

Wageningen Economic Research Agency Report – MAGNET activities 2020-2021

1 Introduction

Wageningen Economic Research part of Wageningen University and Research (WUR), has been a member of the GTAP consortium since November 1996. The standard GTAP model constitutes the basis of the MAGNET model, a modular CGE model approach developed at Wageningen Economic Research. Hence the name MAGNET, short for “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. In addition to Wageningen Economic Research, MAGNET is used and developed by researchers from the Joint Research Centre of the European Commission (JRC) and the Thünen Institute (TI), with the cooperation being organized in a MAGNET consortium.

Extensions to the GTAP model and database in MAGNET are driven by our motivation to navigate to a more equitable and sustainable future world. Our focus is on integrative macro-economic analyses through cooperation within the MAGNET team and by connecting to other models. We deliver foresight macro-economic analyses of climate change, food and nutrition security, inequality and the biobased economy.

In the following a summary of the activities of the MAGNET team at Wageningen Economic Research in 2020/2021. The MAGNET website (<https://www.magnet-model.eu/>) provides access to project information, module descriptions, publications and presents the MAGNET team members. In 2020 we welcomed two new but familiar MAGNET team members. Willem-Jan van Zeist joined the MAGNET team in 2020. Willem-Jan was previously at PBL where as part of his work for the IMAGE model he became familiar with MAGNET and the team. And after several years at IIASA in the GLOBIOM modelling team Michiel van Dijk is back at the WEcR and joined MAGNET. By bringing valuable experience with spatially explicit assessments and other models both strengthen our capacity for integrated assessments. There was also very sad news in 2020 with the passing of Edward Smeets. Although Edward left MAGNET and WEcR in 2018 we still miss his eye for technical details in all biomass related matters. But foremost we miss him as a warm and generous person always willing to help others out, also outside of work.

2 Journal papers

- Bekkers, E., A. Antimiani, C. Carrico, D. Flaig, L. Fontagne, J. Foure, J. Francois, K. Itakura, Z. Kutlina-Dimitrova, W. Powers, B. Saveyn, R. Teh, F. van Tongeren and M. Tsigas (2020). “Modelling trade and other economic interactions between countries in baseline projections.” **Journal of Global Economic Analysis**. 5(1), 273-345.
- Catharina Latka, Marijke Kuiper, Stefan Frank, Thomas Heckeleei, Petr Havlík, Heinz-Peter Witzke, Adrian Leip, Hao David Cui, Anneleen Kuijsten, Johanna Marianne Geleijnse, Michiel van Dijk (2021). Paying the price for environmentally sustainable and healthy EU diets. **Global Food Security**, 28, pp. 100437. <https://doi.org/10.1016/j.gfs.2020.100437>
- Chateau, J., E. Corong, E. Lanzi, C. Carrico, J. Fouré, and D. Laborde (2020). “Characterizing supply-side drivers of structural change in the construction of economic baseline projections.” **Journal of Global Economic Analysis**. 5(1). 109-161.

- David Leclère, Michael Obersteiner, Mike Barrett, Stuart H. M. Butchart, Abhishek Chaudhary, Adriana De Palma, Fabrice A. J. DeClerck, Moreno Di Marco, Jonathan C. Doelman, Martina D'Urquero, Robin Freeman, Michael Harfoot, Tomoko Hasegawa, Stefanie Hellweg, Jelle P. Hilbers, Samantha L. L. Hill, Florian Humpenöder, Nancy Jennings, Tamás Krisztin, Georgina M. Mace, Haruka Ohashi, Alexander Popp, Andy Purvis, Aafke M. Schipper, Andrzej Tabeau, Hugo Valin, Hans van Meijl, Willem-Jan van Zeist, Piero Visconti, Rob Alkemade, Rosamunde Almond, Gill Bunting, Neil D. Burgess, Sarah E. Cornell, Fulvio Di Fulvio, Simon Ferrier, Steffen Fritz, Shinichiro Fujimori, Monique Grooten, Thomas Harwood, Petr Havlík, Mario Herrero, Andrew J. Hoskins, Martin Jung, Tom Kram, Hermann Lotze-Campen, Tetsuya Matsui, Carsten Meyer, Deon Nel, Tim Newbold, Guido Schmidt-Traub, Elke Stehfest, Bernardo B. N. Strassburg, Detlef P. van Vuuren, Chris Ware, James E. M. Watson, Wenchao Wu, Lucy Young (2020). Bending the curve of terrestrial biodiversity needs an integrated strategy. **Nature**, 585(7826), pp. 551–556.
- George Philippidis, Lindsay Shutes, Robert M'barek, Terecia Ronzon, Andrzej Tabeau, Hans van Meijl (2020). Snakes and ladders: World development pathways synergies and trade-offs through the lens of the Sustainable Development Goals. **Journal of Cleaner Production**, 267, pp. 122147.
- Hans van Meijl, Andrzej Tabeau, Elke Stehfest, Jonathan Doelman, Paul Lucas (2020). How food secure are the green, rocky and middle roads: food security effects in different world development paths. **Environmental Research Communications**, 2(3), pp. 031002.
- Hans van Meijl, Lindsay Shutes, Hugo Valin, Elke Stehfest, Michiel van Dijk, Marijke Kuiper, Andrzej Tabeau, Willem-Jan van Zeist, Tomoko Hasegawa, Petr Havlík (2020). Modelling alternative futures of global food security: Insights from FOODSECURE. **Global Food Security**, 25, pp. 100358.
- Kreiss CM, Papathanasopoulou E, Hamon KG, Pinnegar JK, Rybicki S, Micallef G, Tabeau A, Cubillo AM and Peck MA. 2020. Future Socio-Political Scenarios for Aquatic Resources in Europe: An Operationalized Framework for Aquaculture Projections. **Front. Mar. Sci.** 7:568159. <https://doi.org/10.3389/fmars.2020.568159>
- Marcel T.J. Kok, J.W. Meijer, Willem-Jan van Zeist, Jelle P. Hilbers, Marco Immovilli, Jan H. Janse, Elke Stehfest, Michel Bakkenes, A.A. Tabeau, Aafke M. Schipper, J.R.M. Alkemade, 2020. Assessing ambitious nature conservation strategies within a 2 degree warmer and food-secure world. **bioRxiv**. <https://doi.org/10.1101/2020.08.04.236489>
- Marijke Kuiper, Hao David Cui (2020). Using food loss reduction to reach food security and environmental objectives A search for promising leverage points. **Food Policy**, pp. 101915.
- Marijke Kuiper, Lindsay Shutes, Hans van Meijl, Diti Oudendag, Andrzej Tabeau (2020). Labor supply assumptions - A missing link in food security projections. **Global Food Security**, 25, pp. 100328.
- Marnix Brinkman, Jason Levin-Koopman, Birka Wicke, Lindsay Shutes, Marijke Kuiper, Andre Faaij, Floor van der Hilst (2020). The distribution of food security impacts of biofuels, a Ghana case study. **Biomass and Bioenergy**, 141, pp. 105695.
- Pinnegar JK, Hamon KG, Kreiss CM, Tabeau A, Rybicki S, Papathanasopoulou E, Engelhard GH, Eddy TD, and Peck MA. 2020. Future socio-political scenarios for aquatic resources in Europe: a common framework based on shared-socioeconomic-pathways (SSPs). **Front. Mar. Sci.**
- Sandra G. Marquardt, Jonathan C. Doelman, Vassilis Daioglou, Andrzej Tabeau, Aafke M. Schipper, Sarah Sim, Michal Kulak, Zoran J.N. Steinmann, Elke Stehfest, Harry C. Wilting, Mark A.J. Huijbregts, 2021, Identifying regional drivers of future land-based biodiversity. **Global Environmental Change**, Volume 69, July 2021, 102304.
- Tomoko Hasegawa, Shinichiro Fujimori, Petr Havlík, Hugo Valin, Benjamin Leon Bodirsky, Jonathan C. Doelman, Thomas Fellmann, Page Kyle, Jason F. L. Koopman, Hermann Lotze-Campen, Daniel Mason d'Croz, Christoph Müller, Yuki Ochi, Ignacio Pérez Domínguez, Elke Stehfest, Timothy B. Sulser, Andrzej Tabeau, Kiyoshi Takahashi, Jun'ya Takakura, Hans van Meijl, Willem-Jan van Zeist, Keith Wiebe, Peter Witzke (2020). Reply to: An appeal to cost undermines food security risks of delayed mitigation. **Nature Climate Change**, 10(5), pp. 420–421.

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- Verma, M., L. de Vreede, T. Achterbosch, M. Rutten. (2020) Consumers discard a lot more food than widely believed: Estimates of global food waste using an energy gap approach and affluence elasticity of food waste. **PLoS One** 15(2).
- Willem-Jan van Zeist, Elke Stehfest, Jonathan C. Doelman, Hugo Valin, Katherine Calvin, Shinichiro Fujimori, Tomoko Hasegawa, Petr Havlik, Florian Humpen\oder, Page Kyle, Hermann Lotze-Campen, Daniel Mason d'Croze, Hans van Meijl, Alexander Popp, Timothy B. Sulser, Andrzej Tabeau, Willem Verhagen, Keith Wiebe (2020). Are scenario projections overly optimistic about future yield progress?. **Global Environmental Change**, 64, pp. 102120.

3 Book chapters

- Akgul, Z., C. Carrico, and M. Tsigas (2021). "Labor Composition of Fixed Costs, Heterogeneous Firms, and the US Labor Market." in P. Dixon, J. Francois, and D. van der Mensbrugge (Eds.), **Policy Analysis and Modeling of the Global Economy: A Festschrift Celebrating Thomas Hertel** (199-248). World Scientific Publishing.
- Kandemir, C Reynolds, M Verma, M Grainger, G Stewart, S Righi, S Piras, M Setti, M Vittuari, T Quested (2020). Discrete event simulation; machine learning; Bayesian networks; agent-based modelling; and mass balance estimation in **Routledge Handbook of Food Waste**. (eds) C Reynolds and T Soma.

4 Presentations

4.1 Upcoming

- Alessandro Gatto, Maksym Chepeliev, Marijke Kuiper and Hans van Meijl (forthcoming). **Healthier but Wasteful? Changes in food loss and waste along global supply chains with healthier diets**. Presentation at the 24th Annual Conference on Global Economic Analysis, Virtual meeting.
- Bartelings, Heleen, Monika Verma and Kirsten Boysen-Urban (forthcoming) **Waste management and circular economy in a CGE framework**. Presentation during the 24th Annual Conference on Global Economic Analysis (Virtual Conference).
- Benedetta Falsetti, Jason Levin-Koopman, Caitlyn Carrico, Luca Ridolfi, Francesco Laio, (forthcoming) **Impact of the implementation of the African Continental Free Trade Area (AfCFTA) on virtual water trade flows**. Presentation at the 24th Annual Conference on Global Economic Analysis, Virtual meeting.
- Carrico, C., D. Cui, and A. Tabeau. "Disaggregating Underlying Drivers of Fruit and Vegetables Trade: an HS-level Modelling Analysis of the AfCFTA." 24th Annual Conference on Global Economic Analysis, Virtual Conference, planned 2021.
- Jason Levin-Koopman, Caitlyn Carrico, Benedetta Falsetti (forthcoming) **The Advent of the AfCFTA: New Possibilities and Implications for the African Land-Water-Climate-Food Nexus**. Presentation at the 24th Annual Conference on Global Economic Analysis, Virtual meeting.

4.2 Conferences

- Carrico, Caitlyn, Andrzej Tabeau and Marijke Kuiper (2020). **Modelling Trade Growth for Long-Run Economic Prospects: Improving Trade to Income Elasticity Calibration in Baselines**. Paper presented at the 23rd Annual Conference on Global Economic Analysis, Virtual meeting.
- Diogo, Vasco, Wil Hennen, Walter Cervi, Marijke Kuiper (2020). 'Simulating global agricultural land-use change as local economic decisions in a multi-model framework: strengths, limitations and ways forward'. International Congress on Environmental Modelling and Software, Brussels, Belgium.
- Emanuele Ferrari, Zuzana Smeets Kristkova: **Modelling impact of EU policies on developing countries – Forward-looking assessment**. Paper presented at the Organized session on

the Evidences on the impact of the CAP on developing countries - A look back and the way forward. XVI EAAE Virtual Congress, July 2021.

- Hans van Meijl, David Cui, Saeed Moghayer, Andrzej Tabeau, Heleen Bartelings, Caitlyn Carrico, **Assessing the economic impact of COVID-19 on the agrifood system and on global food security: exploring different macro-economic and international trade scenarios**, Paper presented at the 23rd Annual Conference on Global Economic Analysis, Virtual meeting.
- Kuiper, Marijke, Caitlyn Carrico and Andrzej Tabeau (2020). **Calibrating relative wages induced by changed skill rates in long run projections**. Paper presented at the 23rd Annual Conference on Global Economic Analysis, Virtual meeting.
- Kuiper, Marijke, Gonne Beekman and Thom Achterbosch (2020). **Tailoring to scale Macro enablers & micro triggers for inclusive sustainable food systems**. Keynote on global food security at the Symposium Dutch Agriculture, European Policies and Global Food System Transitions on 2, 3 and 4 November 2020.
- Zuzana Smeets Kristkova, David Cui, Andrzej Tabeau, Hans van Meijl, Robert M'Barek, Kirsten Boysen Urban: **Holistic approach to assess the impact of green Investments using the MAGNET model**. Paper presented at the 23rd Annual Conference on Global Economic Analysis, Virtual meeting.
- Zuzana Smeets Kristkova, John Helming, George Philipiddis, Pierre Boulanger: **External dimensions of the CAP – focus on Sub-Saharan Africa**. Paper presented at the XVI EAAE Virtual Congress, July 2021.
- Zuzana Smeets Kristkova, Thijs de Lange, Thom Achterbosch: **The role of labour markets in households income and nutrition– case of Nigeria**. Presentation prepared for the EcoMod Conference on Economic Modelling, July, 2021.

4.3 Other presentations

- Carrico, Caitlyn. **"Impacts of the EU-Mercosur trade agreement on the Dutch economy."** U.S. International Trade Commission Economics Webinar Series, 2021.
- Hans van Meijl & Willem-Jan van Zeist (2020). **Presentations at the GLOBIOM/MAGNET training for SUPREMA**. <https://www.suprema-project.eu/training-sessions>
- Marijke Kuiper (2021). **Team-based model development in a project-based organization – lessons from a decade of MAGNET development**. WUR Good Modeling Practice webinar, May 31st, 2021.
- Saeed Moghayer (2020). **Food Security aspects of Bangladesh Delta Plan 2100**, Bangladesh Metamodel Workshop on Waste, Agriculture and Food Security, August, 2020.
- Willem-Jan van Zeist (2020). **Adventures in Bending the Curve**. IMAGE symposium, November 26, 2020.
- Willem-Jan van Zeist (2021). **MAGNET overview and examples**. IMAGE lecture series. March 26, 2021.

5 Reports

- Blanco, M., Arfa, I., Doelman, J., Janse, J., Stehfest, E., Alexandri, E., Bodirsky, B., Weindl, I., Levin-Koopman, J., Tabeau, A., van Meijl, H., Beltramo, A., Ramos Pereira, E., Teutschbein, C., Blicharska, M., Conradt, T., Hesslerová, P., Pokorný, J., Kravcík, M., ... Mereu, S. 2020. **D3.5: Final report on the application of thematic models**. <https://edepot.wur.nl/538096>
- Carrico, C., E. Corong, and D. van der Mensbrugge (2020). **"The GTAP version 10A Multi-Region Input Output (MRIO) Data Base"**. GTAP Memorandum 34. Center for Global Trade Analysis, Purdue University.
- Carrico, C., van Berkum, S., Tabeau, A., Jager, J., & Plaisier, N. 2020. **Impacts of the EU-Mercosur trade agreement on the Dutch economy**. (Report / Wageningen Economic Research; No. 2020-065). Wageningen Economic Research. <https://doi.org/10.18174/539424>

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- David Cui, Caitlyn Carrico, and Andrzej Tabeau (2020). "**D3: Capturing HS level trade flows in MAGNET**" for project "MAGNET Development and Application to Trade Modelling" of the AgEconEurope Framework contract 935680-2018-A08-NL.
- Diti Oudendag, Monika Verma, Andrzej Tabeau and George Phillipides (2020) D4: final report on activities under task 5 and 6 for the project "**MAGNET – Development and Application to BioEconomy Modelling**" of the AgEconEurope Framework contract 935680-2018-A08-NL
- Ezra Berkhout, Elie Kodsi, Maurits van den Berg, Willem-Jan van Zeist, Richard Mwandundu, Stefan van der Esch, Felix Rembold, Michele Meroni, Michael Cherlet. **Future Perspectives on Land for Eastern Africa: a pilot study focusing on Ethiopia and Kenya**. UNDP, PBL, JRC, WUR, 2021.
- Heleen Bartelings, Monika Verma, George Philippidis (2020) D4: Final deliverable of project "**Improvement of modelling features of the CAP for sustainability**" part of the of the AgEconEurope Framework contract 935680-2018-A08-NL.
- Marijke Kuiper, Monika Verma. **Identifying synergies and trade-offs with food system interventions- Projected changes by 2050 in inclusiveness, nutrition, economy and sustainability using global CGE modelling**. Forthcoming background paper for the IFAD Rural Development Report 2021.
- Willem-Jan van Zeist, Andrzej Tabeau, Hans van Meijl. **De toekomst van de land- en tuinbouw in Nederland, binnen de Europese en mondiale context**. Forthcoming report for the Dutch Ministry of Agriculture, Nature and Food Quality (2021)
- Zuzana Smeets-Kristkova, Hao David Cui, Hugo Ferrer Pérez, María Pilar Gracia de Rentería, George Philippidis, Ana Isabel Sanjuán López (2021). "**Improvement of R&I treatment and SDGS**" of the AgEconEurope Framework contract, D3, 935680-2018-A08-NL.

6 Projects

As the MAGNET team is large (14 current members) we also run a large number of projects (a total of 34 in 2020 with a budget of about 1.3 million Euro) we highlight the areas we work in, grouping work in different projects together by topic.

Integrated assessments of sustainability

- *SIM4NEXUS, KB-Integrated toolbox for climate and circularity, KB-Multiple scales, SUPREMA, GLO2 African scenarios, AGMIP diets, AgMIP Deep Decarbonization*

MAGNET has a long standing cooperation with other models (like IMAGE from the Netherlands environmental Agency and GLOBIOM at IIASA). Currently we are building on this experience to develop stronger links to the many biophysical oriented models available at Wageningen University and Research. These projects, where MAGNET provides the socio-economic complement to detailed biophysical analyses in other models generally focus on integrated assessments of sustainability.

Food system assessments

- *RDR21, A4NH Food systems foresight, Dhaka food systems, BGD Deltaplan, CCAFS*

Building on the initial food system work in the FoodSecure and SUSFANS projects work continues on modelling food system interventions analysing the system impacts of primary production, supply chain and consumption interventions. These studies vary in terms of global scope with aggregate regions, zooming in on how different economic characteristics alter impacts of comparable policies to country-focussed studies (Nigeria, Ethiopia, Bangladesh, Vietnam) enabling the connection to sub-national analyses with micro simulations at household level (Ethiopia) or with a metropolitan focus (Dhaka). This line of works builds on work developed in different strands of research (like SDGS or climate) bringing these together to identify trade-offs and synergies.

Bioeconomy & circularity

- *Connected Circularity, Biomonitor, MAGNET bioeconomy modelling, Data for bioeconomy, PATHWAYS, DG-ENV biobased plastics, KB-Integrated toolbox for climate and circularity, Contribution Bio_economy EU*

Early influential work on land and agriculture exemplified by the EUruralis project has expanded in recent years to modelling the bioeconomy in a wider sense to address the food-feed-fuel-fibre competition. When combined with more technical data and modelling efforts MAGNET proves to have an edge in pulling analyses together into an economywide framework beyond the grasp of the partial technical models. Major challenges in this line of work is to combine the dollar-based quantities with biophysical material balances in a consistent manner. Specific extensions of MAGNET are development of a waste module and associated database to analyse different options of using waste and the sectors associated with this; development of a database on biophysical flows accounting for food loss and waste (FLW) jointly with the GTAP centre; current and future to better capture technical details of livestock production and options for a more circular economic system; further enhancement of the modelling of industrial use of biomass (eg for bioplastics).

Climate & energy & water

- *AGCLIM III, AGCLIM IV, SIM4NEXUS, LNV scenario studies, PBL Baselines and mitigation, PATHWAYS*

While connected to the bioeconomy and integrated assessments several projects focus explicitly on climate change mitigation and/or water use. Key developments here are the modelling of natural resource supply functions (needed to allow a reduction in global fossil fuel use in climate mitigation policies) and incorporation of water use in production (two approaches are tested and top-down and bottom-up module). Linked to the analysis of the role of livestock in the circular bioeconomy work is planned to add biogas, manure and swilladding again more details to the interaction between food and energy sectors. Improving the tracing of biophysical flows (like respecting energy balances) also forms an important component in this strand of work. It is both needed to communicate MAGNET stand-alone results in terms of physical units relevant for policy design as well as enabling a better link to biophysical models in integrated assessments.

Technical change and investment towards a greener economy (Green Deal)

- *MAGNET Green CAP, Bioeconomy to Green Deal, Green deal modelling, LNV scenario studies*

Technical change is a second theme that got revived by changes in the policy landscape: the European Green Deal focuses on hat aims to transform the EU into resource-efficient and competitive economy, with no net emissions of greenhouse gases in 2050. Using MAGNET for investment impact analysis requires that modelling investments is guided by a proper sector investment allocation mechanism, allowing to steer investments into the sectors that are "green", or aligned with the EU taxonomy. Sector allocation of investments is our priority in 2020-21 as this is key to assessing potential pathways towards a more sustainable EU bioeconomy. Alongside these model enhancements policy focussed work for the Dutch Ministry of agriculture is ongoing on the impacts of a greener EU on the Netherlands.

Trade

- *EU-Mercosur, Brexit, MAGNET trade, BATmodel*

The revived interest in trade policies in the past years are reflected in our projects with a mix of policy and modelling-focussed projects. In 200-20-21 we analysed the impacts of the Mercosur trade agreement by request of the Dutch parliament as part of the ratification process. Currently we are working on updating our 2018 study on the impact of the Brexit on European fisheries, aquaculture and fish processing sectors for the European Parliament.

On the model development side we worked on converting the GTAP-HS model in a MAGNET module, enhancing our future ability to trac trade flows at HS6 level. Further extensive modular developments in MAGNET's ability for trade analyses are planned in the EU H2020 BATModel project (2020-2024). The overall goal of BATModel is to improve existing trade modelling tools and approaches, equipped for the analysis of 21st-century trade issues with a focus on agriculture and food to support policy analysis. The current needs of the users are to better account for previously neglected or insufficiently covered issues such as NTMs, GIs, zero trade flows and quality differentiation (as explicitly mentioned in the text of the call), as well as GVCs and distributional and sustainability impacts of trade liberalisation and trade policy. BATModel will address these shortcomings by building upon advances in international trade theory and global value chain

frameworks. As a major contribution, BATModel will bridge the gap between the established simulation models, based on the aggregate agent paradigm, and the micro evidence revealed by models that account for heterogeneity in firms, territories, producers and consumers. The MAGNET contributions in BATModel focus on (1) broadening welfare measurements (specifically employment & income distribution, nutrition & health and SDGs); (2) modelling of Global Value Chains; (3) making all CGE model developments available through coding the GEMPACK versions of the BATmodules that will be made publicly available in the course of the project (alongside GAMS versions coded by other consortium members).

Food and nutrition security

- *Veggies & fruit scoping, COVID-19 scenarios, KB-Marine resources, PHD supervision, KB Seaweed, PATHWAYS, Connected Circularity, AGMIP diets*

The existing MAGNET sector splits (enhancing detail to 111 sectors and 125 commodities) will be expanded and where possible cross-checked with technical experts (for example in livestock production). Current focus is to enhance modelling of healthy diets by splitting the fruit & vegetable sector into categories key for nutrition (eg. fruits, leafy green vegetables and nuts). Past work on fisheries and aquaculture is expanded by including the providing of seaweed and capturing the possible trade-offs between use as food or biofertilizers. In 2020 food and nutrition security played a major role in the assessment of the COVID-19 impacts on the Netherlands for the Dutch ministry of Agriculture. More explorative studies analyse the impacts of drastic reductions in meat consumption, as proposed in the EAT-Lancet and other diets.

Inclusiveness, income distribution and SDGs

- *MAGNET labour market, IFAD-RDR, BATmodel, MAGNET investments & SDGs, KB-Multiple scale*

To enhance all MAGNET-based impact assessments several consecutive projects have worked on better capturing changes in skill rates over time and refining the modelling of labour markets by including the five labour types currently available and matching these with data on the number of workers by sector and occupation from IMPACTecon. As labour is the main source of income for the majority of households these refinements enhance the ability to assess changes in income distribution. Using the additional data a labour-based GINI indicator is being developed, capturing at least changes in the inequality of labour income (as sub-national changes in capital, land and natural resource income remain out of reach without adding household level detail). The SDG insights module of MAGNET is continuously expanded with new SDG indicators and supporting indicators to support coherent policies.

Spatially explicit downscaling

- *KB-Multiple Scales, Dhaka food systems*

Linked to the work on food security (calling for an assessment at household and not national level) and climate change (with spatially heterogeneous impacts) work is continuing to downscale MAGNET results. MAGNETgrid (presented at the 2020 GTAP board meeting) is further developed with an emphasis on enhancing the information used in the downscaling process. In a parallel track the enhanced labour detail now available in MAGNET is used for spatially explicit micro-simulations using household survey data with a prototype application in Ethiopia. Another prototype exercise of downscaling is developed for the Dhaka metropolitan area, adding a spatial dimension to MAGNET simulation results.

Maintenance and quality control

- *KB-Regieteam modellen, Data Stewards, MAGNET investments and SDGs, WEcR investment for baseline development*

Maintaining a model developed by large team in a project based environment with limited to no funds for maintenance and quality control is a constant battle. Pairing JRC investments in MAGNET and WEcR wide investments we have been able to secure funds to update the GTAP model at the core of MAGNET to V7 - a major overhaul as all modules had to be tested and adjusted to match new variable and set definitions. Alongside the model overhaul we are working towards a protocol for developing MAGNET baselines which has highlighted the importance of the indicators chosen to

judge a baseline and their possible conflicts. Given the breadth of scope offered by the MAGNET modules some pragmatic guidance is needed on what to check for in a baseline to avoid potential lopsided calibration driven by the project or modelers' specific focus.

Large investments have also been made in automating the transfer & concatenation of model solution files in the DataWareHouse (DWH) developed for database management at WEcR. Through this DWK model solution files are versioned (key for quality control) and made available for further analyses. Specific efforts are made to develop PowerBI templates of commonly reported MAGNET variables, allowing easy and interactive access to model results. For example, using PowerBI Sankey diagrams of waste flows can be generated to visually communicate complex economywide waste flow. MAGNET results in the DWH can also be queried for further analysis in R or through dashboards developments with Shinyapps. The DWH allows queries of MAGNET solution files facilitating data exchange need for linking to other models, like MAGNETgrid which spatially downscales MAGNET results and ongoing work on spatial micro-simulation models.

7 Other Activities

7.1 Team coherence and synergies

A large team and project portfolio provides a continuous challenge to keep both team and model together. Starting in 2021 we have revised the organization of the team, distributing topic-specific coordination tasks like baseline development and cross-project cooperation across the team. Overall developing and maintaining a team-based model like MAGNET in a project-based organization like WEcR remains a continuous challenge.

As part of our effort to consolidate and develop MAGNET we hold regular update meetings and research workshops at Wageningen Economic Research to present research and address specific issues in depth. Below an overview of presentations at these workshops. Their aim is to tackle model development relevant for multiple projects to increase synergies across projects and team members. Typically they consist of short presentations of project results or model issues around a particular topic followed by discussions on how to take these further in ongoing and future projects.

- **Trade (7 June 2021)**
 - Overview of Trade Theme in MAGNET. Caitlyn Carrico.
 - Modelling Trade Growth for Long-Run Economic Prospects: Improving Trade to Income Elasticity Calibration in Baselines. Caitlyn Carrico, Andrzej Tabeau and Marijke Kuiper.
 - HS Module in MAGNET. David Cui, Caitlyn Carrico, and Andrzej Tabeau.
 - Impacts of the EU-Mercosur trade agreement on the Dutch economy. Caitlyn Carrico, Siemen van Berkum, Andrzej Tabeau, Jakob Jager, Nora Plaisier.
 - First trade preference shift results of COVID19 impacts of food and agriculture: MAGNET-based long-term scenario, 2020-21. Hans van Meijl, David Cui, Saeed Moghayer, Andrzej Tabeau, Roel Jongeneel, Petra Berkhout.
- **Modeling Green Deal investments (22 April 2021)**
 - Modelling European Green Deal in MAGNET - investment approach. Zuzana Smeets Kristkova and David Cui.
 - Alternative approaches for modelling Green Deal in MAGNET. Jason Levin Koopman.
 - Established approaches for modelling climate change mitigation in MAGNET. Andrzej Tabeau and Willem-Jan van Zeist.
 - Next steps in moving towards an integrated climate change mitigation in MAGNET. Hans van Meijl.
- **Baseline construction – towards a shared protocol (8 March 2021)**
 - Short Summary of Baseline Issues. Jason Levin-Koopman.
 - BASELINE step by step in one day: AgMIP 2019 baseline example. Andrzej Tabeau
 - Core baseline drivers & indicators – first lessons & ideas from JRC, IFAD and literature. Marijke Kuiper.

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- Single country baselines. Saeed Moghayer.

In addition to these longer and topic focused workshops we have shorter meetings to discuss ambitions of a new project, discuss challenges in an ongoing project or present results of finished projects:

- **Research Areas & New Developments.** Hans van Meijl.
- MAGNET scenarios: **Are scenario projections overly optimistic about future yield progress?** Willem-Jan van Zeist.
- Summary of **MAGNET Transition to GTAP v7.** Heleen Bartelings.
- Modelling Green Deal Investments in MAGNET: **Improvement of R&I Treatment and SDGs** in MAGNET. Zuzana Smeets Kristkova
- Introducing BATmodel: "**Better Agri-food Trade Modelling for policy Analysis**". Marijke Kuiper.
- **Revamping the MAGNET website.** Michiel van Dijk.
- Dhaka food system: **Interactive dynamic model - MAGNET & grids.** Saeed Moghayer.
- Introduction into the **Simple-G model.** Saeed Moghayer
- **Working with the MAGNET Data warehouse and Power BI Refresher.** Eugene Westerhof and Heleen Bartelings. MAGNET training seminar.
- AgClim50_3: **Climate impacts or Extreme events.** Jason Levin-Koopman.
- Updating MAGNET Database: **GTAPV10 and MAGNET Satellite data.** Diti Oudendag, with contributions from Heleen Bartelings and Monika Verma.
- Key **differences between GTAP v6.2 and v7.** Heleen Bartelings, Diti Oudendag and Monika Verma.
- **MAGNET Labour Market Modelling** - a focus on baseline wage developments by labour skill. David Cui, Marijke Kuiper and Andrzej Tabeau.
- **Food systems foresight and healthy diets in Nigeria** - The role of land and labour markets and possibilities of closing the micronutrient gap. Zuzana Smeets Kristkova.

7.2 Development of CGE summer school based on open source version of MAGNET

Linked to Hans van Meijl's professorship at Wageningen University a MAGNET-focused summer school is being developed. This training may become the basis for a regular CGE course at Wageningen University to help attract junior researchers with the required technical skills for modeling. It also provides a testing ground for developing a first open source version of MAGNET. It will have very limited features for education reasons but also because as we are still searching for a business model to fund maintenance and consolidation of model developments that can generally not be funded from individual projects and for which we now rely on MAGNET license fees. Due to COVID restrictions the first CGE summer course is envisaged in 2022.

More information

Marijke Kuiper
Marijke.Kuiper@wur.nl
www.wur.eu/economic-research