets; Preparation of a modelling approach. Den Haag, LEI, 2010, Rapport 2010-026.

P. Nowicki and Meijl, H. van, (2011) 'Scenar 2020-II: Decomposition analysis to understand policy impacts on agricultural primary production and related processing sectors'. In: Disaggregated Impacts of CAP Reforms; proceedings of an OECD workshop OECD, page 135-150.

P. Nowicki, Hart, K. and Meijl, H. van (2011), 'The impact of modulation as a policy instrument'. In: Disaggregated Impacts of CAP Reforms; proceedings of an OECD workshop, OECD, page 265-284.

Prins, A.G., B. Eickhout, M. Banse, H. van Meijl, W. Rienks and G. Woltjer (2011). Global impacts of European agricultural and biofuel policies, Ecology and Society 16 (1):49. http://www.ecologyandsociety.org/vol16/iss1/art49/

Rutten, M., Chant, L. & Meijerink, G. Sit down at the ball game: how trade barriers make the world less food secure. Submitted to Food Policy.

Tabeau, Andrzej, Martin Banse, Hans van Meijl and Geert Woltjer (2011), Impact of the EU Biofuels Directive on the EU food supply chain, Journal of Food Products Marketing, 17:373-285, 2011

Tabeau A., Hatna E. and Verburg P.H., "Assessing spatial uncertainties of land allocation using the scenario approach and sensitivity analysis", conference paper, International EAAE-SYAL Seminar Spatial Dynamics in Agri-food Systems, Parma, 27-30 October 2010

Tabeau, Andrzej and Geert Woltjer, "Modeling the agricultural employment development within the CGE framework: the consequences for policy responses" conference paper, Thirteenth Annual Conference on Global Economic Analysis, Trade for Sustainable and Inclusive Growth and Development, Penang, Malaysia, June 9-11, 2010.

Annex – the MAGNET team at LEI

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Annex: overview of the structure of the MAGNET model

Files	MGTAP model code →	MGTAP closure	**Key:-**
Sets (Sets added to GTAP)	Extended production structure →	Extended production closure	**GTAP**
Module definition	CAP →	CAP closure	**MAGNET**
	Segmented factor markets →	Segmented factor markets closure	
GTAP model code	Land supply →	Land supply closure	
	Biofuels →	Biofuels closure	
	Investment →	Investment closure	
	Consumption →	Consumption closure	
GTAP closure	Tariff rate quotas →	TRQ closure	
	Greenhouse gases →	GHG closure	