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 (visiting 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**
  - 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.**
  - IEA data used to introduce ethanol and biodiesel data in the version 8 database
  - Biofuels trade data, also based on IEA sources, will be incorporated into MAGNET
  - Biofuels byproducts will also be modeled

- **Fully-flexible production structures**
  - 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**
  - 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)

- **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 for which a procedure has been written

- **Data implemented for dynamic international capital markets**
  - 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**
  - Downscaling data from EU countries in MAGNET to NUTS2 level.

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
  - DSS system for model structure under development to guide users through the large number of possible MAGNET model structures
  - DSS system to create baseline data and baseline scenario definition.
  - DSS system to manage downscaling of data

- **Baseline data**
  - 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:**
  - Developed 64bit version
Linking of models

- **EUruralis**
  - 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**
  - 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**
  - 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.**
  - 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**
  - 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 Bebassic 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**
  - 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**
  - 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:**
  - 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**


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


Netherlands Environmental Assessment Agency, "Rethinking Global Biodiversity Strategies", 2010; co-authors Hans van Meijl, Andrzej Tabeau.


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.


Annex – the MAGNET team at LEI

Hans van Meijl - Team leader
- CAP
- Bio-based economy

Geert Woltjer - Developer
- Land use
- Biofuels

Marijke Kuiper - Developer
- Trade
- Poverty

Lindsay Chant - Factor markets
- Poverty

Andrzej Tabeau - Baseline
- CAP

Martine Rutten - Trade
- Healthy diets

Hans Kremers - Forestry
- Biofuels

Jeff Powell - Biofuels
- Econometric parameter estimation

Myrna van Leeuwen - Single country CGE (ORANGE)
- Agricultural policy

John Doornbos - Software development

Barbara van der Hout - Software development
Annex: overview of the structure of the MAGNET model

Files
- MGTAP model code
  - Extended production structure
    - CAP
      - Segmented factor markets
        - Land supply
          - Biofuels
            - Investment
              - Consumption
                - Tariff rate quotas
                  - Greenhouse gases
          - Biofuels closure
          - Investment closure
          - Consumption closure
          - TRQ closure
    - Land supply closure
    - Biofuels closure
    - Investment closure
    - Consumption closure
    - TRQ closure
    - GHG closure
  - Extended production closure
    - CAP closure
      - Segmented factor markets closure
      - Land supply closure
    - Biofuels closure
    - Investment closure
    - Consumption closure
    - TRQ closure
    - GHG closure
- MGTAP closure

Sets
- Sets added to GTAP

Module definition
- GTAP model code
  - MGTAP model code
  - MGTAP closure

Key:
- GTAP
- MAGNET