

Report to the GTAP Advisory Board 2012

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 2011/2012.

People

In the course of 2011 Hans Kremers left LEI, while Michiel van Dijk, Aikaterini Kavallari and Edward Smeets joined the team (all three of them were recruited within 2011). We currently have eleven researchers involved in CGE-related work: Michiel van Dijk, Aikaterini Kavallari, Marijke Kuiper, Myrna van Leeuwen, Hans van Meijl, Jeff Powell, Martine Rutten, Edward Smeets, Lindsay Shutes, Andrzej Tabeau and Geert Woltjer. Michiel and Edward will attend the forthcoming GTAP short course. In addition John Doornbos and Barbara van Hout continued develop dedicated software tools for MAGNET. The annex contains an overview of the team with their main interests.

MAGNET consortium

The group of developers and users of MAGNET has been extended beyond LEI and includes also researchers from vTI and IPTS. A MAGNET consortium has been created which regularly meets to discuss areas where the different member institutes can join forces in developing parts of the model.

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 2011/2012 to convert the LEITAP model in a modular CGE model called MAGNET: Modular Applied GeNeral Equilibrium Tool. MAGNET has the standard GTAP model at its core with all extensions added in a modular fashion. It allows the user to select which additional modules he/she wishes to include by adjusting the model settings and by including the relevant data.

The modular approach of MAGNET was standardized in the course of 2011/2012 and is now followed in all routines, from data handling to scenario running. This enables us not only to develop different modules in parallel but also to keep record of all preparatory steps for running a simulation, to separate the files per module throughout the system and to ease tracing errors. In detail, the modular approach was extended to:

- Preparation of data (source data)
- Choices in scenario settings
- Adjustments to model parameters
- Data used for shocks
- Files used in each scenario

Routines on adding external data sources to MAGNET, on adjusting data and on simulation scenarios have been further developed and have been incorporated into MAGNET. Hence the MAGNET modeling system goes beyond encompassing the core model and allows to modify a GTAP based SAM and to populate it with other data.

External data enter the system as disaggregated as provided and are adjusted for a lower commodity disaggregation which may be defined according to our needs. Once processed they are mapped into the GTAP regions and commodities. By doing so we are flexible to run MAGNET at a lower disaggregation level than GTAP provided we have sufficient external information for populating the model.

The model is developed using a versioning system (SVN) with a production version as the trunk and development branches for different modules. Dedicated software tools are used to develop the

model code (VisualGtree), assist in database adjustment, the choice of model structure and scenario construction (DSS) and the analysis of results (GEMSE_Analyst).

The software DSS was extended and became the user interface of the model. If the user does not need to adjust the code of the model, DSS can be used straight away to handle data aggregation, to set up the model and to define and run scenarios. Data aggregation as handled in DSS incorporates the attributes of GTAPagg and, going one step ahead, allows the user to add new countries and regions. This increases our flexibility and allows us to tailor our database disaggregation to specific research needs. Furthermore in DSS we built in all selections one has to make for preparing a reference scenario (e.g. a baseline) and for running any shock. Closure and shock files can be edited within DSS, while the user also has the possibility to select and to write specific headers in shock data files. Last but not least, in DSS we can select whether we run MAGNET as a comparative static or as recursive dynamic model. In the case of the latter we can prepare the reference (baseline) scenario by specifying the desired periods, which creates the needed shock data files per period and scenario files that can subsequently be run.

To consolidate and develop MAGNET we meet once per week for quick updates and we organize longer meetings to address specific issues in depth. In 2011 a meeting was again organized with Peter Dixon and Maureen Rimmer (visiting LEI for the fourth time) to work on modeling second generation biomass technologies in Malaysia.

CGE-related research in 2011/2012

Model development

- *Library of procedures for adjusting a GTAP based SAM when splitting regions and commodities*
 - Procedures for adjusting imports and exports of a GTAP derived SAM using external information (BACI, UN COMTRADE)
 - Procedures for adjusting the supply matrix and for adjusting afterwards the supply over final demand and over intermediate demand
 - Procedures for adjusting international capital accounts, export and import margins and regional income
- *Bilateral Tariff Rate Quota (BTRQ)*
 - Specification of BTRQ over sector, source and destination countries with BTRQ by endogenizing the associated bilateral import tax and using the complementarity statement
 - 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
 - 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
- *Land supply*
 - Alternative specification of the land supply function developed jointly with Peter Dixon and Maureen Rimmer to improve performance when the land asymptote is shocked. Methodology applied for REDD criteria related to biofuel directives (RED).
 - Alternative specification of land supply and land use
 - Flexible CET land supply structure
- *Including biofuel sectors into the database.*
 - IEA data used to introduce ethanol and biodiesel data in the version 8 database
 - Biofuels trade data, also based on IEA sources, are incorporated into MAGNET
 - FAO volume data are used to create consistency in energy content
 - Subsidies for biofuel use are based on a comparison between gasoline price and cost price of biofuels
 - Biofuels byproducts are also modeled
- *Dynamic international investment and income flows*
 - Based on GDYN income and wealth accounting system international investment is modeled in a recursively dynamic way using the continuous time variable.
- *Production quota*
 - Specification of quota over sectors and regions with production quota by endogenizing the accompanying production tax and using the complementarity statement
 - 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)

- Very flexible CES nesting production structure, where per sector different nesting structures can be defined and nesting structures can be easily adjusted through a matrix.
- *Factor markets*
 - Dynamic imperfect labor and capital mobility between agricultural and non-agricultural sectors are implemented based on econometric estimates. Uses the continuous time variable.
 - Introduction of upwards-sloping labour supply curves (currently for EU countries) to offer an intermediate labour market specification between flexible employment with fixed wages and full employment with flexible wages.
- *Consumption function*
 - The CDE function is continuously recalibrated during each step of a run based on a function that determines income elasticity based on GDP per capita
- *CAP module*
 - Allowing for fixed budgets, budgets per hectare and different second pillar measures with technology effects.
- Household modelling
 - Identify a separate public agent who receives income from taxes and a private agent that receives income from factor income and transfers
 - Split the representative household into multiple household groups for specified regions
 - Introduce alternative consumption functions at the household level
 - Compute poverty and nutrition indicators for multiple households

Data and model management software

- *DSS (Dynamic Steering System)*
 - 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
 - Automatic checking for warnings written in GEMPACK log files
 - DSS system for model developed, including a substitute for GTAPAgg, aggregation of other data and choices of modules used in simulating
 - DSS system to create baseline data and baseline scenario definition.
 - DSS system to run a scenario, generating files that can be analyzed automatically with GEMSE_Analist
 - DSS system to manage downscaling of data
- *GEMSE_Analist*
 - Easy aggregation of the simulation results over sectors and regions
 - Easy comparison between scenarios
 - Easy switch between absolute values, absolute changes, percentage changes and yearly changes
 - Easy aggregation over simulated periods
 - Easy saving of settings
- *GTREE*
 - Provides a hierarchical tree structure of the model code
 - Used in primary data manipulation, aggregation routines, processing of scenarios data, preparing model settings, and in the model code itself
 - Planned to make routines that can be called, creating the possibility to reuse code (GTREE will automatically replace SETS, COEFFICIENTS, etc. with new names (i.e. adding an extension supplied by the user).

Linking of models and long term scenario development

- *OECD Environmental Outlook.*
 - Netherlands Environmental Assessment Agency and LEI were involved in preparing the input for OECD Environmental Outlook. In the baseline and policy scenario's the IMAGE and LEITAP models are linked.
- *The Economics of Ecosystems and Biodiversity (TEEB) assessment and Road from Rio+20.*
 - 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 link between IMAGE and LEITAP models and uses the scenario approach to investigate different development options. These options are further explored for the RIO conference.
- *VOLANTE*
 - A roadmap for future land resource management in Europe a number of long term development scenarios are analyzed. They vary by macroeconomic and policy

assumptions and are examined by linked system of models including LEITAP, ReMIND/MAGPIE, MOLAND, EFI-GTM, CAPRI, EFISCEN and CLUE.

- GLIMP
 - The long-term scenario approach is used to illuminate the environment-related issues and relationships between the EU and other world regions. By using standard link between IMAGE and LEITAP models, it investigates and quantifies expected consequences of EU actions or non-action on the rest of world.
- *AgMIP Comparison of alternative approaches for long-term scenarios for agricultural markets and trade*
 - In the project, long term projection for agricultural markets and trade made by LEITAP, IMPACT, ENVISAGE, GLOBIOM, IMAGE and 6 other global models, Projections are based on the same set of assumptions and are developed by LEI, IFPRI, IIASA and World Bank. In debt projections comparison is done to improve the global models and learn from each other.

Bioenergy

- The chemical sector in ORANGE has been split into a 'chemical-fossil based' industry and a 'chemical-biobased' industry.
- In the Dutch Bebasic and knowledge infrastructure Biobased economy projects the economic MAGNET model will be linked to bottom up analyses of Copernicus institute and to environmental models.
- A study has been undertaken to the macro economic impacts of the biobased economy for Maylasia (second generation biomass from palm waste and residues used in pellet, biofuels, energy and chemicals).

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 – 2011/2012 related publications

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- Rutten, M., Meijerink, G. and L. Chant (2011). Sit Down at the Ballgame: How Trade Barriers Have Made the World Less Food Secure. SSRN Working Paper Series and GTAP Conference Paper 2011 (GTAP resource nr. 3507). Submitted to Food Policy (2nd round of revision)
- Shutes, L. (2012) Labour supply curves for European Member and Candidate States: an applied general equilibrium analysis Report for the European Commission under the Framework 7 project: Comparative Analysis of Factor Markets for Agriculture across the Member States (FACTOR MARKETS).
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Annex – the MAGNET team at LEI

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|---|---|---|
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Annex: overview of the structure of the MAGNET model

