

GTAP Board Report 2023

European Commission

The European Commission and its various services are active users of the GTAP database and model as well as other products provided by the GTAP Centre. This report highlights GTAP-related activities for the period 2022-2023 and identifies priority areas for future developments in respect to the GTAP model and databases.

GTAP-related activities

A main focus of the *Joint Research Centre (JRC)* when using the GTAP database is the analysis of agricultural and climate/energy policies.

The global CGE model MAGNET model is used to conduct medium to long-term foresight analyses of EU bio-based sectors, agricultural policy, international trade (EU FTAs and African CFTA), SDGs and food security. We are also conducting analysis on the impact of soil erosion, and economic analysis of food waste and loss as well as changes in dietary habits. MAGNET is calibrated on an extended version of the GTAP database. In cooperation with external researchers, the MAGNET model has been extended to account for food waste along the food value chain – from the producer to the consumer.

We are engaged in the process of linking economic models to other economic simulation models with agricultural focus (e.g., DEMETRA, CAPRI and AGLINK) and to biophysical models (e.g., land use, hydrological, forest, natural capital and crop models) to provide comprehensive and integrated analysis. The single-country CGE model DEMETRA is applied to provide food security analysis in selected developing countries. We are also developing a technique (including artificial intelligence) to help linking global and single-country models. We are also using artificial intelligence with CGE towards improving policy design formulations at country level.

The JRC-GEM-E3 model is mainly applied to analyse EU and global climate and energy policies and the model makes use of the GTAP-Power dataset for calibration. Its baseline is developed by incorporating information from partial equilibrium energy models. A particular focus over the last year was the assessment of energy price shocks and potential response policies to these shocks as well as the role of decarbonization policies to increase resilience against future price shocks. In addition, the JRC-GEM-E3 model has informed impact

assessments on air quality, and continues to contribute to the annual Global Energy and Climate Outlook. We are further working on improving the link to distributional analysis for the EU, which was used to analyse the effect of high energy prices and under price changes from EU climate policy.

DG TRADE uses the GTAP database as part of GTAP models (GTAP-RD, RUNGTAP, GTAP-ERD) for analysis of EU trade policy. In addition, DG TRADE also uses the GTAP database while operating the MIRAGE model. Recent work includes the economic impact assessment of the Mercosur-EU Free trade agreement and the ex-post economic impact assessment of the EU-SADC Economic Partnership Agreement. GTAP was also used to conduct supply chain analysis, complementary to the use of TiVA, and for estimations of duty drawbacks for future EU FTAs. Modelling results for studies are produced in-house and external studies built on these.

Future work by DG TRADE relates to attempts to econometrically assess the impact of openness and trade on productivity with the objective to eventually producing estimates at GTAP sector level that can be used for CGE modelling purposes. A second strand of similar work would be to look at the impact of FDI on productivity.

Several **other Commission services** (e.g. DGs ENER, CLIMA, AGRI, EMPL, GROW) are not running models based on the GTAP dataset in house, but rely on GTAP-based model results for their policy making. The numerical modelling is either provided by the JRC or by external consultants. There are also other CGE models operated at the JRC (like the regional model RHOMOLO, the multi-regional macroeconomic model CORTAX¹ focused on corporate taxation model, and the single-country overlapping generations model EDGE-M3 focused on household taxation and pensions) which do not use GTAP data.

Priority areas for future improvements

The European Commission services actively using the GTAP database as an input to their daily impact assessment and analytical activities have highlighted some priority areas for future improvements.

The GTAP database and the accompanying CGE modelling framework has been constantly improved and extended to cover a broad range of policy issues. Several additional improvements are deemed important by the GTAP users at the European Commission.

- In the light of the global energy crisis and ongoing energy transition, we would see the need to further **improve the energy representation**. This includes alignment with

¹ CORTAX is currently a single-good model. If CORTAX was extended to multiple sectors, or if we seek to track the destination of (cross-border) sales more closely, the GTAP database may have a role in the future.

data of production and international trade, we well as considering emerging technologies that are expected to replace fossil fuels.

Global (fossil and renewable) **energy production and trade** should ideally be consistently aligned with international data from IEA or Irena. Especially for natural gas trade of Europe, we had some difficulties reconciling the exposure of EU member states to gas imports from Russia.

When assessing ambitious decarbonization scenarios, a **further disaggregation of energy** sectors would be quite helpful. An explicit representation of **heat and electricity** would be a useful addition to the GTAP-Power database, and **emerging technologies** like (green) hydrogen may need to be represented in the future. With regards to **biofuels**, it would be very useful to have a version of the database available that includes both biofuels and the power sector disaggregation.

Along the same lines, the GTAP database already brings good **detail of the industrial sectors**, but further disaggregation of certain subsectors (e.g., cement, fertilizers, and aluminium) would be desirable to enhance climate policy analysis. Additionally, we foresee potential uses for the **GTAP-Circular Economy database** in our future work. As such, we are interested in following further developments of the sectoral splits into primary and secondary production as well as links to material flows.

- For the upcoming years to come, exploring the **trade and climate change nexus** will be one of the priorities of DG TRADE along with many other Commission services. In this context, GTAP-IAM should replace GTAP-RD, the supported dynamic version of the GTAP model. A substantial improvement would be the **integration of the GTAP-IAM with the MRIO**. It would improve the quality of value chain analysis by having the source of imported inputs and having different tariffs at the agent level.
- In the last years, both new model versions and satellite data have been supplied. However, navigating between database versions, modelling tools and aggregation software is becoming difficult. Furthermore, it is complicated to understand which parts are standard (so continuously updated and supported) and which are not. An overview of **which model is compatible with which dataset** would be useful, for example, in a matrix format. A schedule of what is going to become standard (and not) would equally be helpful (subject Board discussion and common priorities).
- The introduction of a **global, bilateral NTMs database** would be welcomed as a starting point for broader trade policy scenarios.
- The **role of (international) transport** could be further improved in several dimensions. We have submitted to GTAP a set of services trade elasticities that have been produced by CEPII, but they have not been taken up in the GTAP 11 database.

The JRC has started to look into disaggregating transport sectors (land, air, water) into passenger and freight transport. We looked at several sources of external data, such as SBS - Eurostat Structure Business Statistics; BPM6 – Eurostat International Trade in Services; and the outcomes of bottom-up technology models, to further implement a disaggregation of the transport sectors into passengers and freight in the GTAP database. We should note that this activity is ongoing and further improvements are still foreseen over the next year.

- The recent **improvements in regional coverage** has been very welcome especially with respect to the analysis on the African countries. Some countries still remain in regional aggregates and their further disaggregation would be welcome as well. The JRC is also engaged in producing SAM database for specific sub-Saharan Africa countries (Kenya, Senegal, Ghana, Cote d'Ivoire, South Africa, Niger, Nigeria, Cameroon and Ethiopia). On the sectoral level, some **further split of agricultural and food commodities** (e.g. maize, beef cattle, poultry and pigs as separate sectors and commodities) and the associated calorific data would be useful for the analysis of agri-food sectors and food security.
- The new dynamic version of the MAGNET model includes some new data in the model for **international financial flows**. According to our experience, the new additions (e.g. foreign assets and liabilities and FDIs) improve the baseline behaviour. It would be ideal if the GTAP database already included this data as fully compatible and tested. The GTAP-RD could benefit of the data as it would make it easier to build a consistent baseline when the foreign assets and liabilities can be tracked as well.
- The JRC is working on a new **investment matrix** for its JRC-GEM-E3 model based on Eurostat data for the EU member states as well as bottom up data for investments in (renewable) power sector. This allows to include feedbacks from additional investment demand to sectors supplying (additional) investment goods, e.g. for the energy transition.

Selected publications and policy documents based on GTAP data or models

Agriculture, bioeconomy, food and trade policy analyses

Binfeld, J., Boulanger, P., Davids, T., Dudu, H., Ferrari, E. and Mainar Causapé, A., Trade liberalisation in Kenya: A modelling linkage for wheat and maize, *African Journal of Agricultural and Resource Economics*, 2022, 17 (1), p. 1-30.

European Commission (2022). EU Agricultural Outlook for markets, income and environment 2022-2032. https://agriculture.ec.europa.eu/data-and-analysis/markets/outlook/medium-term_en

Ferreira, V., Almazán-Gómez, M.Á., Nechifor, V. and Ferrari, E., The role of the agricultural sector in Ghanaian development: a multiregional SAM-based analysis, *Journal Of Economic Structures*, 2022, 11, p. 6.

Philippidis, G., M'barek, R., Boysen-Urban, K. and Van Zeist, W., Exploring economy-wide sustainable conditions for EU bio-chemical activities, *Ecological Economics*, 210, 2023, p. 107857.

Simola, A., Boysen, O., Ferrari, E., Nechifor, V. and Boulanger, P., Economic integration and food security – the case of the AfCFTA, *Global Food Security*, ISSN 2211-9124, 35, 2022, p. 100651.

Simola, A., Boysen, O., Ferrari, E., Nechifor, V. and Boulanger, P., Effects of the African Continental Free Trade Area on Food Security, European Commission, 2022.

Climate and energy policy analyses at EU and global level

Connell Garcia, W., Di Comite, F., Garrone, M., (2023). Evidence on the Exposure and Impact of the Ongoing Energy Crisis on the EU Industry. *Single Market Economics Briefs*, 3. <https://ec.europa.eu/docsroom/documents/53134/attachments/1/translations/en/renditions/native>

Garaffa et al. (2023). Direct and embodied energy and emissions trade in a decarbonised world. GTAP 2023 Conference Paper. https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=6945

Garaffa et al. (2023). Global and Regional Energy and Employment Transition Implied by Climate Policy Pledges. <http://dx.doi.org/10.2139/ssrn.4141955>

Keramidas et al. (2022). Global Energy and Climate Outlook 2022: Energy trade in a decarbonised world. Publications Office of the European Union, Luxembourg, 2022, doi:10.2760/863694

Norman-López et al. (2023). Integrating air passenger and air freight transport into a global CGE model to analyse European Union policies tackling greenhouse gas emissions from aviation. GTAP

2023 Conference Paper.

https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=6906

Tamba, M., Krause, J., Weitzel, M., Ioan, R., Duboz, L., Grosso, M., & Vandyck, T. (2022). Economy-wide impacts of road transport electrification in the EU. *Technological forecasting and social change*, 182, 121803.

Vandyck, T., Della Valle, N., Temursho, U., & Weitzel, M. (2023). EU climate action through an energy poverty lens. *Scientific Reports*, 13(1), 6040.

Vandyck, T., Temursho, U., Landis, F., Klenert, D., & Weitzel, M. (2022). Prices and standards for vertical and horizontal equity in climate policy. Available at SSRN 4144282.

Weitzel et al. (2023). Modelling the effect of higher energy prices on the EU economy. GTAP 2023 Conference Paper. https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=6799

European Green Deal policy documents

European Commission (2022). The Third Clean Air Outlook. COM(2022) 673 final, and the underlying report available at <https://circabc.europa.eu/ui/group/cd69a4b9-1a68-4d6c-9c48-77c0399f225d/library/4f014b48-eb5a-417c-88f2-abe6bb0abdc3/details>

European Commission (2022). Impact Assessment Report accompanying the document Proposal for a Directive of the European Parliament and of the Council on ambient air quality and cleaner air for Europe (recast). SWD(2022) 545 final

European Commission (2022). Impact assessment accompanying the document Proposal for a Regulation of the European Parliament and of the Council on fluorinated greenhouse gases. SWD(2022) 96 final

European Commission (2023). Commission Staff Working Document: Investment needs assessment and funding availabilities to strengthen EU's Net-Zero technology manufacturing capacity. SWD(2023) 68 final

Resilience

Dimitrov, G. and D. Kancs (2023). Economic Impacts of Resilience Investment Strategies: A Model-based Analysis, JRC Technical Report JRC115573, European Commission, <https://doi.org/10.2760/24769>

Kancs, D. (2023) "Disaster Risk and Resilience", 2023 GTAP Conference Paper, to be presented during the 26th Annual Conference on Global Economic Analysis (Bordeaux, France).

https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=7007

Kancs, D. (2022). Enhancing Resilience: Model-based Simulations, NATO Science and Technology Organization Meeting Proceedings

<https://www.sto.nato.int/publications/STO%20Meeting%20Proceedings/STO-MP-MSG-197/MP-MSG-197-11.pdf>

Social Accounting Matrices and Other Data Advances

El Meligi, A., Ferreira, V., Mainar Causapé, A., Philippidis, G., Ronzon, T., Ferrari, E. and M`barek, R., The food system in the wider bioeconomy: the BioSAM perspective, EUR 31107 EN, Publications Office of the European Union, Luxembourg, 2022, doi:10.2760/66011.

Norman-López et al. (2023, in press). Building a baseline to better integrate air passenger and air freight transport into a global Computable General Equilibrium (CGE) model.