# Envisage V.10 Model Modifications

## 31-Mar-2020

This is a large upgrade

The following have been modified in the model

* Model normalization has been completed. From the user point of view, the biggest change is that there are few calibrated parameters. Most CES/CET expressions now exclusively use base year budget/cost shares. Those that retain the CES/CET dual share parameters is due to shifting technologies/preferences and in such cases, the dual share parameters are nonetheless initialized at 1 rather than calibrated to base year data.
* The labor demand module is more flexible. It includes a new additional nest, which in most cases won’t be needed, but gives the user much more flexibility. The bundles ‘LAB1’ and ‘LAB2’ continue to be defined as before. The former is combined with the K+E bundle in different configurations depending on the sector and the latter is typically a new complement with capital. This is intended to allow users to have skilled labor bundled with capital, though many configurations bundle all labor types into LAB1. We now call LAB1 and LAB2 labor bundles of type 1 and type 2. Within each of these bundles are a number of user defined bundles, indexed by ‘wb’ (worker bundles). For example, if the aggregation has only 2 types of labor and one expects labor to be directly substitutable across types, one can define ‘wb’ to be a single bundle and have both types of labor mapped to the single ‘wb’ type. An alternative is to have two ‘wb’ types, e.g. ‘nsk’ and ‘skl’ and map the respective labor types to each of the bundles. Assuming elasticities are consistent, the results should be identical. In the case of the latter, the ‘skl’ bundle could be mapped to LAB2. Another configuration is to use all 5 labor skills and map them to the ‘nsk’ and ‘skl’ bundle and have the second level nest to disaggregate more finely (i.e. into the 5 labor types). Finally, this configuration can allow the model to be ‘gender-aware’, where the top level labor bundle is defined by type (or skill) and the second level nest disaggregates across gender.
* The cap and trade regime has been significantly revised to deal with partial trading systems, such as the European ETS. Each cap and trade regime now covers a specific set of economic agents. To be compatible with the old system—where all agents were implicitly part of the any cap and trade regime, the user must explicitly define which agents are part of the regime, for example the set ‘aets’ which contains all possible combinations of agents, could have a single label (‘All’ for example), and all agents would be mapped to this (mapETS(“all”,aa) = yes). Additional ETS combinations can be defined over a subset of agents and for specific coalitions. More details are available in the Envisage reference document. One important change is that the emissions tax is now identified by agent as the tax can differ depending on which regime the agent is subject to. Obviously, an agent can only belong to one regime.
* A new iceberg parameter (lambdax) has been introduced to allow for export productivity improvements. See the Envisage reference document for additional information.
* The CES/CET specification has been modified to differentiate between positive and zero elasticities. This has been suggested by Wolfgang Britz. It makes no difference to the model specification, but hopefully improves computational behavior.
* Minor modifications were made to the capital vintage equations to avoid potential inconsistent behavior.

User input files:

‘MAP’ files:

* 1. The global options have been re-organized. The file starts with the user-specified options. This is followed by the ‘include’ statement for the dimensions of the GTAP data base that is being used and finally the location of the various data files and satellite accounts.
  2. New global options include ‘ifR\_D’, which invokes the R&D module, ‘DEPL’, which invokes the depletion module and ‘ifGender’, which invokes a special version of the wages database that includes a gender dimension. (The latter is still being tested and not generally available to the public.)
  3. The new map files use GTAP V10A. Those interested in other databases should contact the Center.
  4. The map files explicitly recognize the land-use database, though the information is ignored if the ‘LU’ global option is set to ‘OFF’.
  5. An additional labor nest has been added to each of the labor bundles in production (‘LAB1’ and ‘LAB2’). This has been added to deal with the gender dimension, but it could also be used for other labor characteristics such as ‘formal’ vs. ‘informal’, ‘native-born’ vs. ‘foreign-born’, etc. The user must define (at least) one generic labor bundle and map the various skills (and or other characteristics) to that labor bundle. Examples of this are provided in the User Guide. The ‘ul’ subset is no longer active.
  6. The mapping to the World Bank’s GIDD database has been renamed from ‘mapl’ (that is now reserved for the aforementioned labor bundles) to ‘maplGIDD’.
  7. The carbon permit regimes have been fully re-worked. The permits now explicitly cover one or more sectors—this was driven by the need to model the European Emission Trading System (ETS). The users must define at least one set of sectors under permit control, by default, this could be ‘all’ agents. The new set is called ‘aets’ and it can contain more than one collection of agents. It also depends on the set of Armington agents, the definition of which is now included in the map file.
  8. The user can construct different sets of consumer price indices. By default, ‘TOT’ includes all goods and services. But the user may be interested in others such as food, energy, etc.
  9. A new macro model is incorporated in the aggregation facility. The main purpose of this facility is to provide a reference path for investment (as a share of GDP). This will be used to create a baseline for dynamic scenarios. The macro model requires a number of user inputs that are described in the user guide.

‘OPT’ file

Putyear has been moved to the model code. (Need to change PUTYEAR to PUTYEAR(t) everywhere.

etaaps has to be added to the parameter file. Default initialization is 0.

# Envisage V.10 Model Modifications

## 08-Mar-2019

This is a minor upgrade with two changes:

* + There are some additional welfare indicators—the equivalent variation of savings that has the same definition as in the GTAP model. And we have added two global social welfare indicators. These have no direct impact on the model.
  + A (macro) R & D module has been added. Refer to the documentation for specification and implementation.
  + A resource depletion module has been added. Refer to the documentation for specification and implementation.
  + The maktab facility has a new table that relates to energy use. This requires the user to add a new parameter to the ‘Tab’ file. This parameter converts electricity output for the primary electricity sectors (e.g. hydro, nuclear, etc.) to take into account the equivalent power efficiency loss from using fossil fuels. A typical value is 3, i.e. a fossil fuel plant uses 3 MTOE to produce 1 MTOE of electricity. This conversion factor is only valid when using the ‘POWER’ database.

The relevant files have been uploaded to GitHub.

We are also making available the ‘parselst’ utility. This is a DOS-based program that will read a GAMS list file and output the variable and equation count for all solve statements. (This requires that the GAMS options limrow and limcol be set to a positive number.) The output is a CSV file that can be loaded in an Excel pivot table. An Excel file has been made available in the 10x10 folder that shows the linkages between the variables and equations in the Envisage model. (Users may need to change the folder definition in the Connection definition (property)). It should work for comparative static and dynamic models. The ‘parselst’ utility is in the ‘Doc’ folder. To run, open a DOS-box. Run the utility, for example:

parselst Runsim.lst > EqnCount.csv

Then refresh the pivot table. (Make sure the query connects to the correct folder beforehand.)

## 25-Feb-2019

This is mostly a minor upgrade with some cleaning up of code and model specification. The post-simulation routines—though still undergoing testing—have been simplified and improved.

The changes to the model code include (in decreasing importance):

1. Equivalent variation expressions for other final demand components have been added—this should allow in principle a more complete evaluation of welfare—similar to what is available in GTAP or GREEN. Unlike GTAP, we do not correctly adjust the welfare derived from investment for net foreign savings. This would require implementing a price of savings, which may be done in a future iteration. On the other hand, in dynamic models, savings is typically not included in the welfare evaluation as savings impacts on future consumption which is included (up to the terminal year). In GREEN, welfare was evaluated based on private and public expenditures. We have also added two expressions for a global social welfare function. One is based on private consumption alone, the other is based on private+public consumption. The social welfare function assumes a neutral aggregation.

With the introduction of the social welfare function, the objective function is now set to the social welfare function and no longer Walras. In the standard global model, Walras’ equation has been dropped. It is replaced with the investment/savings condition that now includes Walras as an additive shifter, but only for one residual region. As per usual, it should evaluate to zero.

1. A new efficiency parameter has been added to the consumer transition matrix (lambdac). This is being tested for use to act as a measure of household consumer waste.
2. The vintage capital specification remains the same in essence. It has been re-coded to make it more intuitive. It now models the supply of *Old* and *New* capital explicitly and equilibrium conditions have been added that equates supply of capital with demand.
3. The macro shares have been consolidated into two variables: rfdshr and nfdshr: the real and nominal share of the final demand variables as a share of GDP. These are now defined over *fdc*.
4. Some household demand variables have changed. The old code used theta for both the subsistence parameters in the LES class of utility functions and for the auxiliary consumption variable for the CDE. The subsistence parameters now use gammac, and the auxiliary consumption variables in the CDE use zcons. Note that the gammac are not normalized, unlike the previous theta parameters that were normalized when used as the subsistence parameter.
5. The model code now differentiates between the firstYear and the baseYear (these are defined in the user’s ‘Opt’ file). The old code assumed the firstYear was the first year of the model, i.e. the base year of the input database. firstYear is now defined to be the first year of the full time horizon (i.e. the first year in tt, which might be 1960, for example). The baseYear is now defined to be the base year for the model (i.e. the reference year of the database).

Post-simulation processing has been stream-lined. In large part this has meant isolating the simulation specific parameters in a single user-based file (called ‘BaseNameTab.gms’). The remaining code is now part of the model sub-directory and is expected to be the same irrespective of the dimensionality. The new code has been described in the user manual. The new code relies on makTab.gms (the workhorse routine), makCSV.gms (the main driver), setupPivot.gms (that creates the code to either refresh or create the pivot-table enabled Excel files), and CreatePivot.gms (which writes the appropriate VBS script for each individual CSV cube). The entire process is run from a Windows command file such as runtab.cmd. The user is responsible for two files—baseNameTab.gms and and runtab.cmd.

### Envisage model files

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| File | Description |
| closure.gms | Has ben changed in accordance with the model changes. |
| initvar.gms | Has been changed in accordance with the model changes. |
| solve.gms | Changes reflect the new model code. When using NLP, the objective function is now defined for the variable obj and no longer Walras. Obj is set to the global social welfare function. |
| cal.gms | cal.gms has been modified to take into account gammac (for the LES family) and zons for the CDE instead of theta. It includes the new variables, evf, sw, and swt. (Legacy code was also removed.) |
| postsim.gms | Has been modified in accordance with the model changes. |
| iterloop.gms | Largely the same. However, the model now differentiates between the firstYear and the baseYear. The latter is the first year defined in tt, the full time horizon and is typically a year well before the base year. The base year, baseYear, is the base year of the database and the model simulations. This affects all code that in the past was using firstYear as the first model year. |
| init.gms | Has been modified in accordance with the model changes. |
| model.gms | model.gms has been modified for the changes described in the introduction. |
| saveparm.gms | Replaced the output of theta, with the output of gammac. |

### 10x10 Files

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| File | Description |
| 10x10Opt.gms | 10x10Opt.gms has been modified to differentiate between the firstYear, now defined as the first year in tt (such as 1960), and the baseYear, which is the reference year for the simulations and the database (e.g. 2011 or 2014). |
| 10x10Prm.gms | Have overridden the value of ‘InvElas’ when it is equal to zero. Set to a minimum level of 0. Includes the default parameterization of the social welfare functions (epsw, welfwgt, welftwgt).ds |
| bauShk.gms | This file has several revisions. It now depends on baseYear (and no longer firstYear). It has been modified for changes in the name of the investment share variable. It has been improved to account for the new procedures to handle updating of variables when ‘re-starting’ from an existing simulation. |

### User maktab files

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| File | Description |
| baseNameTab.gms | File with user options to create the CSV-based pivot tables. Described in the documentation. |
| runtab.cmd | Command file that guides the creation of the CSV cubes. |

### maktab files in the ‘model’ directory

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| File | Description |
| makCSV.gms | File that drives the maktab process. |
| makTab.gms | File that creates the CSV cubes. Which cubes get created depends on user options. |
| setupPivot.gms | Creates a command file that will either refresh an existing Excel file or create a new Excel file with an embedded pivot table. The command file will contain the code for only the CSV cubes the user desires. |
| createPivot.gms | Creates specific VBS scripts for individual CSV cubes. |
| refresh.vbs | A generic VBS script to refresh a pivot table in an Excel file. |

## 4-Dec-2018

The model has had a number of enhancements:

* A new productivity parameter has been added to the CET ‘Make’ function. This allows for post-production improvements in efficiency—for example a reduction in post harvest losses. The parameter name in the code is lambdas.
* The model incorporates the ad valorem equivalent (AVE) of non-tariff measures (NTMs). The instrument is coded as ntmAVE and is bilateral. Income from this measure can be allocated to domestic households and/or government, and/or foreign households or government.
* The model has a new household ‘waste’ module. Aggregate consumption of a good is split into actual consumption and waste in a CES bundle. The latter can be impacted by a tax on waste or preference shifters. The variable XAWC represents the quantity wasted, with a potential tax of WTAXH. Actual consumption is defined by the variable XAAC.

### aggGTAP

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| File | Description |
| GTAPMap.gms | The latest changes to the map files were described in 6-Aug-2018 (see below). The only change is the MRIO flag. |
| aggGTAP.gms | The main change has been the addition of special processing at the end of the aggregation. At the very end of the code, is an optional include file that will read a file called ‘%BaseName%Spc.gms’ if it exists, for example 10x10Spc.gms. This could be used for multiple purposes, but the main one so far has been to aggregate auxiliary databases that are available at the GTAP level of aggregation, but need to be aggregated to the model level of aggregation. The ‘Data’ folder has an example called ‘twSpc.gms’ that has been used to aggregate the Iowa State University database tracking the recent tariff increases. |
| GTAPSetsxx.gms | The GTAP Sets files have some new items. 1) It should contain the version number as a scalar (see the parameter ‘ver’). 2) The standard SAM labels have two new additions to comply with the new model code. The two new labels are ‘wtax’ to hold the taxes based on modeling waste, and ‘ntmY’ to hold the revenues from the ad valorem equivalents (AVEs) of the non-tariff measures (NTMs). |
| makeSet.gms | There are minor changes to this file. Creation of new subsets: iaa(ia)—contains only the aggregate commodities of set ‘ia’, agaa(aga) contains only the aggregate activities of ‘aga’, and rra(ra) contains only the aggregate regions of ‘ra’. |
| makeSetEnv.gms | There are minor changes to this file—code modified to deal with waste and NTMs. |
| Altertax.gms | It has been edited to handle an auxiliary file for a specific aggregation (AFR). |
| GTAPModel\model.gms | The GTAP model has been modified to handle NTMs and thus can be used with Altertax to introduce NTMs into the initial database. |
| GTAPModel\cal.gms | The calibration module has been adjusted to handle NTMs. |
| GTAPModel\postim.gms | The post-simulation module has been adjusted to handle NTMs. |
| GTAPModel\postim.gms | The solve module has been adjusted to handle NTMs. |
| GTAPModel\savedata.gms | The save data module has been adjusted to handle NTMs. It creates a new satellite account called ‘%BaseName%NTM.gdx’. |

### Envisage model files

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| File | Description |
| sam.gms | sam.gms has been adjusted to incporate the new waste tax and the revenues associated with the NTMs. |
| compScen.gms | compScen.gms initializes new parameters glBaU and xfdBaU. |
| initvar.gms | initvar.gms has been adjusted to initialize the revenues associated with the NTMs and fixes that pwfact was not included (as it is the standard numeraire). |
| initScen.gms | initscen.gms now converts the input population data into millions (from levels). |
| cal.gms | cal.gms has been adjusted for the new modules (NTMs and waste). |
| scale.gms | scale.gms has been tinkered with for EVeq—still work in progress. |
| iterloop.gms | iterloop.gms has seen the following changes: 1) Adjusted to improve the ability of the model to start from an existing solution (still work under progress); 2) Fixed some lag variable issues ; 3) Fix gl and xfd(gov) in shock scenarios with new parameters glBaU and xfdBaU that are read from the baseline file. |
| init.gms | init.gms Moved the file input code to a separate module (getData.gms). This allows the user to make direct changes to the database prior to model initialization and calibration. |
| getData.gms | getData.gms reads in the core (GTAP) gdx-based input files—input has been extracted from the ‘init.gms’ file. |
| model.gms | model.gms has been modified for the waste and NTM modules, as well as the technology factor in the make module. Several new flags have been introduced: 1) savfFlag is now a model parameter that takes the value of the %savfFlag% user option; 2) NTMFlag determines the presence of NTMs; 3) ifInitFlag is set to 1 if the model has been initiated from a previous run; 4) startYear takes a user defined value that initiates model variables to a previous run up to and including startYear. If it is set to the base year, the model variables will be initiated with values from a previous year. |

### 10x10 Files

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| File | Description |
| 10x10XXX.GDX | The data files have been updated with the new aggregation facility. |
| 10x10Opt.gms | 10x10Opt.gms has been updated to handle the new features. One significant change is how the BaU file is handled and the ability to start a simulation starting from another simulation file. |
| makTab2.gms | makTab2.gms file has been revised. |

## 6-Aug-2018

* The model and data aggregation facility have been modified to use the newly available GTAP MRIO database. The model had already included the possibility of implementing MRIO (see 31-Aug-2017), but the model assumed strict proportionality and uniform tariff rates across all end-users, i.e. it was based on the standard GTAP database. This has entailed changes to the aggregation facility and the initialization module of the model.
* A new option is added to the standard ‘MAP’ files: ifMRIO. By default it is set to ‘OFF’. Users can set it to ‘ON’, but there must be the corresponding MRIO file. The latter is provided by the Center. At the moment, there is a single version associated with Version 9.2. The database has two matrices with four dimensions: commodity, end-user, and source and destination regions. The MRIO database has only three end-users: ‘INT’ for all intermediate agents, ‘CONS’ for private and public consumption, and ‘CGDS’ for investment expenditures. Within each broad end-user, proportionality is assumed and as well as a uniform tariff rate across all end-users. After aggregation, the MRIO database is copied to relevant folders unadulterated, i.e. the information is not used by either the Filter or Altertax modules.
* The only change to the model has been the initialization module. It complements the earlier initialization module that assumed proportionality across all end-users. The new code assumes proportionality across agents within the broad end-user classification. If the user sets the MRIO flag, the model will first check to see if the MRIO (aggregate) database is available. If so, it will use the MRIO database. If not, the model will use the previous assumption of proportionality across all end-users.

### aggGTAP

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| File | Description |
| GTAPMap.gms | There is a new flag called ifMRIO. By default it is assumed to be set to ‘OFF’. |
| aggGTAP.gms | AggGTAP aggregates the MRIO database (if available) across commodities and source and destination regions. It does not aggregate across broad end-user categories. |
| makeData.cmd | The command file has been modified to copy the ‘MRIO’ file across folders. |

### Envisage model files

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| File | Description |
| init.gms | Init.gms has been adjusted to initialize the model with the new MRIO database, if available and if desired. |

## 11-May-2018

* Have added the expression for equivalent variation for the CDE utility function (i.e. the value of expenditures to achieve utility level *u* at base year prices, P(0) and testing for the LES family.
* Have added government to government transfers. The initial data comes from the ‘MyGTAP’ version of GTAP and for the moment only V9 levels are available.
* New price index ‘pfact’ defined as the Fisher index for factor prices. Can be used to fix the real exchange rate.
* Have added 10 new air emissions—see Envisage documentation for a list. This largely requires only changing the set definitions for ‘em’ and adding 2 new subsets. The NCO2 emissions database is a merger of the standard ‘NCO2’ database and the new pollution database—since their functionality is identical. The ‘CEQ’ arrays are only defined for the GHG.
* The cap\_out\_ratio is now entered as a multiplicative adjustment to the initial capital stock and not in levels.

### aggGTAP

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| File | Description |
| GTAPSetsxx | The GTAP Sets files have been modified to incorporate the new non-greenhouse gas emissions. This includes adding two new subsets: ‘ghg’, i.e. the greenhouse gases, and ‘nghg’ the non greenhouse emissions. |
| aggGTAP.gms | AggGTAP expects to read bilateral government to government transfers in the ‘BoP’ file. These are called ODAIn and ODAOut. The initial data is source from the ‘MyGTAP’ database. There are minor changes to the labels of parameters in the GIDD file. |
| aggNRG.gms | The code has been modified to deal with the new emissions. This was required because there is no ‘CEQ’ component to the non-GHGs. |
| makesetEnv.gms | Added code to deal with the additional emissions—introducing a set called ghg to represent the greenhouse gases and nghg for the non greenhouse emissions. |
| GSDFBOP.gdx | Should contain ODAIn and ODAOut. The arrays can be initialized to 0. |
| GSDFNCO2.gdx | Can contain data for the additional air emissions. If missing, will default to 0. |

### Envisage model files

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| File | Description |
| model.gms | There is a new subset of ‘R’ called ‘fixER(r)’. This will fix the PFACT for a region. Requires a lender/borrower of last resort.  Model has new parameters, variables and equations for the government to government transfers, i.e. ODA.  Model has a new variable ‘pfact’, a Fisher price index of factor prices.  Model now calculates EV as the value of equivalent variation at current utility and base year prices.  Corrected an error in equation ‘k0eq’. There was a .l in one of the variables.  Slight modification to the savfeq. |
| init.gms | Added code to deal with new variables (ODA, EV, PFACT). Modified code to deal with new emissions (all emission variables are based on set ‘em’ and no longer ‘emn’). The emission module has been modified for the new non-GHG emissions. The user parameter ‘CAP\_OUT\_RATIO’ is now entered as an multiplicative adjustment to the initial (i.e. GTAP-based) level. By default it is 1, i.e. no adjustment. A value of 0.8 would reduce the ratio by 20%. A value of 1.2 would raise the ration by 20%. |
| cal.gms | Added code to deal with new ODA variables. Added code to deal with defining utility with the ELES/LES/AIDADS formulation for the EV calculation (still needs testing). New variables included to the normalization section. |
| postsim.gms | Added code to save new variables. Modified code to deal with new emissions—this was needed as there is no ‘CEQ’ component to the new emissions. |
| initvar.gms | Added code to initialize new variables. |
| closure.gms | Added code to reflect new ODA variables. |
| sam.gms | Added code to reflect new ODA variables. |
| iterloop.gms | Added code to fix lags for new variables. |

## 18-Dec-2017

## Data processing files

* Sets files now include AEZ information. This is still being tested.
* Most file names now use ‘/’, rather than ‘\’. This is to be compatible with UNIX/MAC. It appears to work, but issues should be reported to the Center.
* Map file have been modified to use the AEZ database. This is still under development. Users need to provide the location of the AEZ data ($setGlobal AEZFile), and initialize the LU flag ($setGlobal LU OFF/ON).
* The aggGTAP.gms program now checks the mapk mappings in addition to the other aggregation mappings.
* The aggGTAP program can aggregate the LU/AEZ data. This is still under development.
* To be compatible with UNIX/MAC version, deletion of the temporary labels file has been disabled. (See line ‘execute ‘del tmpSets.gms’.)
* Created a Bash shell for makedata (makedata.sh) than can be used to run the data processing facility on UNIX/Mac machines.

## 27-Oct-2017

* The latest UN population projection, 2017 revision, has been added to the projections file. Users can now choose UNMED2017 as a new population scenario. This involves updates to the SSPSETS.GMS and the SSPScenV9.gdx files.
* There have been some changes, mostly minor, to the GTAP model used to run Altertax. This has no impacts on the user interface.
* A new option is needed to run Envisage simulations, LABSCEN, in addition to POPSCEN. This option determines how to differentiate the growth of skilled vs. unskilled labor. If LABSCEN is set to one of the SSPs, the education profiles will be used to determine the growth of skilled labor. In all other cases, the growth of labor across skills is uniform and will match the growth of the working age population. Note that if the parameter skLabgrwgt is set to 0, the education profiles are ignored.

## 31-Aug-2017

This is a major revision. The aggregation facility and the model have been re-engineered to line-up with the new GTAP data files. The main changes are the following:

* The new ‘DAT’ file has a make matrix—for the moment diagonal (and the aggregation facility explicitly assumes diagonality—this is mostly for the ‘filter’ routine that is not currently setup to deal with non-diagonality.) There are two evaluations for the make matrix: pre- and post-tax. The output tax has been converted to apply to the make matrix, thus the output tax now has two dimensions, ‘a’ the source activity of the output, and ‘i’ the supplied commodity.
* Factor income taxes have been converted to be activity specific. This has implications for the database as well as the code. The former vector ‘EVOA’ (now called ‘EVOS’), has two dimensions, ‘f’ the factor being taxed and ‘a’ the source activity of the factor.
* The ‘cgds’ commodity has been eliminated. The new database has a series of vectors for investment expenditures that are thus treated as the private and public expenditure vectors.
* All taxes are now positive (this affects output and export taxes). This reflects a change in the base price from which the tax is evaluated. There is a change in vocabulary as well. The new database refers to basic and purchasers’ prices and no longer market and agents’ prices.
* Naming conventions for many header arrays have been changed. Partly this reflects the new tax conventions and also an attempt to standardize the names. Full detail on the GTAP facelift are available in Corong et al. 2017. (<https://jgea.org/resources/jgea/ojs/index.php/jgea/article/view/47>).
* These changes have an impact on the interface between the aggregation facility, the models and the input database as well as on the model specification. Details on these are further described below.

### GTAP data files

Any current release of the GTAP data files need to be converted to the new format. A GAMS program, called ‘convert.gms’ will read the standard GTAP databases and convert them to the new GTAP standard (i.e. the post-facelift standard).[[1]](#footnote-1) (N.B. The convert program does not convert all potential satellite accounts. For the moment it is designed to convert ‘dat’, ‘par’, ‘wages’, ‘vole’, ‘emiss’ and ‘nco2’ files.) Users need to prepare an options file, e.g. Opt9\_2.gms that contains the new set definitions. The user must set 5 options:

* The directory holding the ‘classic’ GTAP files
* The base name of the ‘classic’ GTAP files (for example, GSD)
* The directory holding the new ‘standard’ GTAP files (can be the same)
* The base name of the new ‘standard’ GTAP files (for the moment using a suffix F to indicate facelift version of database, for example GSDF).
* An option IFALL. If set to 1, will also read and convert non-standard head arrays—such as ‘FTRV’. If set to 0, will only convert the standard header arrays.
* An option IFPOWER. If set to 1, will read ‘GWHR’ from the ‘DAT’ file and store in new ‘DAT’ file.

### aggGTAP

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| File | Description |
| GTAPSetsxx | The GTAP Sets files have been modified to conform to the new GTAP naming conventions (the old ones are still being used for the ‘conversion’ program described above). The changes are:   * The set ‘prod\_comm’ is nor called ‘comm’ and excludes ‘CGDS’. * The set trad\_comm is deleted. * The set ‘comm’ is aliased with ‘acts’, i.e. explicit assumption of diagonality. * The set marg\_comm is renamed ‘MARG’. * The set erg\_comm is renamed ‘ERG’. * The set fuel\_comm is renamed ‘FUEL’. * The set endw\_comm is renamed ‘ENDW’. * The set lab\_comm is renamed ‘LAB’ * The set endws\_comm is renamed ‘ENDWS’. * The set cap\_comm is renamed ‘CAPT’. * The set land\_comm is renamed ‘LAND’. * The set ntrs\_comm is renamed ‘NTRS’. * The set wat\_comm is renamed ‘WATER’. |
| 10x10Map.gms | The set ‘a’ is no longer defined (it was needed to be able to handle the ‘cgds’ activity. ‘a’ is now an explicit alias with ‘i', i.e. diagonality is explicitly assumed. The parameter ‘etrae’ is now region specific. There are new make elasticities: etraq1 and esubq1 and new expenditure elasticities: esubg1, esubi1 and esubs1.The zonal mapping should logically be defined over ‘a’. The activity mapping is defined for ‘acts’ and not ‘prod\_comm’. (trad\_comm has been replaced by ‘comm’, and ‘endw\_comm’ has been replaced by ‘endw’.) All references to ‘cgds’ should be dropped. |
| aggGTAP.gms | ‘AggGTAP.gms’ has been heavily modified. Many header array names have been changed, changes were made relative to the classic ‘cgds’ sector, changes were needed to deal with the new tax structure (ptax, evos and the conversion of negative taxes), changes were required to deal with the addition of regional indices to some of the elasticities (e.g. esubd), additional elasticities are now included (e.g. esubc, the make elasticities, etc.) and changes were made to deal with the introduction of the make matrix. |
| nipa.gms | The ‘nipa.gms’ file has been modified to handle the new header array names and the added dimensionality of the ‘ptax’ and ‘evos’ arrays. The code that calculates the energy subsidies needs to be reviewed before using again. |
| savemap.gms | The code in ‘savemap.gms’ has been modified to add additional ‘tags’ to the ‘$if’ statements. The older version resulted in spurious warnings from GAMS. |
| aggNRG.gms | The code in ‘aggNRG.gms’ has been modified to reflect the names of the new header arrays and the conversion of ‘cgds’ to investment-specific vectors. |
| aggEnvElast.gms | The code in ‘aggEnvElast.gms’ has been modified to reflect the names of the new header arrays and the conversion of ‘cgds’ to investment-specific vectors. |
| aggSAM.gms | The code in ‘aggSAM.gms has been modified to reflect the names of the new header arrays, the conversion of ‘cgds’ to investment-specific vectors and the new dimensionality of ‘PTAX’ and ‘EVOS’. Note that PTAX has moved to the commodities section and is no longer in the activities columns. |
| makeset.gms | The code in ‘makeset.gms has been modified to reflect the removal of ‘cgds’. |

### Filter

|  |  |
| --- | --- |
| File | Description |
| Filter.gms | The calling program, ‘filter.gms’ has been modified to read the renamed header arrays. |
| remTinyValues.gms | ‘remTinyValues.gms’ has been modified to use the new header array names. |
| itrLog.gms | ‘itrLog.gms’ has been modified to use the new header array names. |
| Filter.gms | The main program, ‘filter.gms’ has been extensively modified to use the renamed header arrays. |

### Altertax

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| --- | --- |
| File | Description |
| iterLoop.gms | The variable ‘pp’ has been eliminated from the code. The variable ‘prdtx’ has an additional commodity dimension (‘i’), i.e. the output tax is now specific to the commodity and the activity that produced it. |
| saveData.gms | Changes to the code reflect the extensive changes to the header array names. |
| emiCSV.gms | Changes to the code reflect the extensive changes to the header array names, the removal of the ‘cgds’ activity and some esthetic changes to the tags on ‘$if’ statements. |
| postsim.gms | Changes to the code reflect changes to the ‘prdtx’ and ‘kappaf’ taxes. In addition, ‘ptax’ revenues have been moved to the commodity columns (‘i’). ‘pp’ is no longer a model variable and has been removed from output. The saving of the input header arrays has been modified to reflect the new naming conventions. |
| Model.gms | The variable ‘pp’ has been deleted from the model. The taxes ‘ptax’ and ‘kappaf’ have been redefined. The variable ‘emii’ has been renamed ‘emim’—consistent with the new naming conventions. Equations relating to ‘ptax’ and ‘kappaf’ have been modified. The definition of equation ‘arenteq’ has been modified to reflect that ‘kappaf’ is activity-specific. |
| cal.gms | Changes have been made to ‘cal.gms’ to reflect the modifications to’ model.gms’. Other extensive changes include the reading and subsequent use of the input header arrays to reflect the new naming conventions. |

### Envisage model files

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| --- | --- |
| File | Description |
| model.gms | The variable ‘pp’ is now calculated vis-à-vis ‘p’ the basic make price. (The price markup ‘pim’ has been eliminated for the moment.) The production tax is now activity and commodity specific and is applied to the basic ‘make’ price. The make matrix is now formed with ‘p’ as the base price and the relevant CET price index is ‘px’ instead of ‘pp’. The output tax is applied to ‘p’ and the CES price index ‘ps’ is now a composite index of ‘pp’. These changes have been tested for the power model as well. Profits are no longer defined net of depreciation income (need to understand the impacts of this)—thus capital income outflows are calibrated on a basis of net after tax capital income with no depreciation adjustment. Factor income taxes are now activity specific as well as factor-specific—this affects kappal, kappak, kappat, kappan and kappaw. Changes to kappal and kappak have downstream effects. The remittance rate is now based on gross wages and not wages net of income tax. This may be revised in the future. Depreciation is now subtracted from the definition of ‘yh’ as it is no longer extracted from profits. The aggregate water demand equations are now indexed to ‘PX’ and no longer to ‘PP’. The ‘RoR’ equation has been modified to reflect that the profit tax is now activity specific. The world price ‘pw’ is now an index of ‘px’ and no longer ‘pp’. All factor demand, supply and prices have been collapsed into a single vector (xf and pf). This greatly simplifies many accounting identities. The model has added a third trade option specification—MRIO. By default it works with the standard database with the assumption of uniform source shares across agents, uniform substitution elasticity and uniform tariffs. Price indices have been replaced with Fisher price indices (see pgdpmp, pmuv, pw). |
| init.gms | Code was modified to incorporate new input databases and model changes |
| cal.gms | Code was modified to reflect model changes. |
| postsim.gms | Code was modified to reflect model changes. |
| initvar.gms | Code was modified to reflect model changes. |
| closure.gms | Code was modified to reflect model changes. |
| sam.gms | Code was modified to reflect model changes. |
| iterloop.gms | Code was modified to reflect model changes. |
| solve.gms | Code was modified to reflect model changes. |

### User files

|  |  |
| --- | --- |
| Item | Description |
| xxxPrm.gms | Parameters ‘esubd0’ and ‘esubm0’ are now indexed by r (as well as i0). |
| xxxOpt.gms | No changes required. |

## 29-May-2017

Key modification(s)

* + Beta-testing new capital account closure based on the capital allocation mechanism in the Monash/USAGE models—USE WITH EXTREME CAUTION
  + Created a new subset of ‘k’ that includes only food goods—called ‘fud(k)’. It is specified in the aggregation facility. (Should be removed from any downstream files such as “\*Opt.gms”)

### Envisage model files

|  |  |
| --- | --- |
| File | Description |
| model.gms | Added variables and equations to add a second mechanism for endogenizing net foreign savings. Specification is based on the Monash/USAGE models. This requires a handful of new equations and parameters. The new user parameters are described below. |
| Init.gms | Code was modified to incorporate new foreign saving closure |
| postsim.gms | The new variables were added to the output. |
| Initvar.gms | Code was modified to update the new variables |
| closure.gms | Savf is no longer exogenized—it is now calculated by the model. With the old closure, it is savfbar that is exogenous (and is in fact a parameter). |

### User files

|  |  |
| --- | --- |
| Item | Description |
| 10x10Prm.gms | Added grkMin0, grkMax0, grkTrend0, chigrK0 and RoRn0 to file. These are explained in the user documentation. The user must set these explicitly and add the corresponding model parameters and initialize them. An example initialization is provided in the 10x10prm.gms file. |
| 10x10Opt.gms | The options for ‘savfFlag’ have been modified. There are three valid options: ‘capFix’, ‘capFlexGTAP’ and ‘capFlexUSAGE’. The first fixes the capital them (as in previous versions of the model). The second closes the capital account using the GTAP implementation of endogenous foreign savings. The third closes the capital account using the USAGE-inspired implementation of endogenous foreign savings.  The user must also set the global real interest rate. This is set with a ‘setGlobal’ statement for ‘intRate’ |

### Envisage documentation

|  |  |
| --- | --- |
| File | Description |
| Env10.pdf | Includes a description of the latest modifications. |

### aggGTAP

|  |  |
| --- | --- |
| File | Description |
| 10x10Map.gms | Created a new subset of ‘k’ (consumer goods), that includes only the food consumer goods—it is called ‘fud(k)’. |
| makesetEnv.gms | This file was modified to output the new set fud(k).  Also changed the set range for ‘educmap’. It is now defined over ‘ed’ and not just ‘edx’. |

### Data files

|  |  |
| --- | --- |
| File | Description |
| gsdpwvole.gms | There was an error when using the latest version of the aggregation facility with the ‘vole’ data for the power & water version of the database (v 9.0). The old version of the data file had the investment vector separated from the production matrices. The new version keeps the investment vectors, but also re-merges them back with the production matrices, consistent with the current handling of data by the aggregation facility. |

## 25-May-2017

Key modification(s)

* + Introduced GTAP-style endogenous capital flows—USE WITH CAUTION

### Envisage model files

|  |  |
| --- | --- |
| File | Description |
| model.gms | Added variables and equations to endogenize net foreign savings. Specification is based on the GTAP model. Note that even under the ‘old’ specification, with fixed capital flows, these are now linked to a parameter called ‘savfbar’ that the user can modify. The model will guarantee that the sum adds to 0, but the user should try and make sure savfbar nonetheless adds to zero to avoid unintended consequences. |
| Init.gms | Code was modified to incorporate new foreign saving closure |
| postsim.gms | The new variables were added to the output. |
| Initvar.gms | Code was modified to update the new variables |
| closure.gms | Savf is no longer exogenized—it is now calculated by the model. With the old closure, it is savfbar that is exogenous (and is in fact a parameter). |

### User files

|  |  |
| --- | --- |
| Item | Description |
| 10x10Prm.gms | Added epsRoR0 and epsRoR to file—this is a new key elasticity that drives foreign saving in the case of endogenous foreign saving. It is the user responsibility to initialize epsRoR0. The default value for GTAP is 10. |
| 10x10Opt.gms | There is a new global option, ‘savfFlag’ that is set with the other global options. There are two valid options: ‘capFlex’ and ‘capFix’. The former allows for endogenous net foreign savings flow. The latter fixes them (as in previous versions of the model).x 10x |

### Envisage documentation

|  |  |
| --- | --- |
| File | Description |
| Env10.pdf | Includes a description of the latest modifications. |

## 23-May-2017

Key modification(s)

* + Introduced kinked supply curves for natural resources.

### Envisage model files

|  |  |
| --- | --- |
| File | Description |
| model.gms | Added equation that determines the supply elasticity to apply for natural resources (etanrfeq). The supply function has been adjusted as well, see documentation. |
| Init.gms | Code was modified to reflect that the user enters two supply elasticities (‘lo’ and ‘hi’) |
| Cal.gms | Code was modified to calibrate new supply system for natural resources |
| Iterloop.gms | Code was modified to ‘fix’ new lags in the natural resource equations |
| Initvar.gms | Code was modified to update natural resource elasticity that is now a variable |

### User files

|  |  |
| --- | --- |
| Item | Description |
| 10x10Prm.gms | The user-based parameter file has been modified. The user must enter supply elasticities for natural resources—any values in files will be ignored (We’ll try and correct this in the future.) For each natural resource, the user must enter a ‘lo’ and a ‘hi’ elasticity. They can be the same. Intuition suggests the ‘lo’ elasticity would normally be higher than the ‘hi’ elasticity. |
| 10x10Sets.gms | Added a new set called ‘lh’ that contains the set items ‘lo’ and ‘hi’. Users can insert this by hand in old ‘Sets’ file. The aggregation facility has been modified to insert these automatically. |

### aggGTAP

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| --- | --- |
| File | Description |
| makesetEnv.gms | This file was modified to output the new set ‘lh’ to the ‘Sets’ file. The set ‘lh’ is used by the new natural resource supply module. |

### Envisage documentation

|  |  |
| --- | --- |
| File | Description |
| Env10.pdf | Modified the description of the natural resource supply module for the kinked supply curves. |

## 12-May-2017

Key modification(s)

* + Corrected initialization of ygov0 in the normalization of variables section of cal.gms. It is now initialized to 1 in the case of zero revenues in the base data.

### Envisage model files

|  |  |
| --- | --- |
| File | Description |
| cal.gms | Corrected initialization of ygov0 when initial revenues are 0. It is now initialized to 1 in this case. |

## 5-May-2017

Key modification(s)

* + Code has been amended to allow for ‘twists’ to the Armington share parameters—both top and second nests, and in regards to the latter for either national or agent-based sourcing.
  + Error in iterloop has been corrected.

### Envisage model files

|  |  |
| --- | --- |
| File | Description |
| model.gms | Added parameter declarations for Armington twists |
| Recal.gms | Recal is called if ord(tsim) ge 2, not ge 3. Added code in recal.gms to initiate recalibration of production parameters when ord(tsim) ge 3. Added twist code for Armington parameters in recal.gms. If the user-based twists are set to zero, the twist formulas are redundant. |
| Iterloop.gms | Recal.gms is now called when ord(tsim) ge 2 (see above). The twists, now included in recal.gms, begin in period 2. The re-calibration of the production parameters continue to start with period 3.  Corrected a small error in the initialization of k0. |

### User files

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| --- | --- |
| Item | Description |
| 10x10Opt.gms | Included code to read Armington twisted share parameters from the baseline file. This occurs immediately after the execute\_loadpoint statement. The latter only re-reads equations and variables—not parameters. Note that the twists are only calibrated in the baseline simulation. They are assumed fixed in subsequent simulations. This is unlike the production parameter recalibration that is done for each simulation. |
| 10x10Prm.gms | The user-based parameter file includes the new parameter declarations and initializations for the twist parameters. These are necessary for all Prm files—even if the twist is not implemented. The default values for the twists are 0. |

### Envisage documentation

|  |  |
| --- | --- |
| File | Description |
| Env10.pdf | Added description of the Armington twist parameters. See Section 4.4 for a description, and D2.2 for implementation. |

## 13-Apr-2017

### aggGTAP

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| --- | --- |
| File | Description |
| 10x10Map.gms | Modified 10x10 mapping to use V9\_2 (N.B. For the moment we don’t have the ‘wages’ nor ‘BoP’ databases for V9\_2). |
| filter.gms | Made a minor modification to ‘filter.gms’ to include a $setGlobal for ‘PGMNAME’, that is used in the log file. |
| nipa.gms | The ‘nipa.gms’ has some additional code that we have used to look at energy subsidies. This is commented out for the moment. |
| conopt.opt, conopt4.opt | We have added two ‘.opt’ files for CONOPT. The filter program was giving errors due to large numbers—the ‘.opt’ files reset some key CONOPT parameters. |
| GTAP V9\_2 | Uploaded GTAP V9\_2 to the Dropbox |

### Envisage documentation

|  |  |
| --- | --- |
| File | Description |
| Env10.pdf | Corrected documentation on carbon tax/regime implementation. The carbon tax should be multiplied by ‘cscale’ not ‘escale’. All appearances of emitot.l in the code samples should be multiplied by emitot0 given the new scale factors. |

### Envisage model files

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| --- | --- |
| File | Description |
| model.gms, init.gms | Modified household saving code—made saving a function of YD not YH. This is a fix. The old version did not affect accounting, but was incorrect. Renamed savheq and apseq to respectively savhELESeq and savheq. This affects model.gms and init.gms (where aps is initialized). |

### User files

|  |  |
| --- | --- |
| Item | Description |
| 10x10Prm.gms, runsim.gms | Modest changes to the dynamic simulation files to help generate a baseline. Most significant change was to make natural resource supply more elastic (default values were leading to major changes in real exchange rates). |

## 28-Mar-2017

### aggGTAP

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| --- | --- |
| File | Description |
| aggGTAP.gms | Includes code to save aggregations for input into Excel/Word and/or Latex (see around line 190). Requires savemap.gms. |
| aggGTAP.gms | Added code to output the NIPA accounts for the GTAP database (see around line 275). This is normally commented out. Requires file nipa.gms |
| makeset.gms | Added code to output the ‘sort’ order for subsequent SAMs. This makes use of the user inputted sorted labels for regions, activities and commodities. While there can be significant use for the sorting, for the moment it is generally limited to sorting the labels for automated creations of SAMS. |
| aggNRG.gms | File has been modified to allow for the lack of non-CO2 emissions data. |
| savemap.gms | [NEW] File that saves aggregation concordance from GTAP to final model aggregation. The output options are either ‘TXT’ and ‘LATEX’. In the case of the former, the concordances are saved as comma-delimited text files that import readily into Excel. To import into Word, first import into Excel and use ‘Data|Text to Columns|Delimited|Comma’ to create a three column table. This can be formatted in Excel and/or cut and pasted into Word. In the case of the latter, the concordances are saved as LaTeX tables that more than likely need additional formatting. Special characters, notably ‘\_’ and ‘&’ will need to be ‘escaped’ manually. |
| nipa.gms | [NEW] New file that outputs national income and product accounts from the full GTAP database. The use of this file is normally commented out. |
| GTAPSets9\_2.gms | [NEW] Sets definition file compatible with the standard GTAP database, release 9.2 (essentially includes the addition of Tajikistan (TJK)). |

### MAP file changes

|  |  |
| --- | --- |
| Item | Description |
| SAVEMAP | [NEW] global user option that saves the aggregation mappings in one of two formats: ‘TXT’ a comma delimited text file meant for importing into Excel (and then Word), ‘LATEX’ meant to be inserted in a LaTeX file. (N.B. Beyond formatting the tables in LaTeX, users may need to manually escape special characters such as ‘\_’ and ‘&’. |
| mapRegSort, mapActSort, mapCommSort | [NEW] Sort orders for regions, activities and commodities respectively. This is the order the user would like to see for these labels in output files. For the moment, this is largely limited to the output of the SAMs. |

### Filter

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| --- | --- |
| File | Description |
| filter/filter.gms | File has been modified to allow for the lack of non-CO2 emissions data. |

### Altertax

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| --- | --- |
| File | Description |
| GTAPModel/emiCSV.gms | File has been modified to allow for the lack of non-CO2 emissions data. |

### Envisage model files

|  |  |
| --- | --- |
| File | Description |
| model.gms | Changed model to allow for non-implementation of non-CO2 gases. The flag ifNCO2 has been added. And the equations emiToteq and emiGbleq are now conditioned on having initial emission levels. |
| model.gms | Have included the Cobb-Douglas utility function as a special case of the LES utility function—with all subsistence levels set to 0. The global utility parameter can now take 5 values: CD, LES, ELES, AIDADS and CDE. |
| cal.gms | File has been modified to include calibration of the Cobb-Douglas utility function. |
| init.gms | Initialization of the satellite accounts is somewhat more robust. The code now checks to see if the satellite accounts exist, and if not, it initializes the relevant variables to zero. In the case of the non-CO2 gases, the flag ifNCO2 is set to an appropriate value depending on the existence or not of the non-CO2 gas satellite file. |
| init.gms | There is some code that will over-ride the energy volume data—starting around line 380. This should undergo additional review. Since the domestic volume of production sold for domestic sales is calculated by residual, and given the small discrepancies in the input data, it can happen that the domestic sales of domestic production can be negative (typically though very small). If below a tolerance level, the code simply zeros these out. |
| closure.gms | Fixes the case of zero initial emissions (for non-CO2 gases). |
| closure.gms | Modified to fix utility parameters for the Cobb-Douglas utility function. |
| iterloop.gms | Adjusted labor productivity update for shock simulations—previously it was updated in initvar.gms. This could have led to potentially misleading results as labor productivity was potentially being set to the previous period’s labor productivity and not to the baseline productivity. |
| initvar.gms | Deleted labor productivity update. Now done exclusively in the iterloop.gms module. |

### User files

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| --- | --- |
| Item | Description |
| utility | The global variable ‘utility’ can take the additional value of ‘CD’ for the Cobb-Douglas utility function. The variable can now take five values: CD, LES, ELES, AIDADS and CDE. This variable is normally set in the [basename]Opt.gms file. |

1. The GTAP sets file (e.g. GTAPSets9\_2.gms) required minor modifications. The GTAP sets ‘DIR’ and “TARTYPE’ needed to be added to convert some non-standard header arrays. [↑](#footnote-ref-1)