

D2.4: FINAL (MAINTENANCE)  
STABLE RELEASE VERSION  
DOWNLOADABLE WITH  
INSTRUCTIONS AND TEST  
REPORT FOR CAPRI, INCLUDING  
ANNEX ON PROCEDURES IN  
OTHER MODELLING SYSTEMS

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# Executive summary

From 2016, the CAPRI model was made more accessible to the scientific community by the provision of supported stable releases. The stable releases are tagged and “frozen” versions of the model that can be referenced to and that will not change. The bug fixes and other code updates result in new releases with updated revision numbers. The release versions have been subjected to extensive testing, ensuring that all supported features technically work under different hardware/software settings.

The release process starts by defining a list of supported features of the model that are to be tested, and proceeds in an iterative fashion to test those features under variations of technical conditions such as software/hardware environment, perturbations in starting values etc. The purpose is to detect processes and data constellations that are not stable under variation of irrelevant external factors, to improve reproducibility of results and overall performance of the system.

During this project, we have come a long way towards producing an entirely new generation of CAPRI releases, starting with STAR 3.0. STAR 3 not only includes novel developments from various modelling projects, but it also removes some features that are no longer supported, such as the regional CGE models. The set of test routines was revised accordingly, taking developments of the GAMS software and general computer hardware developments into account. The number of tests was also extended and attached (at their present state) to this document. For instance, the ability to add random disturbances to stored (re-)start values was extended in this project and stability tests for various PMP-parameters were added. Several potential stability risks caused by non-unique file names were also mitigated, and the computational performance of selected subroutines improved.

Unfortunately, at the deadline for this deliverable, the code was not yet sufficiently stable for publication. Instead, we offer a new maintenance release of the established 2<sup>nd</sup> generation of releases, called STAR 2.5, with test report and download instructions. Links to the repositories are provided in this document and on the CAPRI model homepage.

In addition to the development work in CAPRI, we also surveyed testing and versioning in other models of the SUPREMA family. Since (i) we learn from CAPRI that instabilities can easily find their way into complex systems, and (ii) no other model system in SUREMA has formalized rigorous test protocols, we recommend that the teams behind GLOBIOM, MAGNET and AGMEMOD start to undertake regular tests of stability for their models to verify that they behave as expected under variation of seemingly irrelevant conditions.

## Changes with respect to the DoA

During the project, the deadline was extended by 1 month by invocation of the “force majeure clause”.

## Dissemination and uptake

This document is primarily intended for the modelling community behind the SUPREMA models.

#### Short Summary of results (<250 words)

We document the code developments and test routines achieved to prepare for the next generation of CAPRI models, STAR 3. The incremental release of CAPRI STAR 2.5 is tested and published for open dissemination. A survey of versioning and testing activities in other model in the SUPREMA family is carried out and presented.

#### Evidence of accomplishment

The release STAR 2.5 was published on April 30, 2020 on the CAPRI model web page, and a download test was done to verify that the links function:

<https://www.capri-model.org/dokuwiki/doku.php?id=capri:get-capri>.

## Glossary / Acronyms

As the document is written, terms and glossary will be added here as needed. Before the last version is submitted, this list will be re-arranged alphabetically by the lead author.

| TERM    | EXPLANATION / MEANING  |
|---------|--|
| CGE     | COMPUTABLE GENERAL EQUILIBRIUM   |
| CNS     | CONSTRAINED NONLINEAR SYSTEM   |
| DNLP    | DISCONTINUOUS NONLINEAR PROGRAM  |
| GAMS    | GENERAL ALGEBRIC MODELING SYSTEMS  |
| GEMPACK | GENERAL EQUILIBRIUM MODELLING SOFTWARE   |
| GIT     | A VESION HANDLING SYSTEM FOR SOFTWARE DEVELOPMENT. SEE "SVN".  |
| GUI     | GRAPHICAL USER INTERFACE   |
| NLP     | NONLINEAR PROGRAM  |
| PMP     | POSITIVE MATHEMATICAL PROGRAMMING  |
| STAR    | STABLE RELEASE OF CAPRI  |
| SVN     | SUB-VERSION NUMBERING. A DATABASE SYSTEM DESIGNED TO KEEP TRACK OF AND CONSEQUITIVELY NUMBER CODE CHANGES. |
|         |  |
|         |  |

# 1 Introduction

Economic modelling in agriculture has been widely employed for policy impact assessment and foresight analysis concerning global environmental problems. Scientific results should be transparent and reproducible in scientific communities. However, in the past decades, policy analyses have become increasingly comprehensive in terms of coverage of impacts outside of the core of the agricultural sector: impacts of agricultural policies on for instance nutrient balances, biodiversity and certainly greenhouse gas emissions have become commonplace.

The response to the demand for increased scope of analysis has been two-fold. Firstly, modellers have *extended* the capabilities of their tools by introducing biophysical and other modules around the core of their agricultural sector model. In CAPRI, this type of extensions have resulted in improved nutrient balances, emission leakage, land use modules, endogenous mitigation technologies etc. Secondly, modellers have *linked* their specialized models with other specialized systems in order to jointly cover the requested extensions. For instance, CAPRI has been linked with hydrological models, with IFM-CAP, and with GTAP. As a result, models and model systems have grown more complex.

Increased complexity of the models presents challenges to researchers and policy makers alike: Researchers are facing technical challenges in the development work, and the scientific community cannot easily review the models or reproduce the results. Policy makers cannot easily understand how the underlying economic theory works, and might question the robustness and reliability of results produced with such systems.

As systems grow, they become less available to theoretical analysis. The last time that somebody wrote down the complete first-order conditions for the CAPRI model was in 2017 within the TRUSTEE project. That work took many months of full time work, and did not facilitate analysis of model behaviour. Instead, numerical analysis of model behaviour has become more common. Using numerical techniques, the interaction of all the components can be analysed, and possible problems pinpointed. Numerical techniques can help proving that the model actually does what it claims to do in a more convincing way than an analytical solution, in particular when it comes to the interplay of several model components.

In order to open up the black box of CAPRI, the CAPRI community pursues a strategy of stable releases. A stable release (STAR) is a publicly available tested model version that never changes. Tested means that it passes a series of standardized tests. When revisions and bug fixes are needed, they are collected in a new release with incremented version number, so that any given STAR version never changes (hence, is stable). The STAR process helps with several of the problems listed above: model developers always have a running system to start from, peer reviewers can at least in theory download and run the model. The regular testing, versioning and the increased openness to peer review and scientific publication can increase the trust in the system by policy makers.

This paper documents the process and results of STAR 3.0, which is the initial release in a new generation of CAPRI models.

Economic models should produce robust results, which means that they should be sensitive to small variations of parameter values and variables accounted for in the study. Model robustness has drawn less attention in large scale agricultural sector modelling, but it becomes non-trivial as model complexity and data quantities increase. Because as new model features are added to the original one, the main results from endogenous variables may change.



Reproducibility of model results is of importance not only for scientific transparency, but also for research cooperation in model-based research. Model results should be same while working on the same model and database. Nevertheless, we regularly find that conditions that should be irrelevant, such as computer hardware, the existence of starting values or the workload of the processors, have an influence on the model results or on the preparation of the various databases needed.

Model versioning becomes essential for reproducibility in living system where new model features are added, bugs corrected, input data changed etc. The annex of this deliverable gives an overview of versioning activities in the SUPREMA models.

## 2 The CAPRI stable release process

The general procedure for producing a Stable Release is described by the steps in List 1.

### List 1: The stable release process

1. Set the main release number  $n=3$  and the maintenance release number  $m=0$
2. Agree on a list of “supported features” to be in the release
3. Agree on a time point to branch-off the STAR from the TRUNK
4. For each planned code revision do:
  - a. TESTS entire chain for technical feasibility
  - b. Make code revision
  - c. If more revisions remain, return to a.
5. TESTS for numerical stability
  - a. Run with empty result directory (CLEAN)
  - b. Run with technical variations
  - c. Collect and evaluate experiments
  - d. If technical errors arise, return to step 4.
6. Publication of Stable Release “STAR  $n.m$ ”
  - a. test report
  - b. release notes
  - c. data base of the CLEAN test
7. Collection of feedback and bug reports from users
  - a. add them to the list of revisions to do
  - b. When critical bugs are found, set  $m=m+1$  and go to step 4

After giving the new release a name (STAR 3.0), the next step is to define what features of the model are to be tested. Why can we not simply test everything? The reason is that the model contains a lot of code that was developed for various projects and that is not presently used by anybody and presumably not working. Testing all that code would imply testing a very large number of combinations of “this module on, the other one off” making it practically impossible. Furthermore, if such a module that is not presently in use does not function, it is not critical. It is rather kept as a repository to revive if need would arise in the future. In some cases, such as for STAR 3, the consortium meeting agreed to go further, by also *removing* features that have not been used for a long time. The lists of supported features and settings used are committed and documented in the batch execution file “supported\_features.txt” used for testing the correct execution of all tasks from an empty results directory. The list of code changes achieved is shown in the next section.

The STAR branch is created from the central repository, the TRUNK of CAPRI. Since in general no new features are allowed to enter the STAR branch after branching, the precise point in time when the

branching-off is done becomes critical. The STAR 3 process was delayed by several months because of the need to finalize some code revisions in the trunk before branching off. Finally, a branch was created from the trunk on March 13, 2020.

When the STAR branch has been created, two kinds of test-cycles follow. The first cycle, described in point 4. in List 1, aims to produce a release candidate where the batch file “supported\_features.txt” passes without errors and all code revisions have been done. That is generally very time consuming and tedious due to the interdependencies between different sections of the model. The steps 4 and 5 are the key time-consuming parts of the release process. Computation times are very long, making debugging slow. The CAPRI GUI provides the possibility to automate sequences of computation tasks, and this is used extensively in the stable release process. In particular, step 4, testing the chain of tasks for technical feasibility, is done by the automation script versioned itself in the release under the name “batchfiles\supported\_features.txt”. The file used for testing STAR 3.0 is attached in Annex II to this deliverable.

When all code revisions are done and all supported features work, the stability testing starts, in step 5. For this, a reduced set of model features are used in order to reduce computation time. Most importantly, a limited number of simulation years are tested for stability. The reduced list of features to test are executed with the following settings:

- CLEAN: Without any other starting point than the input data.
- RESTART1: Using the results of CLEAN as starting point (to find starting value sensitivity)
- RESTART2: Same as RESTART1 without any other change (to analyse reproducibility)
- RND1: Using CLEAN plus random disturbances as starting point
- OLDGAMS: Using an older GAMS software release, otherwise as RESTART1
- NEWGAMS: Using the newest available GAMS software, otherwise as RESTART1.
- OLDMACH: As RESTART1, but running on an alternative (old) machine, like a laptop.

The supported GAMS version is release 28.2, for OLDGAMS we used 25.1 and for NEWGAMS we used release 30.3. Each computation above is done with the entire CAPRI system, from database generation to calibration and simulation, and thus generates eight complete databases about 3 GB of data each. To keep data apart, we first generate an empty directory structure to hold the results of each technical variation. This is facilitated by the CAPRI GUI task “Create experiment folder structure”, found under the workstep “Tests and Reporting”, as indicated by the screen shot in Figure 1.

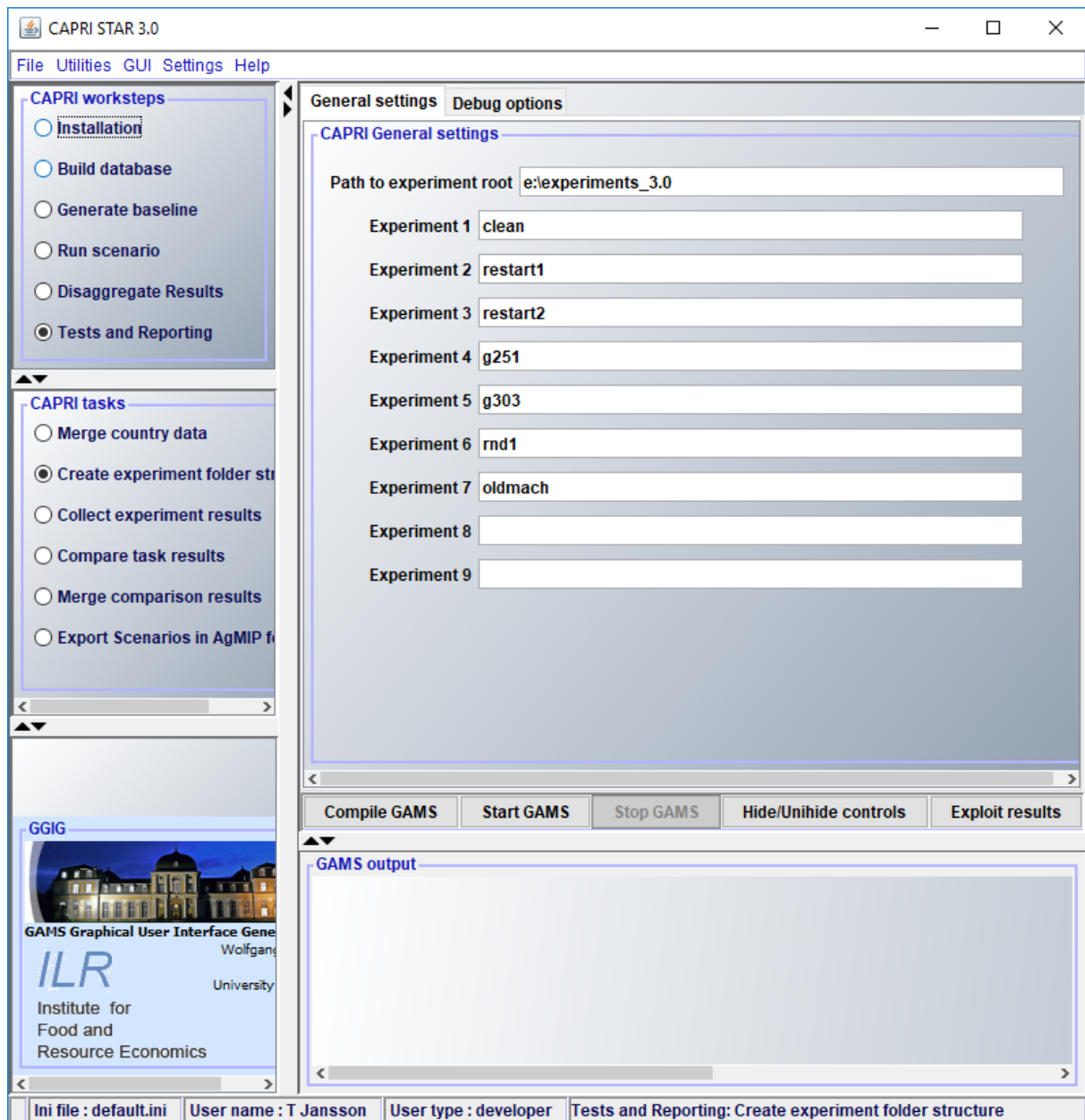
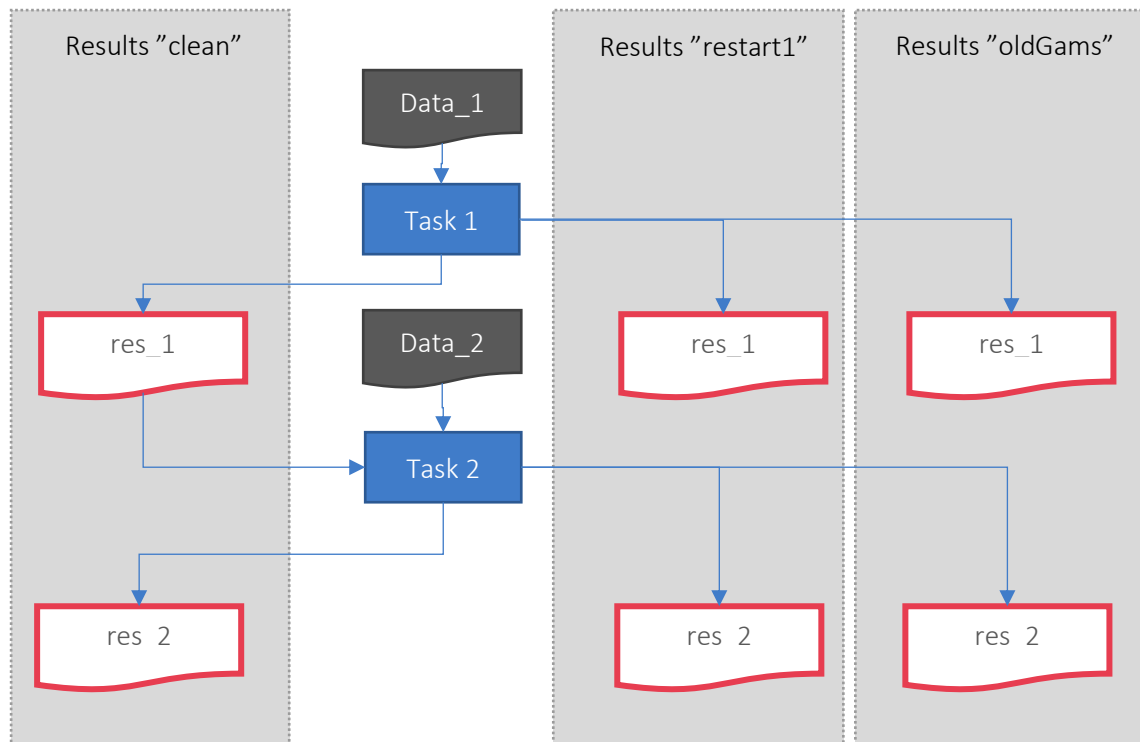


Figure 1. Using the GUI to create a directory structure for the stability tests.

After setting up the directory structure, we use the batch execution file “batchfiles\system\_stability\_experiments.txt” to run the entire sequence of tests of technical variations. The set-up uses different data input and output directories to separate the impact of technical variations on performance from impacts of varying input data. The data flow is illustrated in Figure 2. The first time the program runs, it fills up the empty “clean” result directory using no other input data than the one it just created in “clean”. In all the other experiments, it uses the input data from “clean” in each step to generate outputs stored in a separate folder. This implies that two tasks, say task 1 and task 2, where normally task 2 uses the output of task 1, become de-coupled. In the technical variant, task 2 relies on the output of task 1 generated in “clean”, not from task 2 generated with the technical variant. So, if task 1 turns out to be unstable, this does not impact on our evaluation of task 2, since all technical variants of task 2 use exactly the same input data, namely those of task 1 “clean”. The batch file is re-printed in Annex III.



**Figure 2. Data flow in stability experiments for two stylized processes “Task 1” and “Task 2”**

The data is evaluated for “tasks” as defined by the various software tasks of the CAPRI GUI, and for each module by datasets defined by the main datasets produced by each task. For instance, the task “baseline calibration of supply models” produces the dataset “PMP-parameters” for each country and a calibrated data cube. All task-dataset combinations are evaluated by performing pair-wise computations of the difference to RESTART1. The pair-wise differences are classified in terms of relative deviations from the value in RESTART1. The number of deviations in each class is summarized for each task in CAPRI, to give an overview of how stable the various tasks and datasets are. The pair-wise difference computations and classification of relative deviations is automated by three GUI tasks supported by a script. The first GUI task helps the developer to copy the test result files from the experiment folder structure to the standard model result directory, appending a file name suffix to each file defining which experiment gave rise to it (`_clean`, `_restart1`... etc). Then, pair-wise comparisons between pairs of such files is aided by a batch execution script for the GUI. This script versioned under “batchFiles\test\_stability\_comparer\_task\_results.txt”, printed in Annex IV.

The GUI also contains a task to summarize all the comparisons done into one two-dimensional histogram, showing the number of deviations found for each task-result combo for each histogram class. The output is a table listing all the tasks, file pairs, and symbols analysed and the number of differences found in each relative size class. A small section of the file looks like the following table. In the first line, for instance, we see that we analysed a task called “capmod\_cal\_supply” (baseline calibration of the simulation model) and analysed the symbol “DATAOUT” coming from two files. The files have the suffixes “restart1” and “clean”, showing that they were the results of the simulation with a pristine (empty) result directory and a simple restart without further changes than start values of “clean” existing”. The total number of comparisons,  $N$ , was 2,744,666, and of those 808,348 differed more than machine precision. 13,999 of those differed by at least 1 promille, 3,971 by at least 1%, and so on. The “infinite” difference means that the particular data position was entirely missing in one of the files so that no relative difference (to file 1) could not be computed.

**Table 1: Sample test results from STAR 3**

| Task Label        | Data symbol | File 1  | File 2  | >zero  | >0.001 | >0.01 | >0.1 | >1   | >10 | >100 | infinite | N       |
|-------------------|-------------|---|---|--------|--------|-------|------|------|-----|------|----------|---------|
| capmod_cal_supply | DATAOUT     | capmod_res_2_1215-<br>cap_after_2014_cal_restart1 | capmod_res_2_1215-<br>cap_after_2014_cal_clean    | 808348 | 13999  | 3971  | 1507 | 870  | 645 | 612  | 568      | 2744666 |
| capmod_cal_supply | DATAOUT     | capmod_res_2_1215-<br>cap_after_2014_cal_restart1 | capmod_res_2_1215-<br>cap_after_2014_cal_restart2 | 36676  | 45     | 41    | 41   | 29   | 23  | 23   | 23       | 2744412 |
| capmod_cal_supply | DATAOUT     | capmod_res_2_1230-<br>cap_after_2014_cal_restart1 | capmod_res_2_1230-<br>cap_after_2014_cal_clean    | 802271 | 17392  | 6592  | 2196 | 1019 | 771 | 712  | 672      | 2704294 |
| capmod_cal_supply | DATAOUT     | capmod_res_2_1230-<br>cap_after_2014_cal_restart1 | capmod_res_2_1230-<br>cap_after_2014_cal_restart2 | 103934 | 3369   | 508   | 171  | 106  | 84  | 79   | 77       | 2703976 |
| capmod_cal_supply | p_pmpCnst   | baseline_pmppar_21215-<br>_p_pmpCnst_restart1     | baseline_pmppar_21215-<br>_p_pmpCnst_clean        | 2455   | 129    | 41    | 4    | 1    |     |      |          | 19354   |
| capmod_cal_supply | p_pmpCnst   | baseline_pmppar_21215-<br>_p_pmpCnst_restart1     | baseline_pmppar_21215-<br>_p_pmpCnst_restart2     | 121    |        |       |      |      |     |      |          | 19354   |
| capmod_cal_supply | p_pmpCnst   | baseline_pmppar_21230-<br>_p_pmpCnst_restart1     | baseline_pmppar_21230-<br>_p_pmpCnst_clean        | 2395   | 140    | 59    | 6    | 1    |     |      |          | 18941   |
| capmod_cal_supply | p_pmpCnst   | baseline_pmppar_21230-<br>_p_pmpCnst_restart1     | baseline_pmppar_21230-<br>_p_pmpCnst_restart2     | 368    | 43     | 10    | 1    |      |     |      |          | 18941   |
| capmod_cal_supply | p_pmpQuadP  | baseline_pmppar_21215-<br>_p_pmpQuadPact_restart1 | baseline_pmppar_21215-<br>_p_pmpQuadPact_clean    | 35     |        |       |      |      |     |      |          | 2789    |
| capmod_cal_supply | p_pmpQuadP  | baseline_pmppar_21215-<br>_p_pmpQuadPact_restart1 | baseline_pmppar_21215-<br>_p_pmpQuadPact_restart2 |        |        |       |      |      |     |      |          | 2789    |
| capmod_cal_supply | p_pmpQuadP  | baseline_pmppar_21230-<br>_p_pmpQuadPact_restart1 | baseline_pmppar_21230-<br>_p_pmpQuadPact_clean    | 40     |        |       |      |      |     |      |          | 2789    |
| capmod_cal_supply | p_pmpQuadP  | baseline_pmppar_21230-<br>_p_pmpQuadPact_restart1 | baseline_pmppar_21230-<br>_p_pmpQuadPact_restart2 | 13     |        |       |      |      |     |      |          | 2789    |

The final phase in the stable release process is the publication of the maintenance releases. As the model is used, critical bugs and other improvements are collected in a list of new revisions. Those revisions are included in a maintenance release candidate that has an incremented release number (such as 3.0 ==> 3.1), which is subjected to the same set of tests as the original release, i.e. the process is restarted at step 4 in List 1.

## 3 Code improvements in STAR 3

The code for STAR 3 was created by (1) including all code from the central CAPRI trunk repository, and then (2) implementing selected revisions. The following revisions were achieved so far:

- Removal of files written to the raw data directory during model execution (dat\sugar)
- Complete overhaul of the program cons\_levels.gms doing the harmonization of activity levels and land uses between countries and sub-regions.
- Insertion of random start values for cons\_levels.gms
- Remove switch "BIOFUELS=OFF"
- Removal of the technical symbol "resultDimensions" from all result files to shrink data
- Revision with very significant improvement in computation speed of the land consolidation program in the FAOSTAT country data consolidation step.
- Removing the possibility to switch the young animal market model off.
- Revision of the declaration of all supply model symbols, to avoid duplicate definitions.
- Remove old iterative link with GTAP developed in the SENSOR project
- Creation of a facility to unload stability test data at pre-defined checkpoints in the regionalization program CAPREG
- Removal of the regional CGE models from GUI and model code base
- Debugging of a missing market link for rice and olive oil.

## 4 Test results for STAR 3.0

The release candidate for STAR 3.0 was subjected to more tests than any previous release. Albeit technically successful in all simulation experiments, the stability tests revealed a critical instability in the baseline calibration task for the supply models, resulting in irregularly appearing lack of convergence in simulations with the resulting models. For users, this means that the convergence between market and supply models in CAPRI in simulations would depend on seemingly arbitrary numerical instabilities in the baseline calibration step. At the time of publication of this deliverable, the cause(s) of the instabilities had not been pinpointed. Therefore, the STAR 3.0 publication was postponed until the instabilities have been resolved.

## 5 Stable Release 2.5

### 5.1 Test report

In parallel of developing and testing the new “3” series of releases, we continued entering bug fixes and updates to STAR 2.4, with the aim of producing the maintenance release 2.5. The new release improves on 2.4 via bug fixes in the computations of direct payments, to make the sums of payments better match the official payments. STAR 2.5 was tested with GAMS 25.0, in line with previous releases of generation 2, but analysed also with GAMS 30.3 and GAMS 24.7. As it turned out, the older GAMS version gave results that deviated from the other versions, indicating less stability. As a consequence, we recommend to not use GAMS 24.7 for CAPRI.

In total, >675 million numbers were analysed for stability. Of those, 11 million, or 1.6%, were unstable at the level of 1/1000 relative deviation, which is substantial. However, a large share of those cases were caused by the use of GAMS 24.7.

Among the tasks analysed in STAR 2.5, two stand out: firstly, the build-up of the regionalized time series (CAPREG time series) results in a very large number of data (175 million numbers analysed), but also in a large number of instabilities (9.5 million deviations above 1/1000). This is one of the points of improvements aspired in STAR 3.0. Using GAMS 24.7 caused the largest number of deviations (4.2 million cases), followed by the old machine experiment (2.2 million). Unfortunately, also the simulation with the full model (supply and market) seems to be sensitive to swapping hardware or GAMS version (to either newer or older), but reproducible if no changes are made. A typical simulation produced 5.4 million numbers, of which (at 1/1000 level of relative deviation) 108,000 were sensitive to using GAMS 24.7, and about 34,000 sensitive to using either the newest GAMS version or an old machine. The exact numbers of instabilities depended on the scenario simulated.

Note: In STAR 2.5, we had to replace the hardware used for testing the “old machine”, since the previous hardware was no longer supported by Microsoft nor our department IT service. We updated to use a laptop computer with four cores, model Hewlett-Packard EliteBook 840 G1.

Table 2: Summary of the stability test report for STAR 2.5

| Task               | >zero              | >0.001            | >0.01            | >0.1             | >1             | >10            | >100           | infinite       | N tot              |
|--------------------|--------------------|-------------------|------------------|------------------|----------------|----------------|----------------|----------------|--------------------|
| faostat            | 314,190            | 981               | 35               | 26               | 3              | 3              | 3              | 3              | 55,997,018         |
| coco1              | 0                  | 0                 | 0                | 0                | 0              | 0              | 0              | 0              | 19,932,997         |
| coco2              | 102,549            | 121               | 27               | 13               | 4              | 4              | 4              | 4              | 43,000,468         |
| Compile_RDP_data   | 0                  | 0                 | 0                | 0                | 0              | 0              | 0              | 0              | 1,067,269          |
| capreg_time_series | 63,069,998         | 9,544,878         | 3,250,808        | 800,495          | 192,435        | 135,661        | 127,758        | 123,477        | 174,910,966        |
| capreg_base_year   | 4,617,574          | 101,271           | 39,956           | 17,437           | 1,796          | 1,377          | 1,241          | 1,110          | 19,047,683         |
| global             | 302,745            | 44,755            | 28,237           | 14,456           | 3,630          | 1,328          | 774            | 414            | 35,294,926         |
| est_ghg_std        | 20,365             | 34                | 30               | 28               | 25             | 19             | 16             | 14             | 129,157            |
| est_ghg_lca        | 23,694             | 422               | 361              | 329              | 286            | 241            | 205            | 74             | 150,664            |
| captrd             | 1,328,211          | 141,563           | 41,875           | 8,164            | 1,268          | 881            | 846            | 763            | 3,605,164          |
| capmod_cal_market  | 168,459            | 29,319            | 11,172           | 2,596            | 279            | 117            | 94             | 74             | 2,356,628          |
| fert_trm           | 1,012,244          | 13,556            | 5,479            | 1,950            | 225            | 78             | 56             | 28             | 118,224,512        |
| feed_trm           | 414,905            | 172,344           | 161,355          | 14,835           | 9,753          | 9,556          | 9,441          | 9,325          | 1,927,288          |
| capmod_cal_supply  | 7,868,126          | 246,079           | 206,839          | 173,418          | 110,564        | 35,787         | 30,421         | 27,111         | 48,598,031         |
| capmod_sim         | 21,499,803         | 316,846           | 263,449          | 234,187          | 156,152        | 72,884         | 66,645         | 65,478         | 75,331,688         |
| capmod_supply      | 8,208,065          | 121,728           | 106,839          | 93,704           | 60,650         | 25,201         | 22,932         | 22,421         | 64,034,342         |
| capmod_market      | 1,439,038          | 8,589             | 3,576            | 2,554            | 1,811          | 1,551          | 1,526          | 1,394          | 11,937,418         |
| <b>Total</b>       | <b>110,389,966</b> | <b>10,742,486</b> | <b>4,120,038</b> | <b>1,364,192</b> | <b>538,881</b> | <b>284,688</b> | <b>261,962</b> | <b>251,690</b> | <b>675,546,219</b> |

## 5.2 Download instructions

In total, STAR 2.5 is a robust system that runs without failure under the wide range of hardware and software specifications tested in this release. The release STAR 2.5 complete with data and release notes can be downloaded from the CAPRI homepage on [www.capri-model.org](http://www.capri-model.org).

The stable release consists of (a) the model code including raw data and (b) the compiled data base including calibrated baselines. The model is really self contained in (a), since all software and raw data needed to compile the data bases and construct the baselines is found there. Albeit (b), the databases, can be derived from (a), doing so is a somewhat complicated process. Therefore, we provide (b) as a shortcut. Furthermore, it turns out that generating (b) may generate slightly different results on different hardware/software combinations, and therefore it is convenient to use a common versioned database release.

The current release and selected previous releases can be downloaded as compressed (zipped) archives using the links in the following table. Note that the item “SVN-tag” only are available to developers with a an account in the SVN database. Information about each release is found in the release notes and in each release code base.

Table 3: Download links for selected CAPRI releases

| Release  | Item     | Link  |
|----------|----------|---|
| STAR 2.5 | Code     | <a href="https://1drv.ms/u/s!Aj7_RXyD8q-Mg4BDjQ4AbWbXXzY1_g?e=NvvyLT">https://1drv.ms/u/s!Aj7_RXyD8q-Mg4BDjQ4AbWbXXzY1_g?e=NvvyLT</a> |
|          | Database | <a href="https://1drv.ms/u/s!Aj7_RXyD8q-Mg4BBF3d-IsULH9gH3A?e=fIIFOd">https://1drv.ms/u/s!Aj7_RXyD8q-Mg4BBF3d-IsULH9gH3A?e=fIIFOd</a> |
|          | SVN-tag  | <a href="https://svn1.agp.uni-bonn.de/svn/capri/tags/star/2.5">https://svn1.agp.uni-bonn.de/svn/capri/tags/star/2.5</a>               |
| STAR 2.4 | Code     | <a href="https://1drv.ms/u/s!Aj7_RXyD8q-MgtQmzmdEn_3FuNaqyA">https://1drv.ms/u/s!Aj7_RXyD8q-MgtQmzmdEn_3FuNaqyA</a>                   |
|          | Database | <a href="https://1drv.ms/u/s!Aj7_RXyD8q-MgtQIHdUSz6F5Uv_Sgw">https://1drv.ms/u/s!Aj7_RXyD8q-MgtQIHdUSz6F5Uv_Sgw</a>                   |
|          | SVN-tag  | <a href="https://svn1.agp.uni-bonn.de/svn/capri/tags/star/2.4">https://svn1.agp.uni-bonn.de/svn/capri/tags/star/2.4</a>               |

| Release  | Item     | Link  |
|----------|----------|---|
| STAR 1.4 | Code     | <a href="https://1drv.ms/u/s!Aj7_RXyD8q-MgpgRyPwElFGkhK5QJw">https://1drv.ms/u/s!Aj7_RXyD8q-MgpgRyPwElFGkhK5QJw</a>     |
|          | Database | <a href="https://1drv.ms/u/s!Aj7_RXyD8q-MgpgSo2ebWO0Y-c3oXA">https://1drv.ms/u/s!Aj7_RXyD8q-MgpgSo2ebWO0Y-c3oXA</a>     |
|          | SVN-tag  | <a href="https://svn1.agp.uni-bonn.de/svn/capri/tags/star/1.4">https://svn1.agp.uni-bonn.de/svn/capri/tags/star/1.4</a> |

## 5.3 System requirements for CAPRI STAR 2.5

CAPRI requires that you have a windows computer with Java runtime environment (64-bit) and GAMS (<http://www.gams.com>, distribution 28.2 or later is recommended) installed. You need a license for the CONOPT solver. Many tasks in CAPRI utilize parallel computing. It is therefore an advantage if you have a machine that can run many threads in parallel.

## 5.4 Installation instructions for the model without database

Using CAPRI requires extensive knowledge of how the system works. Please look out for CAPRI training courses on the page of upcoming events. The following bare-bone instructions may nevertheless be sufficient to get the system up and technically running.

1. Create an installation folder to hold **model source files** on your local hard drive such that the path does not contain spaces. Thus, it will not work to install the model in "My Documents" (path containing space) or on a network drive (the access will be too slow).
2. Extract the files of the compressed archive (or checkout from SVN) into the folder you just created.
3. Go to the subfolder GUI, double-click "start\_capri.bat". That should open the graphical user interface (GUI). If not, something is wrong with your Java-installation.
4. In the menu **settings**, choose **Edit settings**.
  - In the first tab: enter your name
  - In the second tab: verify that the paths to result and restart folders are set to **../output/results** and **../output/restart**. The GAMS directory should read **../gams** and the data directory should read **../dat**.
  - In the third tab: enter the complete path to the GAMS executable. Probably it is something like **c:/gams/win64/30.3/gams.exe**. Also verify that the path to the Scratch directory is **../output/temp**. Click the button to "get number of processors".
  - In the fourth tab: do nothing.
  - In the final tab: do nothing, or, if you have a programming text editor, enter the path to that editor in the proper field.
5. Click "Save in caprinew.ini" and accept the file name suggested for your settings.
6. Initialize the result directory structure by executing the task "Create result and restart directory structure" in the workstep "Installation" by marking those radio-buttons in the GUI and clicking "Start GAMS".
7. Close the GUI, then start it again (using start\_capri.bat), to make it process all your settings.

## 5.5 Build databases and baselines



The stable releases are shipped with only input data, but not with any of the consistent model databases needed to run the model. As mentioned above, there are two options for obtaining the complete and consistent databases needed by and fitting with the CAPRI model.

1. The simpler way is to download the zipped archive from <https://www.capri-model.org/dokuwiki/doku.php?id=capri:get-capri>.
2. The advanced way is to compile the database yourself from raw data.

If you download the data as a compressed archive, you decompress the archive and place all the files and folders in the result directory of your capri model installation. For example, assume you installed the model in the directory C:\CAPRI\_STAR\_2.5. Then you place the files and folders extracted (see below) in the folder C:\CAPRI\_STAR\_2.5\output\results. The following files and folders should be extracted:

| Name                 | Type               |
|----------------------|--------------------|
| arm                  | File folder        |
| baseline             | File folder        |
| capmod               | File folder        |
| capreg               | File folder        |
| Capreg_tseries       | File folder        |
| coco                 | File folder        |
| envind               | File folder        |
| fao                  | File folder        |
| fert                 | File folder        |
| global               | File folder        |
| policy               | File folder        |
| simini               | File folder        |
| delete_chk_files.bat | Windows Batch File |
| void.gdx             | GDX File           |

**Figure 3: Result files and folders extracted from the compressed archive, to copy to the output\results directory in your CAPRI installation.**

Those are created by tasks executable from the GUI. So, now you need to build all databases of CAPRI. This takes a long time. Depending on the hardware you use, it can take up to several days. In order to keep track of all the various settings required for completing all the steps, the release contains a “batch execution file” that instructs the GUI how to carry out a sequence of tasks without intervention of the user. Here is what you need to do:

1. In the GUI, choose the menu GUI → Batch execution
2. In the dialogue, choose the file <gamsdir>/GUI/batchfiles/build\_database\_and\_baseline.txt
3. Uncheck the option “Only compile the GAMS programs”
4. Click “Start batch execution”.
5. Wait for the program to finish (hours, days).
6. Click “Open HTML report” and verify that all steps were completed without errors (RC=0).

The current batch execution file (STAR 2.5) does not take over the path to your GAMS installation as entered in the settings dialogue during installation, but you will have to open the text file and enter the appropriate path manually.

## 6 Conclusions and recommendations

During this project, we have come a long way towards producing an entirely new generation of CAPRI releases, starting with STAR 3.0. STAR 3 not only includes novel developments from various modelling projects, but it also removes some features that are no longer supported, such as the regional CGE models. The set of test routines was revised and extended accordingly and attached to this document.

Unfortunately, at the deadline for this deliverable, the code was not yet sufficiently stable for publication. Instead, we offer a new maintenance release of the established 2<sup>nd</sup> generation of releases, called STAR 2.5, with test report and download instructions.

In addition to the development work in CAPRI, we also surveyed testing and versioning in other models of the SUPREMA family. The results of the survey are, according to the description of work in the grant agreement, published in an annex (Annex I) to this deliverable. One lesson learnt from the experience of systematic testing in CAPRI is that the only way to know that the system is stable is to run regular and systematic tests. Instabilities are regularly discovered in various parts of the system, and due to the interconnectedness of various modules the instabilities may propagate. Since no other model system has formalized rigorous test protocols, they actually cannot know if their code is stable. A recommendation to the teams behind GLOBIOM, MAGNET and AGMEMOD is therefore to start to undertake regular tests of stability for their models to verify that they behave as expected under variation of seemingly irrelevant conditions.

# Annex I: Survey of versioning in SUPREMA models

## Introduction

In order to survey the testing and versioning activities of the models in SUPREMA, SLU carried out a qualitative survey among the modellers. The survey was based on interviews with one developer for each model. First, a questionnaire was sent to the modeller via e-mail. Then, a Skype interview was undertaken where each question of the questionnaire was discussed in depth.

The questionnaire is reprinted in the section “Questionnaire” below, and the subsequent section summarizes the results in tabular form. The questionnaire contained three sections. The first two related to model stability testing and versioning. The final section contained questions about model governance, and it relates to deliverable 4.7 of the SUPREMA project. It is omitted in this deliverable.

Participating models: CAPRI, GLOBIOM, MAGNET, AGMEMOD

Interviewer: Hyungsik Choi

Interviewees:

Torbjörn Jansson (CAPRI),  
Stefan Frank (GLOBIOM),  
Heleen Bartelings (MAGNET),  
Myrna van Leeuwen (AGMEMOD)

## Questionnaire

**Instructions:** In task 2.4 of SUPREMA, we are asked to survey and document model versioning and testing activities for all the models involved. This is important, since we / the scientific community would like to facilitate transparency and reproducibility of results from our models, some of which are sometimes referred to as “black-box-type-models”. We kindly ask you to answer the questions we prepared regarding model stability, model versioning and model governance. We expect you to answer those questions in a descriptive manner with your ideas and explanations, not in ‘yes’ or ‘no’ style.

### Model Stability

**Background:** Model stability has drawn less attention in economic modelling. As model complexity and data quantities increase, it becomes non-trivial. Here, we consider mainly numerical stability related to numerical accuracy, which is affected by various internal or external factors. Model results should generally be reproducible with unchanged parameters (e.g. scenarios) regardless of irrelevant circumstances such as hardware or software versions, but reproducibility and stability have not been discussed much in large-scale agri-food economic modelling systems. Furthermore, model robustness should be concerned with respect to how new model features and computing system affect results.

- 1) Which software do you use for simulations?
  - a. Which solver(s) do you use to solve your model?
  - b. And what type of model structure do you have (linear (LP), non-linear (NLP), MCP and so on)?

- 2) Do you have any model stability issues that bother you? Please, describe it generally or specific issues related to your model.
- 3) Do you know that if your model results be reproduced in other machines (hardware)?
- 4) Do you know that if your model results be reproduced in other version of the same software (e.g. GAMS)?
- 5) Does your model include some schemes to check the stability of your database or model results? If yes, how do you check the database consistency and model stability?
- 6) Is your model set-up capable of reproducing results from previous research? (for example, using versioning system or something else).
- 7) Does your model have different versions in different model complexities of regions and modules? Do different model version produce same or similar results?
- 8) Do you find your model is sensitive to certain parameters, modules or to certain scenario shocks? If yes, how do you deal with such sensitivity? (This question is related to model robustness).
- 9) What other problems did you encounter regarding model stability? What do you suggest for its improvement?

### Model versioning

Model versioning is common in software development. However, in economic modelling, model versioning has not been widely used for publishing and communicating their results. This may hinder in producing robust model results and communicating scientific results in a transparent way. This convention needs to be improved for efficient model development and scientific transparency.

- 1) Please, tell us if you use a versioning system software for your model maintenance. If yes, please, describe which software you use and how you use it for your model development.
- 2) Do you document the version of your model and release it publicly? If yes, explain your policy on model versioning and its publication.
- 3) How many modellers normally contribute to model developments for coding? What do you suggest for efficient model development methods, cooperating with other modellers in a team?
- 4) How many model versions do you have? Do you have several version used in parallel e.g. global version and regional version, full version and simple version? Please, describe you manage various model versions for policy impact assessment.

## Survey results

Table 4 shows the results of the survey regarding technical implementation and versioning. GAMS software is widely used in SUPREMA modelling communities. CAPRI, GLOBIOM and AGMEMOD are

implemented in GAMS, whereas MAGNET is implemented in GEMPACK. GLOBIOM is a linear model, which may have less problems in numerical optimization. Other models are non-linear, which implies a more complex numerical optimization process. CAPRI, GLOBIOM and MAGNET use some professional versioning system for software (GIT or SVN). AGMEMOD uses a cloud storage system, saving the present model version to the cloud.

**Table 4. Technical implementation of models**

|                            | CAPRI                       | GLOBIOM                    | MAGNET                    | AGMEMOD     |
|----------------------------|-----------------------------|----------------------------|---------------------------|-------------|
| Software                   | GAMS                        | GAMS                       | GEMPACK                   | GAMS, excel |
| Model classification       | Supply: NLP<br>Market: DNLP | LP                         | NLP                       | CNS         |
| Solver                     | CONOPT                      | CPLEX                      | Multi-step Euler or Gragg | CONOPT      |
| Versioning system/software | SVN server, Tortoise SVN    | SVN server<br>Tortoise SVN | SVN server, Tortoise SVN  | Cloud       |

\*NLP: Nonlinear Program, DNLP: Discontinuous Nonlinear Program, CNS: Constrained Nonlinear System

Table 2 shows the survey results on model stability. All modelling groups are aware of model stability issues regarding version of the software. For the same project, the same software version is normally used by all participants. This implies that if a specific software version is not communicated in scientific results, model results cannot be reproduced. The CAPRI group finds that model solutions are different in different computing machines and restarting from previous solution.

All models have internal skims to check database consistency. Furthermore, all models or modellers check for an optimal solution of their model: The GLOBIOM model checks the global objective value, and MAGNET inspects Walras's slack. This gives an indication of whether the model was solved to optimality or not.

Only CAPRI has systematic checks of model stability. The CAPRI stability test check both if the software reports optimal solutions, but also how those optimal solutions vary with variation of "irrelevant parameters". A regular finding is that even though the software (GAMS/CONOPT) reports that the solution is good (i.e. within tolerance), different starting values, different hardware, different GAMS versions or even no change at all give different results for a small share of all results. The testing serves to discover and mitigate such cases. CAPRI has a growing toolbox to aid in stability testing.

MAGNET reported that a future development direction is towards systematic sensitivity analyses and the generation of confidence intervals. This is a related topic but is different from stability testing in that it varies parameters that are thought to have influence on the solution, in contrast to parameters that should be irrelevant.

**Table 5 Stability**

|                        | CAPRI   | GLOBIOM      | MAGNET          | AGMEMOD  |
|------------------------|---|--------------|-----------------|--|
| Awareness of stability | GAMS version/machines /restarting from previous solutions | GAMS version | GEMPACK version | Largely stable, cautious about uncertainty in parameter estimation |

|                              |  |   |   |                      |
|------------------------------|--|---|---|----------------------|
| Checking model stability     | Regular systematic stability tests of database, global and local variables | Database consistency, Checking the global objective value | SAM balancing<br>Checking walras slack                        | Database consistency |
| Sensitive parts of the model | PMP values   | Parameters  | Parameters  | Parameters           |
| Future direction             | Tool box for systemic testing  |   | Systemic sensitivity analysis, Confidence interval generation |                      |

All models use some kind of release/version system. CAPRI publishes “stable releases” with increasing version numbers, in addition to project specific SVN (sub-version numbering) branches. GLOBIOM comes in several regionalized versions in addition to the global model. MAGNET maintains one central model, which was at version 2.0 during the survey. Similarly, AGMEMOD was at AGMEMOD 8.0 at the time of writing. In addition, AGMEMOD reported that the specific version, presumably deviating from the cloud version, is archived together with the results of each project on a central server to aid reproducibility. For the same purpose, other models rely on a repository of SVN type (or GIT type). SVN is a database system where each change to the model code is given a new “revision number”, and where particular such revisions can be given special names called “tags”. Furthermore, the SVN type repository supports “branches” which are variants of the central version (a.k.a. the trunk) that are maintained in parallel.

AGMEMOD centralizes model development and versioning at WECR after consultation with country teams, and report no particular problems associated with that process. In contrast, the teams working with the SVN type versioning report problems of two kinds, originating from the distributed nature of model developments: (1) merging different model features and new development into the trunk version, and (2) managing conflicts between different modules within the system.

**Table 6 Versioning**

|                         | CAPRI  | GLOBIOM  | MAGNET  | AGMEMOD                                      |
|-------------------------|--|--|---|--|
| Version                 | CAPRI star 2.2   | GLOBIOM<br>GLOBIOM-EU<br>GLOBIOM-Brazil                | MAGNET 2.0  | AGMEMOD 8.0                                  |
| Results reproducibility | Possible in SVN branches   | Possible in SVN branches and tagging                   | Possible in SVN branches                                | Possible via cloud                           |
| Model development       | Decentralized<br>Focusing on the EU markets with different model features – fertilizer, GHG, trade | Centralized<br>Focusing on different regional features | Centralized<br>Customers also contribute to development | Centralized<br>Other members also contribute |

|        |  |    |
|--------|--|----|
| Issues | Merging different model features and new development into the trunk<br>Managing model conflicts with different modules within the model system | No |
|--------|--|----|

## Annex II: Batch routine for running all supported features

```

* -----
* Batch file for running "supported features" in the release process
* It was revised for the creation of STAR 3 (T. Jansson)
* -----

* This will remove your entries in the settings of the GUI such that you need to (or
may) specify them explicitly here.
* If you don't like that and instead want to take over your settings from the GUI,
deactivate the following:
  gams options = kill

  gamsexec = C:\gams\win64\28.2\gams.exe
* rscriptex = D:\R\R-3.5.0\bin\Rscript.exe
  work dir = ..\gams
  dat dir = ..\dat

  output dir = ..\output\batchoutput
  res dir = ..\output\results
  restartdir = ..\output\restart

* If you are NOT working on a network drive the following is ok:
  scr dir = ..\output\temp
* When the current directory is on a network drive it is necessary to set the scratch
directory to a directory on your hard disc:
* scr dir = c:\users\witzke\temp

  number of processors = 56
  gams options = threads 0 pw=200 ps=9999 errmsg=1 gdxcompress=1

* -----
* Declare MACRO strings to use in this batch
* -----

  MACRO = eu27Countries
  BL000000\SE000000\DK000000\DE000000\EL000000\ES000000\FR000000\IR000000\IT000000\NL00
0000\AT000000\PT000000\FI000000\UK000000\CY000000\EE000000\LV000000\LT000000\MT000000
\PL000000\SK000000\BG000000\CZ000000\HU000000\SI000000\RO000000
  MACRO = candidateCountries
  CS000000\AL000000\MO000000\HR000000\BA000000\MK000000\KO000000\TUR
  MACRO = otherCountries NO000000
  MACRO = allCountries %eu27Countries% %otherCountries% %candidateCountries%
  MACRO = calibrationYears 2015\2020\2025\2030\2050
  MACRO = TREND_YEARS 2014,2015,2020,2025,2030,2050
* Select one year for which to make additional tests (threads on/off, ghg abatement
tech on/off)
  MACRO = TEST_YEAR 2030
  MACRO = allCountriesOrdered
  NO000000\TUR\UK000000\BL000000\DK000000\DE000000\EL000000\ES000000\FR000000\IR000000\
IT000000\NL000000\AT000000\PT000000\SE000000\FI000000\CY000000\CZ000000\EE000000\HU00
0000\LT000000\LV000000\MT000000\PL000000\SI000000\SK000000\RO000000\BG000000\AL000000
\MK000000\CS000000\MO000000\HR000000\BA000000\KO000000
  MACRO = bas 12
  MACRO = baseyear 20%bas%
  MACRO = Scenariodesc cap_after_2014\ref
  MACRO = ScenariodescUnderscore cap_after_2014_ref
  MACRO = ScenariodescCal cap_after_2014\cal
  MACRO = ScenariodescCalUnderscore cap_after_2014_cal

  MACRO = allCountriesComma BL000000 "Belgium and Luxembourg",DK000000
"Denmark",DE000000 "Germany",EL000000 "Greece",ES000000 "Spain",FR000000
"France",IR000000 "Ireland",IT000000 "Italy",NL000000 "The Netherlands",AT000000
"Austria",PT000000 "Portugal",SE000000 "Sweden",FI000000 "Finland",UK000000 "United
Kingdom",CZ000000 "Czech Republic",HU000000 "Hungary",PL000000 "Poland",SI000000
"Slovenia",SK000000 "Slovak Republic",EE000000 "Estonia",LT000000
"Lithuania",LV000000 "Latvia",CY000000 "Cyprus",MT000000 "Malta",BG000000
"Bulgaria",RO000000 "Romania",NO000000 "Norway",TUR "Turkey",AL000000
"Albania",MK000000 "Macedonia",CS000000 "Serbia",MO000000 "Montenegro",HR000000
"Croatia",BA000000 "Bosnia and Herzegovina",KO000000 "Kosovo"

```



```

MACRO = eu27CountriesComma BL000000 "Belgium and Luxembourg",DK000000
"Denmark",DE000000 "Germany",EL000000 "Greece",ES000000 "Spain",FR000000
"France",IR000000 "Ireland",IT000000 "Italy",NL000000 "The Netherlands",AT000000
"Austria",PT000000 "Portugal",SE000000 "Sweden",FI000000 "Finland",UK000000 "United
Kingdom",CZ000000 "Czech Republic",HU000000 "Hungary",PL000000 "Poland",SI000000
"Slovenia",SK000000 "Slovak Republic",EE000000 "Estonia",LT000000
"Lithuania",LV000000 "Latvia",CY000000 "Cyprus",MT000000 "Malta",BG000000
"Bulgaria",RO000000 "Romania"

MACRO = CAPINVYEARS
1990,1991,1992,1993,1994,1995,1996,1997,1998,1999,2000,2001,2002,2003,2004,2005,2006,
2007,2008,2009,2010,2011,2012,2013,2014,2016
MACRO = CAPINVYEARSforLOOP
1990\1991\1992\1993\1994\1995\1996\1997\1998\1999\2000\2001\2002\2003\2004\2005\2006\
2007\2008\2009\2010\2011\2012\2013\2014\2016

* Select manure trade model (use the new one? not yet)
MACRO = NEW_MANURE_TRADE_MODEL off

* Select fertilizer distribution routine (use new from star 2)
MACRO = INNER_FERT_MODEL on

* select aglink projection
MACRO = AglinkVersion Aglink2017OECD

* decide whether UK should be part of the EU,
* possible options: EU28, BREXIT
* brexit scenarios are only operational in the latter case
*
* Note: The global database is run twice: with EU28 and also with BREXIT to prepare
the data
* Data files are flagged accordingly by using the setglobal %EUMODE% in the GAMS
code
* Note: COCO, Prepare FAOSTAT, CAPREG and CAPTRD are all run with the EU28 setting at
the moment
* The reason is that they do not generate results for market model regions that
would depend on the EUMODE switch (e.g. EU_WEST with or without UK)
* In the future these modules will need to be prepared to use the BREXIT
switch, e.g. when UK domestic ag. policies will be different from the CAP in CAPRI
* Note: in generate trend projection the selection ONLY depends on the assumptions in
the Aglink baseline. UK is part of the EU for all currently available projections.
* in generate trend projection EU28 is always ON (see below), independent of
the MACRO setting!!
MACRO = EU_composition BREXIT

*
* --- Steering of tasks with the switches below
*
* here we can activate or deactivate tasks or groups of tasks

* core tasks
MACRO = FAOSTAT ON
MACRO = FAOSTAT_generateOutput ON
MACRO = Build_global_database_map_FAO_eu28 ON
MACRO = Build_global_database_map_FAO_brexit ON
MACRO = COCO_for_non_candidateMS ON
MACRO = COCO_only_integrate_non_candidateMS ON
MACRO = COCO_for_candidateMS ON
MACRO = COCO_finish_allMS ON
MACRO = Compile_RDP_data ON
MACRO = Build_regional_time_series ON
MACRO = Build_regional_database ON
MACRO = Build_global_database_eu28 ON
MACRO = Build_global_database_brexit ON
MACRO = Estimate_GHG_emission_coefficients ON
MACRO = Generate_trend_projection_eu28 ON
MACRO = Baseline_calibration_market_model ON
MACRO = Baseline_calibration_supply_model ON
MACRO = Run_scenario_with_market_model ON

* optional tasks
MACRO = Build_GHG_Inventories off
MACRO = Collect_GHG_and_map_to_Inventories off
MACRO = Compare_GHG_with_EEA off
MACRO = Run_scenario_without_market_model off

```

```

IF %FAOSTAT% = ON
* -----
* task = Prepare FAOSTAT database
*
* NOTE: This needs to run first as FAO data are also used in coco.
* -----

    EU regional composition = EU28
    Consolidation_steps = CountryData, TradeFlows
    Country Data Consolidation Steps =
consolidateProdStat,consolidateCommodityBalances,Combine,EstimateMilk
,AdjustPopulation ,Prices
    Trade Consolidation Steps = SELECT, AGGTRADE ,UVATRADE ,STATRADE ,TRDTRADE
,INITRADE, MODTRADE, SHOWTRADE
    Productgroups to consolidate =
agrInputs,cereFeed,cereFood,cereGrain,animFats,feedstuff,fruitTemp,fruitTrop,induCrop
,meats,meatProc,milkProd,oilcakes,vegoils,oilseeds,pulses,roots,sugaProd,vegeProc,veg
etabl,textiles,lifeAnim,nonAlcBeverage,fruitProc,nuts,skinhide,skinProd,alcBeverage,c
ereFlour
    Load meta information from older task = ON
    Print gams code to listing = onListing
    Solprint = On
    Limrow = 0.0
    Limcol = 0.0
    Start threats in visible dos windows = OFF
    execute=Gamsrun

ENDIF

IF %FAOSTAT_generateOutput% = ON
* -----
* task = Prepare FAOSTAT database
*
* NOTE: This needs to run first as FAO data are also used in coco.
* -----

* We keep building the data base with pre-brexit settings
    EU regional composition = EU28
    Consolidation_steps = TradeFlows
    Country Data Consolidation Steps =
consolidateProdStat,consolidateCommodityBalances,Combine,EstimateMilk
,AdjustPopulation ,Prices
    Trade Consolidation Steps = ExportGUI ,ExportGlobal
    Productgroups to consolidate =
agrInputs,cereFeed,cereFood,cereGrain,animFats,feedstuff,fruitTemp,fruitTrop,induCrop
,meats,meatProc,milkProd,oilcakes,vegoils,oilseeds,pulses,roots,sugaProd,vegeProc,veg
etabl,textiles,lifeAnim,nonAlcBeverage,fruitProc,nuts,skinhide,skinProd,alcBeverage,c
ereFlour
    Load meta information from older task = ON
    Print gams code to listing = onListing
    Solprint = On
    Limrow = 0.0
    Limcol = 0.0
    Start threats in visible dos windows = OFF
    execute=Gamsrun
ENDIF

IF %Build_global_database_map_FAO_eu28% = ON
* -----
* task = Build global database
*
* NOTE: Global should be run before coco with "Only map market data from FAO then
unload and exit = ON"
* to obtain global\data_market_raw.gdx to be used for FAO input into coco
* Currently we have the "old solution": using dat\fao_dataMarket.gdx produced
by the stand alone "coco_fao_MarketBalances.gms".
* -----

    EU regional composition = EU28

```

```

    First ex post year = 1984
    * Pick base year = 2012 (independent of %baseyear%) here to trigger completion of
time series until 2013 for coco
    Base year = 2012
    Last ex post year = 2013
    Only map market data from FAO then unload and exit = ON
    Countries = %allCountriesComma%
    Regional breakdown = Countries
    Non-default FAO trade matrix vintage = OFF
    FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
    Update transportcost matrix = ON
    Update longrun projections = OFF
    Advanced tariff aggregation = OFF
    GLOBIOM Version for longrun projections = GLOBIOM_EU "Projections with GLOBIOM-EU
model"
    Use specific Aglink Scenario settings = ON
    Aglink Cosimo model version = %AglinkVersion%
    Aglink Cosimo scenario name = %AglinkVersion%
    Load meta information from older task = ON
    Additional input data identifier =
    Additional result type identifier =
    Print gams code to listing = onListing
    Solprint = On
    Limrow = 0.0
    Limcol = 0.0

    execute=Gamsrun
ENDIF

```

```

IF %Build_global_database_map_FAO_brexit%=on
* -----
* task = Build global database
*
* NOTE: Global should be run before coco with "Only map market data from FAO then
unload and exit = ON"
* to obtain global\data_market_raw.gdx to be used for FAO input into coco
* Currently we have the "old solution": using dat\fao_dataMarket.gdx produced
by the stand alone "coco_fao_MarketBalances.gms".
* -----

```

```

    EU regional composition = BREXIT
    First ex post year = 1984
    Base year = %Baseyear%
    Last ex post year = 2013
    Only map market data from FAO then unload and exit = ON
    Countries = %allCountriesComma%
    Regional breakdown = Countries
    Non-default FAO trade matrix vintage = OFF
    FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
    Update transportcost matrix = ON
    Update longrun projections = OFF
    Advanced tariff aggregation = OFF
    GLOBIOM Version for longrun projections = GLOBIOM_EU "Projections with GLOBIOM-EU
model"
    Use specific Aglink Scenario settings = ON
    Aglink Cosimo model version = %AglinkVersion%
    Aglink Cosimo scenario name = %AglinkVersion%
    Load meta information from older task = ON
    Additional input data identifier =
    Additional result type identifier =
    Override results_in: =
    Override results_out: =
    Override restart_in: =
    Override restart_out: =
    Print gams code to listing = onListing
    Solprint = On
    Limrow = 0.0
    Limcol = 0.0

    execute=Gamsrun
ENDIF

```

```

IF %COCO_for_non_candidateMS% = ON
* -----
  task = Prepare national database
* -----

  First ex post year = 1984
  Last ex post year = 2017
  Automatic check for selection of years = ON
  Regional breakdown = Countries
* Check final settings = full_check
* Check final settings = accept_any_result
  Check final settings = accept_any_tseries_dif
* Check final settings = accept_after_chk
  Non-default FAO trade matrix vintage = OFF
  FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
  Estimate areas, yields and crop production = ON
  Estimate animals = ON
  Estimate markets = ON
  Estimate land use = ON
  Load meta information from older task = ON
  Print gams code to listing = onListing
  Solprint = on
  Limrow = 0.0
  Limcol = 0.0
  Additional result type identifier =

  startParallel
    FOR curCountry = %eu27Countries%\%otherCountries%
      Countries = %curCountry%
      execute=gamsrun
    ENDFOR
  collectParallel
ENDIF

IF %COCO_only_integrate_non_candidateMS% = ON
* -----
* COC02: Consolidation of EU27 has to occur before running balkan countries
* -----
* Note: Consolidation of EU27 has to occur before running balkan countries
* which partly rely on average shares taken from EU27 or from a sub-group of
EU27 and read from coco1_output.gdx
  task = Finish national database

  First ex post year = 1984
  Last ex post year = 2017
  Only integrate results for single MS = ON
  Countries = BL000000 "Belgium and Luxembourg",DK000000 "Denmark",DE000000
"Germany",EL000000 "Greece",ES000000 "Spain",FR000000 "France",IR000000
"Ireland",IT000000 "Italy",NL000000 "The Netherlands",AT000000 "Austria",PT000000
"Portugal",SE000000 "Sweden",FI000000 "Finland",UK000000 "United Kingdom",CZ000000
"Czech Republic",HU000000 "Hungary",PL000000 "Poland",SI000000 "Slovenia",SK000000
"Slovak Republic",EE000000 "Estonia",LT000000 "Lithuania",LV000000 "Latvia",CY000000
"Cyprus",MT000000 "Malta",BG000000 "Bulgaria",RO000000 "Romania",NO000000 "Norway",
  Regional breakdown = Countries
  Load meta information from older task = ON
  Print gams code to listing = offListing
  Solprint = on
  Limrow = 0.0
  Limcol = 0.0

  execute=Gamsrun
ENDIF

IF %COCO_for_candidateMS% = ON
* -----
  task = Prepare national database
* -----

  First ex post year = 1995
  Last ex post year = 2016
  Automatic check for selection of years = ON
  Regional breakdown = Countries

```

```

* Check final settings = full_check
* Check final settings = accept_any_result
Check final settings = accept_any_tseries_dif
* Check final settings = accept_after_chk
Non-default FAO trade matrix vintage = OFF
FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
Estimate areas, yields and crop production = ON
Estimate animals = ON
Estimate markets = ON
Estimate land use = ON
Load meta information from older task = ON
Print gams code to listing = onListing
Solprint = on
Limrow = 0.0
Limcol = 0.0

startparallel
  FOR curCountry = %candidateCountries%
    Countries = %curCountry%
    execute = Gamsrun
  ENDFOR
collectparallel
ENDIF

IF %COCO_finish_allMS% = ON
* -----
  task = Finish national database
* -----

  First ex post year = 1984
  Last ex post year = 2016
* Set to 'on' if only integration is desired and main parts of coco2 should be run
  later
* Only integrate results for single MS = ON
  Only integrate results for single MS = OFF
  Countries = %allCountriesComma%
  Regional breakdown = Countries
  Non-default FAO trade matrix vintage = OFF
  FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
  Load meta information from older task = ON
  Print gams code to listing = offListing
  Solprint = on
  Limrow = 0.0
  Limcol = 0.0

  execute=Gamsrun
ENDIF

IF %Compile_RDP_data% = ON
* -----
  task = Compile RDP data
* -----

  EU regional composition = %EU_COMPOSITION%
  Load meta information from older task = ON
  Print gams code to listing = offListing
  Solprint = on
  Limrow = 0.0
  Limcol = 0.0

  execute=Gamsrun
ENDIF

IF %Build_regional_time_series% = ON
* -----
  task = Build regional time series
* -----

  First ex post year = 1984
  Base year = %baseyear%
  Last ex post year = 2016

```

```

Time series = ON
New Manure Trade Module = %NEW_MANURE_TRADE_MODEL%
Regional breakdown = NUTS2
Non-default FAO trade matrix vintage = OFF
FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
Load meta information from older task = ON
Print gams code to listing = onListing
Solprint = Off
Limrow = 0.0
Limcol = 0.0

startparallel
  FOR curCountry = %allCountries%
    Countries = %curCountry%
    execute=gamsrun
  ENDFOR
collectparallel

ENDIF

IF %Build_regional_database% = ON
* -----
  task = Build regional database
* -----

  First ex post year = 1984
  Base year = %baseyear%
  Last ex post year = 2016
  New Manure Trade Module = %NEW_MANURE_TRADE_MODEL%
  Use inner fertilizer model = %INNER_FERT_MODEL%
  Yields/Input Costs per farm from FADN = OFF
  Load meta information from older task = ON
  Solution printing = Suppress
  Print gams code to listing = offListing
  Solprint = Off
  Limrow = 0.0
  Limcol = 0.0

  startparallel
    FOR curCountry = %allCountries%
      Regional breakdown = NUTS2
      Countries = %curCountry%
      execute = GAMSrun
    ENDFOR
  collectparallel

* startparallel
*   FOR curCountry = %allCountries%
*     Regional breakdown = Farm types
*     Countries = %curCountry%
*     execute = GAMSrun
*   ENDFOR
* collectparallel
ENDIF

IF %Build_GHG_Inventories% = ON
* -----
  task = Build GHG Inventories
* -----

* step 1

  GHG_per_Country = ON
  Map_CAPRI_NIR = OFF
  Base year = 2012
  Load meta information from older task = ON
  Additional input data identifier =
  Additional result type identifier =
  Override results_in: =
  Override results_out: =
  Override restart_in: =
  Override restart_out: =
  Print gams code to listing = offListing

```

```

Solprint = On
Limrow = 0.0
Limcol = 0.0

startparallel
  FOR curCountry = %eu27Countries%
    FOR curYEAR = %CAPINVYEARSforLOOP%

      InvYears = %curYEAR%
      Countries = %curCountry%

      execute=gamsrun
    ENDFOR
  ENDFOR
collectparallel

ENDIF

IF %Collect_GHG_and_map_to_Inventories% = ON

  task = Collect GHG and map to Inventories

  Load meta information from older task = ON
  Additional input data identifier =
  Additional result type identifier =
  Override results_in: =
  Override results_out: =
  Override restart_in: =
  Override restart_out: =
  Print gams code to listing = offListing
  Solprint = On
  Limrow = 0.0
  Limcol = 0.0

  InvYears = %CAPINVYEARS%
  Countries = %eu27CountriesComma%
  execute=gamsrun

ENDIF

IF %Compare_GHG_with_EEA% = ON

* -----
*
* Task specific settings for batch file mode
*
* -----
  task = Compare GHG with EEA

  Load meta information from older task = ON
  Additional input data identifier =
  Additional result type identifier =
  Override results_in: =
  Override results_out: =
  Override restart_in: =
  Override restart_out: =
  Print gams code to listing = offListing
  Solprint = On
  Limrow = 0.0
  Limcol = 0.0
  execute=Rrun
ENDIF

IF %Build_global_database_eu28% = ON
* -----
  task = Build global database
* -----

  EU regional composition = EU28
  First ex post year = 1984
  Base year = %baseyear%
  Last ex post year = 2015
  Only map market data from FAO then unload and exit = OFF
  Countries = %allCountriesComma%
  Regional breakdown = Countries

```

```

Non-default FAO trade matrix vintage = OFF
FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
Tariff aggregation source = MACMAP2016
* Tariff aggregation source = MACMAP2020
Only map market data from FAO then unload and exit = OFF
Update transportcost matrix = ON
Update longrun projections = ON
Advanced tariff aggregation = OFF
GLOBIOM version for longrun projections = GLOBIOM_EU "Projections with GLOBIOM-EU
model",GLOBIOM_GL "Projections with standard GLOBIOM model"
Aglink Cosimo model version = %AglinkVersion%
Aglink Cosimo scenario name = %AglinkVersion%
Load meta information from older task = ON
Print gams code to listing = offListing
Solprint = On
Limrow = 0.0
Limcol = 0.0

execute=gamsrun
ENDIF

```

```

IF %Build_global_database_brexit% = ON

```

```

* -----
* task = Build global database
* -----

```

```

EU regional composition = BREXIT
First ex post year = 1984
Base year = %baseyear%
Last ex post year = 2015
Only map market data from FAO then unload and exit = OFF
Countries = %allCountriesComma%
Regional breakdown = Countries
Non-default FAO trade matrix vintage = OFF
FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
Tariff aggregation source = MACMAP2016
* Tariff aggregation source = MACMAP2020
Only map market data from FAO then unload and exit = OFF
Update transportcost matrix = ON
Update longrun projections = ON
Advanced tariff aggregation = OFF
GLOBIOM version for longrun projections = GLOBIOM_EU "Projections with GLOBIOM-EU
model",GLOBIOM_GL "Projections with standard GLOBIOM model"
Aglink Cosimo model version = %AglinkVersion%
Aglink Cosimo scenario name = %AglinkVersion%
Load meta information from older task = ON
Print gams code to listing = offListing
Solprint = On
Limrow = 0.0
Limcol = 0.0

execute=gamsrun
ENDIF

```

```

IF %Estimate_GHG_emission_coefficients% = ON

```

```

* -----
* task = Estimate GHG emission coefficients
* -----

```

```

EU regional composition = %EU_COMPOSITION%
Base year = %baseyear%
Countries = %allCountriesComma%
Global, spatial multi-commodity model = ON
Non-default FAO trade matrix vintage = OFF
FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
Math programming supply model = OFF
Re-compile Edgar data = ON
Only compile Edgar = OFF
Load meta information from older task = ON
Additional input data identifier =
Additional result type identifier =
Override results_in: =
Override results_out: =

```



```

Override restart_in: =
Override restart_out: =
Print gams code to listing = onListing
Solprint = Off
Limrow = 0.0
Limcol = 0.0

execute=Gamsrun

ENDIF
* -----
*
* pseudo task: call_create_longrun_info:
*               = stand alone program run typically by PW based on GLOBIOM-GL or
GLOBIOM-EU outputs
*               Requires many settings of global variables in
global\convert_globiom.gms
*               For specific GLOBIOM runs (eg those from the AgClim50 project) also
needs big input files that are not committed
*               Gives results\global\longrun_info_fac.gdx for captrd and for the
baseline market calibration
*               To run in a command prompt window:
*               "gams call_create_longrun_info.gms"
*
* -----
IF %Generate_trend_projection_eu28% = ON
* -----
task = Generate trend projection
* -----
* in trend projections we assume no Brexit as long as the Aglink baseline does the
same
* will change in future releases
EU regional composition = EU28

First ex post year = 1984
Base year = %baseyear%
Simulation years = %TREND_YEARS%
Last simulation year = 2050
Last year of NUTS2 trends for FTs = 2030
Countries = %allCountriesComma%
Regional breakdown = NUTS2
Aglink Cosimo model version = %AglinkVersion%
Aglink Cosimo scenario name = %AglinkVersion%
Scaling to DG Agri baseline = OFF
Long run baseline selection = globiom_eu_2018+REFERENCE+REFERENCE "GLOBIOM_EU
reference run for DG CLIMA based on PRIMES 301117"
Primes scenarios for biofuel supports = primes_ref_301117
Non-default FAO trade matrix vintage = OFF
FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
Load meta information from older task = ON
Print gams code to listing = offListing
Solprint = On
Limrow = 0.0
Limcol = 0.0

execute=gamsrun
ENDIF

IF %Baseline_calibration_market_model% = ON
* -----
task = Baseline calibration market model
* -----
EU regional composition = %EU_COMPOSITION%
Scenario description = %ScenariodescCal%
Trace data flow = OFF
Base year = %baseyear%
Countries = %allCountriesComma%
Regional breakdown = Countries
Policy blocks (additional geographical layer) = OFF
Alternative GAMS license file for GHG emission estimation = gamslice
Long run baseline selection = globiom_eu_2018+REFERENCE+REFERENCE "GLOBIOM_EU
reference run for DG CLIMA based on PRIMES 301117"
Load meta information from older task = ON
Print gams code to listing = onListing

```

```

Solprint = off
Limrow = 0.0
Limcol = 0.0
Solution print at preparatory solve = OFF
Abort after preparatory solve = OFF
Solution print for pre-steps in 1st iteration with abort = OFF
Plus iterlim to zero for 1st pre-steps in 1st iteration = OFF
Number of presteps before abort = 1
FOR curYear = %calibrationYears%
    Simulation years = %curYear%
    execute = Gamsrun
ENDFOR
ENDIF

IF %Baseline_calibration_supply_model% = ON
* -----
task = Baseline calibration supply models
* -----
EU regional composition = %EU_COMPOSITION%
Scenario description = %ScenariodescCal%
Base year = %baseyear%
Regional breakdown = NUTS2
New Manure Trade Module = %NEW_MANURE_TRADE_MODEL%
Use inner fertilizer model = %INNER_FERT_MODEL%
Dampening of high activity level elasticities = off
Load meta information from older task = ON
Solution printing = Suppress
Determine point price elasticities = ON
Print gams code to listing = offListing
Solprint = off
Limrow = 0.0
Limcol = 0.0

startParallel

    FOR curYear = %calibrationYears%
        Simulation years = %curYear%

        FOR curCountry = %allCountries%
            Countries = %curCountry%
            execute=gamsrun
        ENDFOR

    ENDFOR
collectParallel

ENDIF

IF %Run_scenario_without_market_model% = ON

task = Run scenario without market model

EU regional composition = %EU_COMPOSITION%
Scenario description = %Scenariodesc%
Base year = %baseyear%
Countries = %allCountriesComma%
Generate GAMS child processes on different threads = on
Generate CMD per Thread = OFF
GHG abatement technology = off
Regional breakdown = NUTS2
New Manure Trade Module = %NEW_MANURE_TRADE_MODEL%
Use inner fertilizer model = %INNER_FERT_MODEL%
Non-default reference scenario for carbon accounting = OFF
Reference scenario for carbon accounting = res_2_%bas%10_%Scenariodesc%.gdx
Non-default FAO trade matrix vintage = OFF
FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
Number of iterations = 99
Aggregates for activities and commodities = ON
Environmental Indicators = OFF
Life-cycle assessment for energy = OFF
Multi-functionality indicators = OFF
Iteration tracking = ON

```

```

Sensitivity experiments with features in supply model = OFF
Load meta information from older task = ON
Solution printing = variables and equations
Determine point price elasticities = OFF
generate.gdx file with Values of Supply model = OFF
Print gams code to listing = onListing
Solprint = On
Limrow = 0.0
Limcol = 0.0
Additional result type identifier = _sup

* Parallel execution works fine if carbon accounting is always against BAS, otherwise
ref files need to be specified as below, "with market model"
startParallel
  FOR curYear = %calibrationYears%
    Simulation years = %curYear%
    execute=gamsrun
  ENDFOR
collectParallel

ENDIF

IF %Run_scenario_with_market_model% = ON
* -----
  task = Run scenario with market model
* -----
  EU regional composition = %EU_COMPOSITION%
  Scenario description = %Scenariodesc%
  GHG abatement technology = off
  Base year = %baseyear%
  Countries = %allCountriesComma%
  Regional breakdown = NUTS2
  New Manure Trade Module = %NEW_MANURE_TRADE_MODEL%
  Use inner fertilizer model = %INNER_FERT_MODEL%
  Non-default reference scenario for carbon accounting = OFF
  Non-default FAO trade matrix vintage = OFF
  FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
  Policy blocks (additional geographical layer) = OFF
  Endogenous margins between trade block and country prices = OFF
  Advanced tariff aggregation module = OFF
  Number of iterations = 99
  Use lower price iterations weights after iteration = 20
  Alternative GAMS license file for GHG emission estimation = gamslice
  Aggregates for activities and commodities = ON
  Environmental Indicators = ON
  Life-cycle assessment for energy = OFF
  Multi-functionality indicators = OFF
  Iteration tracking = ON
  Sensitivity experiments with features in supply model = OFF
  Load meta information from older task = ON
  Solution printing = suppress
  Determine point price elasticities = OFF
  Print gams code to listing = offListing
  Solprint = off
  Limrow = 0.0
  Limcol = 0.0
  Maximum number of pre-steps market model = 15
  Solution print at preparatory solve = OFF
  Abort after preparatory solve = OFF
  Solution print for pre-steps in 1st iteration with abort = OFF
  Plus iterlim to zero for 1st pre-steps in 1st iteration = OFF
  Number of presteps before abort = 1
  Kill simini file = On
  Generate GAMS child processes on different threads = ON
  Generate CMD per Thread = off

* --- First, test baseline reproduction runs for all calibration years
startParallel
  FOR curYear = %calibrationYears%
    Simulation years = %curYear%
    execute=gamsrun
  ENDFOR
collectParallel

```

```

* --- Then, test specific features for a selected year called TEST_YEAR
*   Make sure that 2015 is run and finalized before running the
*   remaining tests in parallel
Simulation years = 2015
execute=gamsrun
Simulation years = %TEST_YEAR%

startParallel

*   Test if the non-default reference scenario settings works for 2015
Non-default reference scenario for carbon accounting = ON
Reference scenario for carbon accounting = res_2_%bas%15%ScenariodescUnderscore%
execute=gamsrun
Non-default reference scenario for carbon accounting = OFF

*   Test threads off (they were on before)
Generate GAMS child processes on different threads = OFF
execute=gamsrun
Generate GAMS child processes on different threads = ON

*   Test with ghg abatement technologies on
GHG abatement technology = ON
execute=gamsrun
GHG abatement technology = OFF

collectParallel

ENDIF

```

## Annex III: Batch execution file for stability tests

```
*****
*
* Batch file for testing stability of database and baseline mechanisms in capri*
*
*****

* This will remove your entries in the settings of the GUI such that you need to (or
may) specify them explicitly here.
* If you don't like that and instead want to take over your settings from the GUI,
deactivate the following:
  gams options = kill

* --- Local Settings for TJ ---

gamsexe = c:\gams\win64\28.2\gams.exe
work dir = ..\gams
dat dir = ..\dat

output dir = ..\output\batchOutput
res dir = ..\output\results
restartdir = ..\output\restart
scr dir = ..\output\temp

number of processors = 56

gams options = threads 0 pw=200 ps=9999 errmsg=1 gdxcompress=1

* -----
* Declare MACRO strings to use in this batch
* -----

MACRO = experimentRoot e:\experiments_3.0

MACRO = override_results_in %experimentRoot%\results_clean
MACRO = override_restart_in %experimentRoot%\restart_clean

* Machine specific paths to various GAMS installations
MACRO = gams247 c:\gams\win64\24.7\gams.exe
MACRO = gams249 c:\gams\win64\24.9\gams.exe
MACRO = gams250 c:\gams\win64\25.0\gams.exe
MACRO = gams251 c:\gams\win64\25.1\gams.exe
MACRO = gams282 c:\gams\win64\28.2\gams.exe
MACRO = gams303 c:\gams\win64\30.3\gams.exe

* Specify which GAMS version is the default/supported one for CAPRI (clean)
MACRO = supportedGams %gams282%

MACRO = eu27Countries
BL000000\SE000000\DK000000\DE000000\EL000000\ES000000\FR000000\IR000000\IT000000\NL00
0000\AT000000\PT000000\FI000000\UK000000\CY000000\EE000000\LV000000\LT000000\MT000000
\PL000000\SK000000\BG000000\CZ000000\HU000000\SI000000\RO000000
MACRO = candidateCountries
CS000000\AL000000\MO000000\HR000000\BA000000\MK000000\KO000000\TUR
MACRO = otherCountries NO000000
MACRO = allCountries %eu27Countries%\%otherCountries%\%candidateCountries%
MACRO = calibrationYears 2015\2030
MACRO = sim 15\30

* Year selection for the trend projection tool: in sensitivity analyses, we use a
limited set of projections.
MACRO = TREND_YEARS 2015,2030,2050
MACRO = allCountriesOrdered
TUR\NO000000\DE000000\IT000000\ES000000\FR000000\UK000000\BL000000\DK000000\EL000000\
IR000000\NL000000\AT000000\PT000000\SE000000\FI000000\CY000000\CZ000000\EE000000\HU00
0000\LT000000\LV000000\MT000000\PL000000\SI000000\SK000000\RO000000\BG000000\AL000000
\MK000000\CS000000\MO000000\HR000000\BA000000\KO000000
MACRO = bas 12
MACRO = baseyear 20%bas%
MACRO = Scenariodesc cap_after_2014\ref
MACRO = ScenariodescCal cap_after_2014\cal
MACRO = ScenariodescUnderscore cap_after_2014_ref
MACRO = ScenariodescCalUnderscore cap_after_2014_cal
```

```

MACRO = allCountriesComma BL000000 "Belgium and Luxembourg",DK000000
"Denmark",DE000000 "Germany",EL000000 "Greece",ES000000 "Spain",FR000000
"France",IR000000 "Ireland",IT000000 "Italy",NL000000 "The Netherlands",AT000000
"Austria",PT000000 "Portugal",SE000000 "Sweden",FI000000 "Finland",UK000000 "United
Kingdom",CZ000000 "Czech Republic",HU000000 "Hungary",PL000000 "Poland",SI000000
"Slovenia",SK000000 "Slovak Republic",EE000000 "Estonia",LT000000
"Lithuania",LV000000 "Latvia",CY000000 "Cyprus",MT000000 "Malta",BG000000
"Bulgaria",RO000000 "Romania",NO000000 "Norway",TUR "Turkey",AL000000
"Albania",MK000000 "Macedonia",CS000000 "Serbia",MO000000 "Montenegro",HR000000
"Croatia",BA000000 "Bosnia and Herzegovina",KO000000 "Kosovo"

* Select manure trade model (use the new one? not yet)
MACRO = NEW_MANURE_TRADE_MODEL off

* Select fertilizer distribution routine (use new from star 2)
MACRO = INNER_FERT_MODEL on

* select the appropriate Aglink version
MACRO = AglinkVersion Aglink2017OECD

* decide whether UK should be part of the EU,
* possible options: EU28, BREXIT
* brexit scenarios are only operational in the latter case
*
* Note: The global database is run twice: with EU28 and also with BREXIT to prepare
the data
* Data files are flagged accordingly by using the setglobal %EUMODE% in the GAMS
code
* Note: COCO, Prepare FAOSTAT, CAPREG and CAPTRD are all run with the EU28 setting at
the moment
* The reason is that they do not generate results for market model regions that
would depend on the EUMODE switch (e.g. EU_WEST with or without UK)
* In the future these modules will need to be prepared to use the BREXIT
switch, e.g. when UK domestic ag. policies will be different from the CAP in CAPRI
* Note: in generate trend projection the selection ONLY depends on the assumptions in
the Aglink baseline. UK is part of the EU for all currently available projections.
* in generate trend projection EU28 is always ON (see below), independent of
the MACRO setting!!
MACRO = EU_composition BREXIT

*
* --- Steering of tasks with the switches below
*
* here we can activate or deactivate tasks or groups of tasks

* core tasks
MACRO = FAOSTAT ON
MACRO = FAOSTAT_generateOutput ON
MACRO = Build_global_database_map_FAO_eu28 ON
MACRO = Build_global_database_map_FAO_brexit ON
MACRO = COCO_for_non_candidateMS ON
MACRO = COCO_only_integrate_non_candidateMS ON
MACRO = COCO_for_candidateMS ON
MACRO = COCO_finish_allMS ON
MACRO = Compile_RDP_data ON
MACRO = Build_regional_time_series ON
MACRO = Build_regional_database ON
MACRO = Build_global_database_eu28 ON
MACRO = Build_global_database_brexit ON
MACRO = Estimate_GHG_emission_coefficients ON
MACRO = Generate_trend_projection ON
MACRO = Baseline_calibration_market_model ON
MACRO = Baseline_calibration_supply_model ON
MACRO = MERGE_CALIBRATION_RESULTS ON
MACRO = Run_scenario_with_market_model ON
MACRO = Run_scenario_without_market_model ON
MACRO = Run_scenario_only_market_model ON

* optional tasks
MACRO = FARMTYPES OFF
MACRO = Build_GHG_Inventories OFF

```

```

* --- Open loop over sensitivity experiments
FOR curExperiment = clean\restart1\restart2\g251\g303\rnd1
*FOR curExperiment = clean\restart1\restart2
*FOR curExperiment = clean

* --- Experiment-specific settings

*   Define which GAMS version to use
IF %curExperiment% = g247
    gamsexe = %gams247%
ELSEIF %curExperiment% = g249
    gamsexe = %gams249%
ELSEIF %curExperiment% = g251
    gamsexe = %gams251%
ELSEIF %curExperiment% = g282
    gamsexe = %gams282%
ELSEIF %curExperiment% = g303
    gamsexe = %gams303%
ELSE
    gamsexe = %supportedGams%
ENDIF

*   We allow up to three experiments with random restart values
IF %curExperiment% = rnd1
    MACRO = randomStartValues ON
ELSEIF %curExperiment% = rnd2
    MACRO = randomStartValues ON
ELSEIF %curExperiment% = rnd3
    MACRO = randomStartValues ON
ELSE
    MACRO = randomStartValues OFF
ENDIF

*   Define where the results are going to be stored for this experiment
MACRO = override_results_out %experimentRoot%\results_%curExperiment%
MACRO = override_restart_out %experimentRoot%\restart_%curExperiment%

IF %FAOSTAT% = ON
* -----
    task = Prepare FAOSTAT database
*
* NOTE: This needs to run first as FAO data are also used in coco.
* -----

    EU regional composition = EU28
    Consolidation_steps = CountryData, TradeFlows
    Country Data Consolidation Steps =
consolidateProdStat,consolidateCommodityBalances,Combine,EstimateMilk
,AdjustPopulation ,Prices
    Trade Consolidation Steps = SELECT, AGGTRADE ,UVATRADE ,STATRADE ,TRDTRADE
,INITRADE, MODTRADE, SHOWTRADE
    Productgroups to consolidate =
agrInputs,cereFeed,cereFood,cereGrain,animFats,feedstuff,fruitTemp,fruitTrop,induCrop
,meats,meatProc,milkProd,oilcakes,vegoils,oilseeds,pulses,roots,sugaProd,vegeProc,veg
etabl,textiles,lifeAnim,nonAlcBeverage,fruitProc,nuts,skinhide,skinProd,alcBeverage,c
ereFlour
    Load meta information from older task = ON
    Print gams code to listing = onListing
    Solprint = on
    Limrow = 0.0
    Limcol = 0.0
    Start threats in visible dos windows = OFF

    Override results_in: = %override_results_in%
    Override restart_in: = %override_restart_in%
    Override results_out: = %override_results_out%
    Override restart_out: = %override_restart_out%

```

execute=Gamsrun

ENDIF

IF %FAOSTAT\_generateOutput% = ON

```
* -----
* task = Prepare FAOSTAT database
*
* NOTE: This needs to run first as FAO data are also used in coco.
* -----
*
* We keep building the data base with pre-brexit settings
* EU regional composition = EU28
* Consolidation_steps = TradeFlows
* Country Data Consolidation Steps =
consolidateProdStat,consolidateCommodityBalances,Combine,EstimateMilk
,AdjustPopulation ,Prices
* Trade Consolidation Steps = ExportGUI ,ExportGlobal
* Productgroups to consolidate =
agrInputs,cereFeed,cereFood,cereGrain,animFats,feedstuff,fruitTemp,fruitTrop,induCrop
,meats,meatProc,milkProd,oilcakes,vegoils,oilseeds,pulses,roots,sugaProd,vegeProc,veg
etabl,textiles,lifeAnim,nonAlcBeverage,fruitProc,nuts,skinhide,skinProd,alcBeverage,c
ereFlour
* Load meta information from older task = ON
* Print gams code to listing = onListing
* Solprint = on
* Limrow = 0.0
* Limcol = 0.0
* Start threats in visible dos windows = OFF
```

```
Override results_in: = %override_results_in%
Override restart_in: = %override_restart_in%
Override results_out: = %override_results_out%
Override restart_out: = %override_restart_out%
```

execute=Gamsrun  
ENDIF

IF %Build\_global\_database\_map\_FAO\_eu28% = ON

```
* -----
* task = Build global database
*
* NOTE: Global should be run before coco with "Only map market data from FAO then
unload and exit = ON"
* to obtain global\data_market_raw.gdx to be used for FAO input into coco
* Currently we have the "old solution": using dat\fao_dataMarket.gdx produced
by the stand alone "coco_fao_MarketBalances.gms".
* -----
```

```
EU regional composition = EU28
First ex post year = 1984
* Pick base year = 2012 (independent of %baseyear%) here to trigger completion of
time series until 2013 for coco
Base year = 2012
Last ex post year = 2013
Only map market data from FAO then unload and exit = ON
Countries = %allCountriesComma%
Regional breakdown = Countries
Non-default FAO trade matrix vintage = OFF
FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
Update transportcost matrix = ON
Update longrun projections = OFF
Advanced tariff aggregation = OFF
GLOBIOM version for longrun projections = GLOBIOM_EU "Projections with GLOBIOM-EU
model"
Use specific Aglink Scenario settings = ON
Aglink Cosimo model version = %AglinkVersion%
Aglink Cosimo scenario name = %AglinkVersion%
Load meta information from older task = ON
Additional input data identifier =
```



```

Additional result type identifier =
Print gams code to listing = onListing
Solprint = On
Limrow = 0.0
Limcol = 0.0

Override results_in: = %override_results_in%
Override restart_in: = %override_restart_in%
Override results_out: = %override_results_out%
Override restart_out: = %override_restart_out%

execute=Gamsrun

ENDIF

IF %Build_global_database_map_FAO_brexit% = ON
* -----
  task = Build global database
*
* NOTE: Global should be run before coco with "Only map market data from FAO then
  unload and exit = ON"
*   to obtain global\data_market_raw.gdx to be used for FAO input into coco
*   Currently we have the "old solution": using dat\fao_dataMarket.gdx produced
  by the stand alone "coco_fao_MarketBalances.gms".
* -----
  EU regional composition = BREXIT
  First ex post year = 1984
*   Pick base year = 2012 (independent of %baseyear%) here to trigger completion of
  time series until 2013 for coco
  Base year = 2012
  Last ex post year = 2013
  Only map market data from FAO then unload and exit = ON
  Countries = %allCountriesComma%
  Regional breakdown = Countries
  Non-default FAO trade matrix vintage = OFF
  FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
  Update transportcost matrix = ON
  Update longrun projections = OFF
  Advanced tariff aggregation = OFF
  GLOBIOM version for longrun projections = GLOBIOM_EU "Projections with GLOBIOM-EU
model"
  Use specific Aglink Scenario settings = ON
  Aglink Cosimo model version = %AglinkVersion%
  Aglink Cosimo scenario name = %AglinkVersion%
  Load meta information from older task = ON
  Additional input data identifier =
  Additional result type identifier =
  Print gams code to listing = onListing
  Solprint = On
  Limrow = 0.0
  Limcol = 0.0

  Override results_in: = %override_results_in%
  Override restart_in: = %override_restart_in%
  Override results_out: = %override_results_out%
  Override restart_out: = %override_restart_out%

  execute=Gamsrun

ENDIF

IF %COCO_for_non_candidateMS% = ON
* -----
  task = Prepare national database
* -----

  First ex post year = 1984
  Last ex post year = 2017
  Automatic check for selection of years = ON
  Regional breakdown = Countries
*   Check final settings = full_check
*   Check final settings = accept_any_result
  Check final settings = accept_any_tseries_dif
*   Check final settings = accept_after_chk

```

```

Non-default FAO trade matrix vintage = OFF
FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
Estimate areas, yields and crop production = ON
Estimate animals = ON
Estimate markets = ON
Estimate land use = ON
Load meta information from older task = ON
Print gams code to listing = onListing
Solprint = on
Limrow = 0.0
Limcol = 0.0
Additional result type identifier =

Override results_in: = %override_results_in%
Override restart_in: = %override_restart_in%
Override results_out: = %override_results_out%
Override restart_out: = %override_restart_out%

startParallel
  FOR curCountry = %eu27Countries%\%otherCountries%
    Countries = %curCountry%
    execute=gamsrun
  ENDFOR
collectParallel

ENDIF

IF %COCO_only_integrate_non_candidateMS% = ON
* -----
* COC02: Consolidation of EU27 has to occur before running balkan countries
* which partly rely on average shares taken from EU27 or from a sub-group of
EU27 and read from coco1_output.gdx
* task = Finish national database
* -----

  First ex post year = 1984
  Last ex post year = 2017
  Only integrate results for single MS = ON
  Countries = BL000000 "Belgium and Luxembourg",DK000000 "Denmark",DE000000
"Germany",EL000000 "Greece",ES000000 "Spain",FR000000 "France",IR000000
"Ireland",IT000000 "Italy",NL000000 "The Netherlands",AT000000 "Austria",PT000000
"Portugal",SE000000 "Sweden",FI000000 "Finland",UK000000 "United Kingdom",CZ000000
"Czech Republic",HU000000 "Hungary",PL000000 "Poland",SI000000 "Slovenia",SK000000
"Slovak Republic",EE000000 "Estonia",LT000000 "Lithuania",LV000000 "Latvia",CY000000
"Cyprus",MT000000 "Malta",BG000000 "Bulgaria",RO000000 "Romania",NO000000 "Norway",
  Regional breakdown = Countries
  Load meta information from older task = ON
  Print gams code to listing = offListing
  Solprint = on
  Limrow = 0.0
  Limcol = 0.0

  Override results_in: = %override_results_in%
  Override restart_in: = %override_restart_in%
  Override results_out: = %override_results_out%
  Override restart_out: = %override_restart_out%

  execute=Gamsrun

ENDIF

IF %COCO_for_candidateMS% = ON
* -----
* task = Prepare national database
* -----

  First ex post year = 1995
  Last ex post year = 2016
  Automatic check for selection of years = ON
  Regional breakdown = Countries
  * check final settings = full_check
  * check final settings = accept_any_result
  * check final settings = accept_any_tseries_dif
  * check final settings = accept_after_chk
  Non-default FAO trade matrix vintage = OFF

```

```

FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
Estimate areas, yields and crop production = ON
Estimate animals = ON
Estimate markets = ON
Estimate land use = ON
Load meta information from older task = ON
Print gams code to listing = onListing
Solprint = on
Limrow = 0.0
Limcol = 0.0

Override results_in: = %override_results_in%
Override restart_in: = %override_restart_in%
Override results_out: = %override_results_out%
Override restart_out: = %override_restart_out%

startParallel
  FOR curCountry = %candidateCountries%
    Countries = %curCountry%
    execute=gamsrun
  ENDFOR
collectParallel

ENDIF

IF %COCO_finish_allMS% = ON
* -----
  task = Finish national database
* -----

  First ex post year = 1984
  Last ex post year = 2016
* Set to 'on' if only integration is desired and main parts of coco2 should be run
  later
* Only integrate results for single MS = ON
  Only integrate results for single MS = OFF
  Countries = %allCountriesComma%
  Regional breakdown = Countries
  Non-default FAO trade matrix vintage = OFF
  FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
  Load meta information from older task = ON
  Print gams code to listing = offListing
  Solprint = on
  Limrow = 0.0
  Limcol = 0.0

  Override results_in: = %override_results_in%
  Override restart_in: = %override_restart_in%
  Override results_out: = %override_results_out%
  Override restart_out: = %override_restart_out%

  execute=Gamsrun

ENDIF

IF %Compile_RDP_data% = ON

* -----
  task = Compile RDP data
* -----

  EU regional composition = EU28
  Load meta information from older task = ON
  Print gams code to listing = offListing
  Solprint = on
  Limrow = 0.0
  Limcol = 0.0

  Override results_in: = %override_results_in%
  Override restart_in: = %override_restart_in%
  Override results_out: = %override_results_out%
  Override restart_out: = %override_restart_out%

  execute=Gamsrun

```

ENDIF

```

IF %Build_regional_time_series% = ON
* -----
  task = Build regional time series
* -----

  First ex post year = 1984
  Base year = %baseyear%
  Last ex post year = 2016
  Time series = ON
  New Manure Trade Module = %NEW_MANURE_TRADE_MODEL%
  Regional breakdown = NUTS2
  Non-default FAO trade matrix vintage = OFF
  FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
  Load meta information from older task = ON
  Print gams code to listing = onListing
  Solprint = On
  Limrow = 0.0
  Limcol = 0.0
  Override results_in: = %override_results_in%
  Override restart_in: = %override_restart_in%
  Override results_out: = %override_results_out%
  Override restart_out: = %override_restart_out%

  startparallel
    FOR curCountry = %allCountries%
      Countries = %curCountry%
      execute=gamsrun
    ENDFOR
  collectparallel

ENDIF

```

```

IF %Build_regional_database% = ON
* -----
  task = Build regional database
* -----

  Replace restart values with random numbers (where possible) = %randomStartvalues%
  First ex post year = 1984
  Base year = %baseyear%
  Last ex post year = 2016
  New Manure Trade Module = %NEW_MANURE_TRADE_MODEL%
  Use inner fertilizer model = %INNER_FERT_MODEL%
  Yields/Input Costs per farm from FADN = OFF
  Load meta information from older task = ON
  Solution printing = Suppress
  Print gams code to listing = offListing
  Solprint = On
  Limrow = 0.0
  Limcol = 0.0
  Override results_in: = %override_results_in%
  Override restart_in: = %override_restart_in%
  Override results_out: = %override_results_out%
  Override restart_out: = %override_restart_out%

  startparallel
    FOR curCountry = %allCountriesOrdered%
      Regional breakdown = NUTS2
      Countries = %curCountry%
      execute = GAMSrun
    ENDFOR
  collectparallel

ENDIF

```

```

IF %Build_GHG_Inventories% = ON
* -----
  task = Build GHG Inventories
* -----

```

\*\*\*Step 1: Calculate GHG emission values per country

```

First inventory year = 1990
Base year = %baseyear%
Last inventory year = 2014
Load meta information from older task = ON
Print gams code to listing = onListing
Solprint = On
Limrow = 0.0
Limcol = 0.0
GHG_per_Country = ON
Pool_GHG_Results = OFF
Map_CAPRI_NIR = OFF
Override results_in: = %override_results_in%
Override restart_in: = %override_restart_in%
Override results_out: = %override_results_out%
Override restart_out: = %override_restart_out%

startparallel
  FOR curCountry = %allCountries%
    Countries = %curCountry%
    execute=gamsrun
  ENDFOR
collectparallel

```

\*\*\*Step 2: Pool results from individual countries

```

GHG_per_Country = OFF
Pool_GHG_Results = ON
Map_CAPRI_NIR = OFF
Countries = %allCountriesComma%
execute=Gamsrun

```

\*\*\*Step 3: Map CAPRI results to NIR format

```

GHG_per_Country = Off
Pool_GHG_Results = OFF
Map_CAPRI_NIR = ON
* independent of the country selection this runs for all countries
  Countries = DK000000 "Denmark"
  execute=Gamsrun
ENDIF

```

```

IF %Build_global_database_eu28% = ON

```

```

* -----
  task = Build global database
* -----

```

```

  EU regional composition = EU28
  First ex post year = 1984
  Base year = %baseyear%
  Last ex post year = 2015
  Only map market data from FAO then unload and exit = OFF
  Countries = %allCountriesComma%
  Regional breakdown = Countries
  Non-default FAO trade matrix vintage = OFF
  FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
  Tariff aggregation source = MACMAP2016
* Tariff aggregation source = MACMAP2020
  Only map market data from FAO then unload and exit = OFF
  Update transportcost matrix = ON
  Update longrun projections = ON
  Advanced tariff aggregation = OFF
  GLOBIOM Version for longrun projections = GLOBIOM_EU "Projections with GLOBIOM-EU
model", GLOBIOM_GL "Projections with standard GLOBIOM model"
  Aglink Cosimo model version = %AglinkVersion%
  Aglink Cosimo scenario name = %AglinkVersion%
  Load meta information from older task = ON
  Print gams code to listing = offListing
  Solprint = On
  Limrow = 0.0
  Limcol = 0.0

```

```

Override results_in: = %override_results_in%
Override restart_in: = %override_restart_in%
Override results_out: = %override_results_out%
Override restart_out: = %override_restart_out%

```

```

execute=gamsrun
ENDIF

```

```

IF %Build_global_database_brexit% = ON

```

```

* -----
* task = Build global database
* -----

```

```

EU regional composition = BREXIT
First ex post year = 1984
Base year = %baseyear%
Last ex post year = 2015
Only map market data from FAO then unload and exit = OFF
Countries = %allCountriesComma%
Regional breakdown = Countries
Non-default FAO trade matrix vintage = OFF
FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
Tariff aggregation source = MACMAP2016
* Tariff aggregation source = MACMAP2020
Only map market data from FAO then unload and exit = OFF
Update transportcost matrix = ON
Update longrun projections = ON
Advanced tariff aggregation = OFF
GLOBIOM version for longrun projections = GLOBIOM_EU "Projections with GLOBIOM-EU
model", GLOBIOM_GL "Projections with standard GLOBIOM model"
Aglink Cosimo model version = %AglinkVersion%
Aglink Cosimo scenario name = %AglinkVersion%
Load meta information from older task = ON
Print gams code to listing = offListing
Solprint = on
Limrow = 0.0
Limcol = 0.0
Override results_in: = %override_results_in%
Override restart_in: = %override_restart_in%
Override results_out: = %override_results_out%
Override restart_out: = %override_restart_out%

```

```

execute=gamsrun
ENDIF

```

```

IF %Estimate_GHG_emission_coefficients% = ON

```

```

* -----
* task = Estimate GHG emission coefficients
* -----

```

```

Replace restart values with random numbers (where possible) = %randomStartValues%
Base year = %baseyear%
Countries = %allCountriesComma%
Non-default FAO trade matrix vintage = OFF
FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
Load meta information from older task = ON
Additional input data identifier =
Additional result type identifier =
Override results_in: =
Override results_out: =
Override restart_in: =
Override restart_out: =
Print gams code to listing = onListing
Solprint = off
Limrow = 0.0
Limcol = 0.0

Override results_in: = %override_results_in%
Override restart_in: = %override_restart_in%
Override results_out: = %override_results_out%
Override restart_out: = %override_restart_out%

```

```

execute=Gamsrun

```

ENDIF

```
* -----
*
* pseudo task: call_create_longrun_info:
*               = stand alone program run typically by PW based on GLOBIOM-GL or
GLOBIOM-EU outputs
*               Requires many settings of global variables in
global\convert_globiom.gms
*               For specific GLOBIOM runs (eg those from the AgClim50 project) also
needs big input files that are not committed
*               Gives results\global\longrun_info_fac.gdx for captrd and for the
baseline market calibration
*               To run in a command prompt window:
*               "gams call_create_longrun_info.gms"
*
* -----
```

```
IF %Generate_trend_projection% = ON
* -----
* task = Generate trend projection
* -----
* in trend projections we assume no Brexit as long as the Aglink baseline does the
same
* will change in future releases
  EU regional composition = EU28

  First ex post year = 1984
  Base year = %baseyear%
  Simulation years = %TREND_YEARS%
  Last simulation year = 2050
  Last year of NUTS2 trends for FTs = 2030
  Countries = %allCountriesComma%
  Regional breakdown = NUTS2
  Aglink Cosimo model version = %AglinkVersion%
  Aglink Cosimo scenario name = %AglinkVersion%
  Scaling to DG Agri baseline = OFF
  Long run baseline selection = globiom_eu_2018+REFERENCE+REFERENCE "GLOBIOM_EU
reference run for DG CLIMA based on PRIMES 301117"
  Primes scenarios for biofuel supports = primes_ref_301117
  Non-default FAO trade matrix vintage = OFF
  FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
  Load meta information from older task = ON
  Print gams code to listing = offListing
  Solprint = on
  Limrow = 0.0
  Limcol = 0.0

  Override results_in: = %override_results_in%
  Override restart_in: = %override_restart_in%
  Override results_out: = %override_results_out%
  Override restart_out: = %override_restart_out%

  execute=gamsrun
ENDIF
```

```
IF %Baseline_calibration_market_model% = ON
* -----
* task = Baseline calibration market model
* -----
  EU regional composition = %EU_COMPOSITION%
  Scenario description = %ScenariodescCal%
  Trace data flow = OFF
  Base year = %baseyear%
  Countries = %allCountriesComma%
  Regional breakdown = Countries
  Policy blocks (additional geographical layer) = OFF
  Alternative GAMS license file for GHG emission estimation = gamslice
  Long run baseline selection = globiom_eu_2018+REFERENCE+REFERENCE "GLOBIOM_EU
reference run for DG CLIMA based on PRIMES 301117"
* Long run baseline selection = primes_ref_2016+REFERENCE+REFERENCE "GLOBIOM_EU
reference run for DG CLIMA based on PRIMES 170216"
  Load meta information from older task = ON
  Print gams code to listing = onListing
  Solprint = off
```

```

Limrow = 0.0
Limcol = 0.0
Solution print at preparatory solve = OFF
Abort after preparatory solve = OFF
Solution print for pre-steps in 1st iteration with abort = OFF
Plus iterlim to zero for 1st pre-steps in 1st iteration = OFF
Number of presteps before abort = 1

Override results_in: = %override_results_in%
Override restart_in: = %override_restart_in%
Override results_out: = %override_results_out%
Override restart_out: = %override_restart_out%

FOR curYear = %calibrationYears%
    Simulation years = %curYear%
    execute = Gamsrun
ENDFOR
ENDIF

IF %Baseline_calibration_supply_model% = ON
* -----
    task = Baseline calibration supply models
* -----
    Replace restart values with random numbers (where possible) = %randomStartValues%
    EU regional composition = %EU_COMPOSITION%
    Scenario description = %ScenariodescCal%
    Base year = %baseyear%
    New Manure Trade Module = %NEW_MANURE_TRADE_MODEL%
    Use inner fertilizer model = %INNER_FERT_MODEL%
    Regional breakdown = NUTS2
    Dampening of high activity level elasticities = OFF
    Load meta information from older task = ON
    Solution printing = Suppress
    Determine point price elasticities = ON
    Print gams code to listing = offListing
    Solprint = Off
    Limrow = 0.0
    Limcol = 0.0

    Override results_in: = %override_results_in%
    Override restart_in: = %override_restart_in%
    Override results_out: = %override_results_out%
    Override restart_out: = %override_restart_out%

    startParallel
        FOR curYear = %calibrationYears%
            Simulation years = %curYear%

            FOR curCountry = %allCountriesOrdered%
                Countries = %curCountry%
                execute=gamsrun
            ENDFOR

        ENDFOR
    collectParallel
ENDIF

IF %MERGE_CALIBRATION_RESULTS% = ON
    task = Merge country data

    Countries = %allCountriesComma%
    Result folder name (e.g. "capreg") = capmod
    GAMS symbol name (e.g. data2) = DATAOUT
    Load meta information from older task = ON
    Additional input data identifier =
    Additional result type identifier =

*   Special case: this task is not stability tested, but only used for easier
comparisons later
*   Therefore, it works OUT-->OUT to merge the results of the just tested calibration
task

```



```

Override results_in: = %override_results_out%
Override restart_in: = %override_restart_out%
Override results_out: = %override_results_out%
Override restart_out: = %override_restart_out%

Print gams code to listing = offListing
Solprint = On
Limrow = 0.0
Limcol = 0.0

FOR curBas = %bas%
  FOR curSim = %sim%
    File name prefix (e.g. "res_08") =
res_2_%curBas%_%curSim%_%Scenariodesc%_CalUnderscore%
    execute=Gamsrun
  ENDFOR
ENDFOR

ENDIF

IF %Run_scenario_without_market_model%=ON
* -----
  task = Run scenario without market model
* -----

  EU regional composition = %EU_COMPOSITION%
  Scenario description = %Scenariodesc%
  Base year = %baseyear%
  Countries = %allCountriesComma%
  New Manure Trade Module = %NEW_MANURE_TRADE_MODEL%
  Use inner fertilizer model = %INNER_FERT_MODEL%
  Generate GAMS child processes on different threads = ON
  Generate CMD per Thread = OFF
  GHG abatement technology = off
  Regional breakdown = NUTS2
  Non-default reference scenario for carbon accounting = OFF
  Non-default FAO trade matrix vintage = OFF
  FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
  Number of iterations = 99
  Aggregates for activities and commodities = ON
  Environmental Indicators = OFF
  Life-cycle assessment for energy = ON
  Multi-functionality indicators = ON
  Iteration tracking = ON
  Sensitivity experiments with features in supply model = OFF
  Load meta information from older task = ON
  Solution printing = Suppress
  Determine point price elasticities = OFF
  Print gams code to listing = offListing
  Solprint = On
  Limrow = 0.0
  Limcol = 0.0

  Additional result type identifier = _sup
  Override results_in: = %override_results_in%
  Override restart_in: = %override_restart_in%
  Override results_out: = %override_results_out%
  Override restart_out: = %override_restart_out%

  startParallel
    FOR curYear = %calibrationYears%
      Simulation years = %curYear%
      execute=gamsrun
    ENDFOR
  collectParallel

ENDIF

IF %Run_scenario_only_market_model% = ON
* -----
  task = Run scenario only with market model
* Running without market model for %curExperiment%
* -----

```

```

EU regional composition = %EU_COMPOSITION%
Scenario description = %Scenariodesc%
Base year = %baseyear%
Countries = %allCountriesComma%
Regional breakdown = NUTS2
Policy blocks (additional geographical layer) = OFF
Endogenous margins between trade block and country prices = OFF
Use lower price iterations weights after iteration = 20
Alternative GAMS license file for GHG emission estimation = gamslice
Aggregates for activities and commodities = ON
Load meta information from older task = ON
Print gams code to listing = offListing
Solprint = off
Limrow = 0.0
Limcol = 0.0
Kill simini file = ON

```

```

Generate GAMS child processes on different threads = ON
Generate CMD per Thread = OFF

```

```

Additional input data identifier =
Additional result type identifier = _mrk

```

```

Override results_in: = %override_results_in%
Override restart_in: = %override_restart_in%
Override results_out: = %override_results_out%
Override restart_out: = %override_restart_out%

```

```

startParallel
  FOR curYear = %calibrationYears%
    Simulation years = %curYear%
    execute=gamsrun
  ENDFOR
collectParallel

```

```
ENDIF
```

```

IF %Run_scenario_with_market_model% = ON
* -----
* task = Run scenario with market model
* -----
  EU regional composition = %EU_COMPOSITION%
  Scenario description = %Scenariodesc%
  GHG abatement technology = off
  Base year = %baseyear%
  Countries = %allCountriesComma%
  New Manure Trade Module = %NEW_MANURE_TRADE_MODEL%
  Use inner fertilizer model = %INNER_FERT_MODEL%
  Regional breakdown = NUTS2
  Non-default reference scenario for carbon accounting = OFF
  Non-default FAO trade matrix vintage = OFF
  FAO trade matrix vintage (determines FAOregions) = FAO_trade_matrix_1986_2013
  Policy blocks (additional geographical layer) = OFF
  Endogenous margins between trade block and country prices = OFF
  Advanced tariff aggregation module = OFF
  Number of iterations = 15
  Use lower price iterations weights after iteration = 20
  Alternative GAMS license file for GHG emission estimation = gamslice
  Aggregates for activities and commodities = ON
  Environmental Indicators = ON
  Life-cycle assessment for energy = OFF
  Multi-functionality indicators = OFF
  Iteration tracking = ON
  Sensitivity experiments with features in supply model = OFF
  Load meta information from older task = ON
  Solution printing = Suppress
  Determine point price elasticities = OFF
  Print gams code to listing = offListing
  Solprint = off
  Limrow = 0.0
  Limcol = 0.0
  Kill simini file = ON

  Generate GAMS child processes on different threads = ON
  Generate CMD per Thread = OFF

```

```

Override results_in: = %override_results_in%
Override restart_in: = %override_restart_in%
Override results_out: = %override_results_out%
Override restart_out: = %override_restart_out%

```

```

Non-default reference scenario for carbon accounting = Off

```

```

startParallel
  FOR curYear = %calibrationYears%
    Simulation years = %curYear%
    execute=gamsrun
  ENDFOR
collectParallel

```

```

* --- To test the carbon accounting, it is useful to run a smaller time step
* at a time, each building the accounting on the previous step.
* Something like this:
*
* Simulation years = 2015
* Non-default reference scenario for carbon accounting = Off
* execute=gamsrun
*
* Simulation years = 2030
* Non-default reference scenario for carbon accounting = On
* Reference scenario for carbon accounting = res_2_%bas%15%ScenariodescUnderscore%
* execute=gamsrun
*
* Simulation years = 2050,
* Reference scenario for carbon accounting = res_2_%bas%30%ScenariodescUnderscore%
* execute=gamsrun
*
* Simulation years = 2070,
* Reference scenario for carbon accounting = res_2_%bas%50%ScenariodescUnderscore%
* execute=gamsrun

```

```

ENDIF

```

```

ENDFOR

```

## Annex IV: Batch execution file for evaluating sensitivity experiment results

```
*****
*
* Batch file for evaluating results of stability tests by
* pair-wise comparisons and classifications of differences
* @author: Torbjörn Jansson, SLU
*
*****

* This will remove your entries in the settings of the GUI such that you need to (or
may) specify them explicitly here.
* If you don't like that and instead want to take over your settings from the GUI,
deactivate the following:
  gams options = kill

* =====
* MACRO settings for this batch file
* =====

MACRO = baseYearLastTwo 12
MACRO = simulationYearsLastTwo 15\30
MACRO = baselineScen cap_after_2014

MACRO = eu27Countries
BL000000\SE000000\DK000000\DE000000\EL000000\ES000000\FR000000\IR000000\IT000000\NL00
0000\AT000000\PT000000\FI000000\UK000000\CY000000\EE000000\LV000000\LT000000\MT000000
\PL000000\SK000000\BG000000\CZ000000\HU000000\SI000000\RO000000
MACRO = candidateCountries
CS000000\AL000000\MO000000\HR000000\BA000000\MK000000\KO000000\TUR
MACRO = otherCountries NO000000
MACRO = allCountries %eu27Countries%\%otherCountries%\%candidateCountries%

MACRO = allCountriesShort BL \SE \DK \DE \EL \ES \FR \IR \IT \NL \AT \PT \FI \UK
\CY \EE \LV \LT \MT \PL \SK \BG \CZ \HU \SI \RO \CS \AL \MO \HR \BA \MK \KO \TU \NO

* --- Local Settings for TJ ---
*ontext
  gamsexex = c:\gams\win64\28.2\gams.exe
  work dir = ..\gams
  dat dir = ..\dat

  output dir = ..\output\batchoutput
  res dir = ..\output\results
  restartdir = ..\output\restart
  scr dir = ..\output\temp

  number of processors = 56
*offtext

* --- Local settings for AG ---
*ontext
  gamsexex = d:\gams\win64\24.6\gams.exe
  work dir = d:\public\gocht\star_1\gams

  output dir = d:\public\gocht\star_1\batchoutput
  res dir = d:\public\gocht\star_1\results
  scr dir = d:\public\gocht\star_1\temp
  dat dir = d:\public\gocht\star_1\dat
  restart dir = d:\public\gocht\star_1\restart

  number of processors = 56
*offtext

* =====
* Turn sections on/off in this batch
* =====

MACRO = do_faostat ON
MACRO = do_Coco1 ON
```

```

MACRO = do_Coco2 ON
MACRO = do_Compile_rdp_data ON
MACRO = do_capreg_base_year ON
MACRO = do_capreg_time_series ON
MACRO = do_global ON
MACRO = do_est_ghg ON
MACRO = do_captrd ON
MACRO = do_capmod_cal_market ON
MACRO = do_fert_trm ON
MACRO = do_feed_trm ON
MACRO = do_capmod_cal_supply ON
MACRO = do_capmod_sim ON
MACRO = do_capmod_supply ON
MACRO = do_capmod_market ON

* =====
* Loop over experiments
* =====

* which experiment should we use as reference data to compare to?
MACRO = referenceSuffix _restart1

* which experiments should be compared to the reference?
MACRO = nonReferenceSuffixes _clean\_restart2\_g247\_g251\_oldMach\_rnd1
* MACRO = nonReferenceSuffixes _clean\_restart2
* MACRO = nonReferenceSuffixes _clean

* Should we start a new round of comparisons or add to an existing batch?
MACRO = clearComparisonList ON

*-----
* === Preparations: merge country data in case there is one file per MS ===
*-----

FOR curExperiment = %referenceSuffix%\%nonReferenceSuffixes%

*-----
* Merging country files for experiment %curExperiment%
*-----

task = Merge country data

Countries = BL000000 "Belgium and Luxembourg",DK000000 "Denmark",DE000000
"Germany",EL000000 "Greece",ES000000 "Spain",FR000000 "France",IR000000
"Ireland",IT000000 "Italy",NL000000 "The Netherlands",AT000000 "Austria",PT000000
"Portugal",SE000000 "Sweden",FI000000 "Finland",UK000000 "United Kingdom",CZ000000
"Czech Republic",HU000000 "Hungary",PL000000 "Poland",SI000000 "Slovenia",SK000000
"Slovak Republic",EE000000 "Estonia",LT000000 "Lithuania",LV000000 "Latvia",CY000000
"Cyprus",MT000000 "Malta",BG000000 "Bulgaria",RO000000 "Romania",NO000000
"Norway",TUR "Turkey",AL000000 "Albania",MK000000 "Macedonia",CS000000
"Serbia",MO000000 "Montenegro",HR000000 "Croatia",BA000000 "Bosnia and
Herzegovina",KO000000 "Kosovo"

IF %do_fert_trm% = ON

*-----
* Merging country files for fertilizer calibration (%curExperiment%)
*-----

* Fertilizer calibration data is stored in several parameter in one file per MS.
* This is somewhat inconvenient for the comparison tasks, which loop over MS
* We therefore merge the country results into one file for each parameter,
* each containing all MS data. I know this weakens the test, since there is risk
* for error in this merge step, but it makes it so much faster!

FOR curParam =
p_priFertDist\p_nutAvailFactExcr\p_nutAvailFactCres\p_cropNutNeedMultFact\p_cropNutNe
edAddFact

* Merge parameters for the base year

Result folder name (e.g. "capreg") = fert
File name prefix (e.g. "res_08") = priFertDist_

```

```

GAMS symbol name (e.g. data2) = %curParam%
Additional input data identifier = %baseYearLastTwo%%curExperiment%
Additional result type identifier =
%baseYearLastTwo%_%curParam%%curExperiment%

execute = gamsrun

*
Merge parameters for each calibration year

FOR curSimYear = %simulationYearsLastTwo%
  MACRO = bassim %baseYearLastTwo%%curSimYear%

  Result folder name (e.g. "capreg") = fert
  File name prefix (e.g. "res_08") = priFertDist_
  GAMS symbol name (e.g. data2) = %curParam%
  Additional input data identifier = %bassim%%curExperiment%
  Additional result type identifier = %bassim%_%curParam%%curExperiment%

  execute = gamsrun
ENDFOR

ENDFOR

ENDIF

IF %do_feed_trm% = ON

*-----
*   Merging country files for feed calibration (%curExperiment%)
*-----

*
Merge parameters for the baselines
FOR curSimYear = %simulationYearsLastTwo%
  MACRO = bassim %baseYearLastTwo%%curSimYear%

  Result folder name (e.g. "capreg") = baseline
  File name prefix (e.g. "res_08") = fedtrm_2%bassim%
  GAMS symbol name (e.g. data2) = p_animReqCorrFac
  Additional input data identifier = %curExperiment%
  Additional result type identifier = %curExperiment%
  execute=gamsrun
ENDFOR

*
Merge parameters for the base year

Result folder name (e.g. "capreg") = capreg
File name prefix (e.g. "res_08") = chk_feed_2%baseYearLastTwo%
GAMS symbol name (e.g. data2) = p_feed
Additional input data identifier = %curExperiment%
Additional result type identifier = %curExperiment%
execute=gamsrun

ENDIF

IF %do_capreg_time_series% = ON

*-----
*   Merging country files for capreg time series (%curExperiment%)
*-----

Result folder name (e.g. "capreg") = capreg
File name prefix (e.g. "res_08") = res_time_series_%baseYearLastTwo%
GAMS symbol name (e.g. data2) = DATA1
Additional input data identifier = %curExperiment%
Additional result type identifier = %curExperiment%
execute=gamsrun

ENDIF

IF %do_capreg_base_year% = ON

*-----
*   Merging country files for capreg base year (%curExperiment%)
*-----
Result folder name (e.g. "capreg") = capreg

```

```

File name prefix (e.g. "res_08") = res_%baseYearLastTwo%
GAMS symbol name (e.g. data2) = DATA2
Additional input data identifier = %curExperiment%
Additional result type identifier = %curExperiment%
execute=gamsrun

```

```
ENDIF
```

```
IF %do_capmod_cal_supply% = ON
```

```

*-----
*   Merging result files for baseline calibration (%curExperiment%)
*-----
    FOR cursimYear = %simulationYearsLastTwo%
        MACRO = bassim %baseYearLastTwo%%cursimYear%
        Result folder name (e.g. "capreg") = capmod
        File name prefix (e.g. "res_08") = res_2_%bassim%%baselineScen%_cal
        GAMS symbol name (e.g. data2) = dataout
        Additional input data identifier = %curExperiment%
        Additional result type identifier = %curExperiment%
        execute=gamsrun
    ENDFOR

*-----
*   Merging pmp parameters in baseline calibration (%curExperiment%)
*-----
    FOR cursimYear = %simulationYearsLastTwo%
        MACRO = bassim %baseYearLastTwo%%cursimYear%
        Result folder name (e.g. "capreg") = baseline
        File name prefix (e.g. "res_08") = pmppar_2%bassim%

        Additional input data identifier = %curExperiment%

        FOR curPar =
p_pmpCnst\p_pmpQuadPact\p_pmpQuadTechn\p_pmpFeedInpCoeff\p_pmpLandSupplyTail\p_pmpQua
dLandTypes\p_scaleQuot

            Additional result type identifier = _%curPar%%curExperiment%

            GAMS symbol name (e.g. data2) = %curPar%
            execute=gamsrun

        ENDFOR
    ENDFOR

ENDIF
ENDFOR

```

```

*-----
*   === Start comparing pairs of GDX files ===
*-----

FOR curExperiment = %nonReferenceSuffixes%

* -----
*   task = Compare task results
* -----

    Load meta information from older task = ON
    Add comparison output to cumulative list of comparisons = ON
    Name of cumulative comparisons list = all_comparisons.txt
    Additional input data identifier =
    Print gams code to listing = offListing
    Solprint = On
    Limrow = 0.0
    Limcol = 0.0

    IF %do_faostat% = ON

```

```

*-----
*   Analysing results from FAOSTAT, experiment %curExperiment%
*-----

Name of task to analyse = faostat
Gams parameter to analyse = p_faoTradeFlows

Clear cumulative list of all comparisons done = %clearComparisonList%
Additional result type identifier = %curExperiment%
First file = fao\fao_trade_for_global%referenceSuffix%
Second file = fao\fao_trade_for_global%curExperiment%
execute=gamsrun
MACRO = clearComparisonList OFF

Name of task to analyse = faostat
Gams parameter to analyse = p_sua_final

Clear cumulative list of all comparisons done = %clearComparisonList%
Additional result type identifier = %curExperiment%
First file = fao\faodata%referenceSuffix%
Second file = fao\faodata%curExperiment%
execute=gamsrun
MACRO = clearComparisonList OFF

ENDIF

IF %do_Coco1% = ON

*-----
*   Analysing results from Coco1, experiment %curExperiment%
*-----

Name of task to analyse = coco1
Gams parameter to analyse = DATA2

Clear cumulative list of all comparisons done = %clearComparisonList%
Additional result type identifier = _%curExperiment%
First file = coco\coco1_output%referenceSuffix%
Second file = coco\coco1_output%curExperiment%
execute=gamsrun
MACRO = clearComparisonList OFF

ENDIF

IF %do_Coco2% = ON

*-----
*   Analysing results from Coco2, experiment %curExperiment%
*-----

Name of task to analyse = coco2
Gams parameter to analyse = DATA2

Clear cumulative list of all comparisons done = %clearComparisonList%
Additional result type identifier = %curExperiment%
First file = coco\coco2_output%referenceSuffix%
Second file = coco\coco2_output%curExperiment%
execute=gamsrun
MACRO = clearComparisonList OFF

ENDIF

IF %do Compile_rdp_data% = ON

*-----
*   Analysing results from RDP data compilation, experiment %curExperiment%
*-----

Name of task to analyse = Compile_RDP_data
Gams parameter to analyse = p_rdBudget

```



```

Clear cumulative list of all comparisons done = %clearComparisonList%
Additional result type identifier = %curExperiment%
First file = policy\rd_budget%referenceSuffix%
Second file = policy\rd_budget%curExperiment%
execute=gamsrun
MACRO = clearComparisonList OFF
ENDIF

```

```

IF %do_capreg_time_series% = ON

```

```

*-----
*   Analysing results from CAPREG time series, experiment %curExperiment%
*-----

```

```

Name of task to analyse = capreg_time_series
Gams parameter to analyse = DATA1

Clear cumulative list of all comparisons done = %clearComparisonList%
Additional result type identifier = %curExperiment%
First file = capreg\res_time_series_%baseYearLastTwo%%referenceSuffix%
Second file = capreg\res_time_series_%baseYearLastTwo%%curExperiment%
execute=gamsrun
MACRO = clearComparisonList OFF
ENDIF

```

```

IF %do_capreg_base_year% = ON

```

```

*-----
*   Analysing results from CAPREG base year, experiment %curExperiment%
*-----

```

```

Name of task to analyse = capreg_base_year
Gams parameter to analyse = DATA2

Clear cumulative list of all comparisons done = %clearComparisonList%
Additional result type identifier = %curExperiment%
First file = capreg\res_%baseYearLastTwo%%referenceSuffix%
Second file = capreg\res_%baseYearLastTwo%%curExperiment%
execute=gamsrun
MACRO = clearComparisonList OFF
ENDIF

```

```

IF %do_global% = ON

```

```

*-----
*   Analysing results from GLOBAL database, market data, with brexit, experiment
%curExperiment%
*-----

```

```

Name of task to analyse = global
Gams parameter to analyse = p_dataMarket

Clear cumulative list of all comparisons done = %clearComparisonList%
Additional result type identifier = %curExperiment%
First file = global\FAO_agg_%baseYearLastTwo%_BREXIT%referenceSuffix%
Second file = global\FAO_agg_%baseYearLastTwo%_BREXIT%curExperiment%
execute=gamsrun
MACRO = clearComparisonList OFF

```

```

*-----
*   Analysing results from GLOBAL database, trade flows, with brexit, experiment
%curExperiment%
*-----

```

```

Name of task to analyse = global
Gams parameter to analyse = p_tradeFlows

Clear cumulative list of all comparisons done = %clearComparisonList%
Additional result type identifier = %curExperiment%

```

```

First file = global\FAO_agg_%baseYearLastTwo%_BREXIT%referenceSuffix%
Second file = global\FAO_agg_%baseYearLastTwo%_BREXIT%curExperiment%
execute=gamsrun
MACRO = clearComparisonList OFF

```

```

*-----
*   Analysing results from GLOBAL database, market data, without BREXIT, experiment
%curExperiment%
*-----

```

```

Name of task to analyse = global
Gams parameter to analyse = p_dataMarket

Clear cumulative list of all comparisons done = %clearComparisonList%
Additional result type identifier = %curExperiment%
First file = global\FAO_agg_%baseYearLastTwo%_EU28%referenceSuffix%
Second file = global\FAO_agg_%baseYearLastTwo%_EU28%curExperiment%
execute=gamsrun
MACRO = clearComparisonList OFF

```

```

*-----
*   Analysing results from GLOBAL trade flows, without BREXIT, with brexit,
experiment %curExperiment%
*-----

```

```

Name of task to analyse = global
Gams parameter to analyse = p_tradeFlows

Clear cumulative list of all comparisons done = %clearComparisonList%
Additional result type identifier = %curExperiment%
First file = global\FAO_agg_%baseYearLastTwo%_EU28%referenceSuffix%
Second file = global\FAO_agg_%baseYearLastTwo%_EU28%curExperiment%
execute=gamsrun
MACRO = clearComparisonList OFF

```

ENDIF

IF %do\_est\_ghg% = ON

```

*-----
*   Analysing results from ghg trend estimation (beta1, no LCA), experiment
%curExperiment%
*-----

```

```

Name of task to analyse = est_ghg_std
Gams parameter to analyse = p_beta1

Clear cumulative list of all comparisons done = %clearComparisonList%
Additional result type identifier = %curExperiment%
First file = envind\ghg_emission_trends_std%referenceSuffix%
Second file = envind\ghg_emission_trends_std%curExperiment%
execute=gamsrun
MACRO = clearComparisonList OFF

```

```

*-----
*   Analysing results from ghg trend estimation (beta2, no LCA), experiment
%curExperiment%
*-----

```

```

Name of task to analyse = est_ghg_std
Gams parameter to analyse = p_beta2

Clear cumulative list of all comparisons done = %clearComparisonList%
Additional result type identifier = %curExperiment%
First file = envind\ghg_emission_trends_std%referenceSuffix%
Second file = envind\ghg_emission_trends_std%curExperiment%
execute=gamsrun
MACRO = clearComparisonList OFF

```

```

*-----
*   Analysing results from ghg trend estimation (beta1, LCA), experiment
%curExperiment%
*-----

```

```

Name of task to analyse = est_ghg_lca

```

```

Gams parameter to analyse = p_beta1

Clear cumulative list of all comparisons done = %clearComparisonList%
Additional result type identifier = %curExperiment%
First file = envind\ghg_emission_trends_lca%referenceSuffix%
Second file = envind\ghg_emission_trends_lca%curExperiment%
execute=gamsrun
MACRO = clearComparisonList OFF

*-----
*   Analysing results from ghg trend estimation (beta12 LCA), experiment
%curExperiment%
*-----
    Name of task to analyse = est_ghg_lca
    Gams parameter to analyse = p_beta2

    Clear cumulative list of all comparisons done = %clearComparisonList%
    Additional result type identifier = %curExperiment%
    First file = envind\ghg_emission_trends_lca%referenceSuffix%
    Second file = envind\ghg_emission_trends_lca%curExperiment%
    execute=gamsrun
    MACRO = clearComparisonList OFF

ENDIF

IF %do_captrd% = ON

*-----
*   Analysing results from CAPTRD, experiment %curExperiment%
*-----

    Name of task to analyse = captrd
    Gams parameter to analyse = DATA2

    FOR curSimYear = %simulationYearsLastTwo%
        MACRO = bassim %baseYearLastTwo%%curSimYear%
        Clear cumulative list of all comparisons done = %clearComparisonList%
        Additional result type identifier = %bassim%%curExperiment%
        First file = baseline\trends_%bassim%referenceSuffix%
        Second file = baseline\trends_%bassim%curExperiment%
        execute=gamsrun
        MACRO = clearComparisonList OFF
    ENDFOR
ENDIF

IF %do_capmod_cal_market% = ON

*-----
*   Analysing results from market model calibration, experiment %curExperiment%
*-----

    Name of task to analyse = capmod_cal_market
    Gams parameter to analyse = data_cal

    FOR curSimYear = %simulationYearsLastTwo%
        MACRO = bassim %baseYearLastTwo%%curSimYear%
        Clear cumulative list of all comparisons done = %clearComparisonList%
        Additional result type identifier = %bassim%%curExperiment%
        First file = baseline\data_market_%bassim%referenceSuffix%
        Second file = baseline\data_market_%bassim%curExperiment%
        execute=gamsrun
        MACRO = clearComparisonList OFF
    ENDFOR
ENDIF

IF %do_fert_trm% = ON

*-----
*   Analyse fertilizer calibration results
*-----

```

```

Name of task to analyse = fert_trm

FOR curParam =
p_priFertDist\p_nutAvailFactExcr\p_nutAvailFactCres\p_cropNutNeedMultFact\p_cropNutNe
edAddFact

*-----
*   ... for the base year ...
*-----

    Gams parameter to analyse = %curParam%

    Clear cumulative list of all comparisons done = %clearComparisonList%
    Additional result type identifier = %curExperiment%
    First file = fert\priFertDist_%baseYearLastTwo%_%curParam%%referenceSuffix%
    Second file = fert\priFertDist_%baseYearLastTwo%_%curParam%%curExperiment%

    execute=gamsrun
    MACRO = clearComparisonList OFF

*-----
*   ... for the simulation years ...
*-----

    FOR curSimYear = %simulationYearsLastTwo%
        MACRO = bassim %baseYearLastTwo%curSimYear%
        Clear cumulative list of all comparisons done = %clearComparisonList%
        Additional result type identifier = %curExperiment%
        First file = fert\priFertDist_%bassim%_%curParam%%referenceSuffix%
        Second file = fert\priFertDist_%bassim%_%curParam%%curExperiment%

        execute=gamsrun
        MACRO = clearComparisonList OFF
    ENDFOR
ENDFOR

ENDIF

IF %do_feed_trm% = ON

*-----
*   Analyse feed calibration results
*-----

    Name of task to analyse = feed_trm
    Additional result type identifier = %curExperiment%

*-----
*   ... for each baseline
*-----

    FOR curSimYear = %simulationYearsLastTwo%
        MACRO = bassim %baseYearLastTwo%curSimYear%

        Clear cumulative list of all comparisons done = %clearComparisonList%

        Gams parameter to analyse = p_animReqCorrFac
        First file = baseline\fedtrm_2%bassim%%referenceSuffix%
        Second file = baseline\fedtrm_2%bassim%%curExperiment%
        execute=gamsrun
        MACRO = clearComparisonList OFF

    ENDFOR

*-----
*   ... for the base year
*-----

    Gams parameter to analyse = p_feed
    First file = capreg\chk_feed_2%baseYearLastTwo%%referenceSuffix%
    Second file = capreg\chk_feed_2%baseYearLastTwo%%curExperiment%
    execute=gamsrun

```

```

MACRO = clearComparisonList OFF

ENDIF

IF %do_capmod_cal_supply% = ON

*-----
*   Analysing results from supply model calibration, experiment %curExperiment%
*-----

Name of task to analyse = capmod_cal_supply
Gams parameter to analyse = DATAOUT

FOR curSimYear = %simulationYearsLastTwo%
  MACRO = bassim %baseYearLastTwo%%curSimYear%
  Clear cumulative list of all comparisons done = %clearComparisonList%
  Additional result type identifier = %bassim%%curExperiment%
  First file = capmod\res_2_%bassim%%baselineScen%_cal%referenceSuffix%
  Second file = capmod\res_2_%bassim%%baselineScen%_cal%curExperiment%
  execute=gamsrun
  MACRO = clearComparisonList OFF
ENDFOR

*-----
*   --- Selection of pmp-parameters, experiment %curExperiment%
*-----

FOR curSimYear = %simulationYearsLastTwo%
  MACRO = bassim %baseYearLastTwo%%curSimYear%
  Clear cumulative list of all comparisons done = %clearComparisonList%
  Additional result type identifier = %bassim%%curExperiment%
  First file = baseline\pmppar_2%bassim%_%referenceSuffix%
  Second file = baseline\pmppar_2%bassim%_%curExperiment%

  FOR curPar =
p_pmpCnst\p_pmpQuadPact\p_pmpQuadTechn\p_pmpFeedInpCoeff\p_pmpLandSupplyTail\p_pmpQua
dLandTypes\p_scaleQuot
    Gams parameter to analyse = %curPar%
    First file = baseline\pmppar_2%bassim%_%curPar%%referenceSuffix%
    Second file = baseline\pmppar_2%bassim%_%curPar%%curExperiment%
    execute=gamsrun

    MACRO = clearComparisonList OFF
  ENDFOR
ENDFOR

ENDIF

IF %do_capmod_sim% = ON

*-----
*   Analysing results from baseline reproduction run, experiment %curExperiment%
*-----

Name of task to analyse = capmod_sim
Gams parameter to analyse = DATAOUT

FOR curSimYear = %simulationYearsLastTwo%
  MACRO = bassim %baseYearLastTwo%%curSimYear%
  Clear cumulative list of all comparisons done = %clearComparisonList%
  Additional result type identifier = %bassim%%curExperiment%
  First file = capmod\res_2_%bassim%%baselineScen%_ref%referenceSuffix%
  Second file = capmod\res_2_%bassim%%baselineScen%_ref%curExperiment%
  execute=gamsrun
  MACRO = clearComparisonList OFF
ENDFOR
ENDIF

IF %do_capmod_supply% = ON

```

```

*-----
*   Analysing results from scenario run with supply model only, experiment
%curExperiment%
*-----

Name of task to analyse = capmod_supply
Gams parameter to analyse = DATAOUT

FOR cursimYear = %simulationYearsLastTwo%
  MACRO = bassim %baseYearLastTwo%%cursimYear%
  Clear cumulative list of all comparisons done = %clearComparisonList%
  Additional result type identifier = %bassim%%curExperiment%
  First file = capmod\res_2_%bassim%%baselineScen%_ref_sup%referenceSuffix%
  Second file = capmod\res_2_%bassim%c%baselineScen%_ref_sup%curExperiment%
  execute=gamsrun
  MACRO = clearComparisonList OFF
ENDFOR
ENDIF

IF %do_capmod_market% = ON

*-----
*   Analysing results from scenario run with MARKET model only, experiment
%curExperiment%
*-----

Name of task to analyse = capmod_market
Gams parameter to analyse = DATAOUT

FOR cursimYear = %simulationYearsLastTwo%
  MACRO = bassim %baseYearLastTwo%%cursimYear%
  Clear cumulative list of all comparisons done = %clearComparisonList%
  Additional result type identifier = %bassim%%curExperiment%
  First file = capmod\res_2_%bassim%%baselineScen%_ref_mrk%referenceSuffix%
  Second file = capmod\res_2_%bassim%%baselineScen%_ref_mrk%curExperiment%
  execute=gamsrun
  MACRO = clearComparisonList OFF
ENDFOR
ENDIF

ENDIFOR

*-----
* Summarizing the comparison results
*-----

task = Merge comparison results

File containing list of comparisons = all_comparisons
Load meta information from older task = ON
Additional input data identifier =
Additional result type identifier =
Override results_in: =
Override results_out: =
Override restart_in: =
Override restart_out: =
Print gams code to listing = onListing
Solprint = On
Limrow = 0.0
Limcol = 0.0

execute=Gamsrun

```