



GGIG

GAMS Graphical Interface Generator

Wolfgang Britz

Why GUIs for economic models?

- **Steer the applications with a known Touch & Feel** – reduce need to know details about software and specific implementation
- **Exploit the results** – often not nicely supported by the modeling languages
- GUI development **supports a good structure of the applications** themselves

Some history

- Graphical User Interfaces (GUI) to steer economic simulation models exist at the institute for food and resource economics since the 70ties:
 - Already for terminals to connect to mainframe
 - Sequence of dialogues (one dialogue = one full screen page)
 - Supported where text fields

Some history

```
Table file services ----- SPEL ----- Rename entries

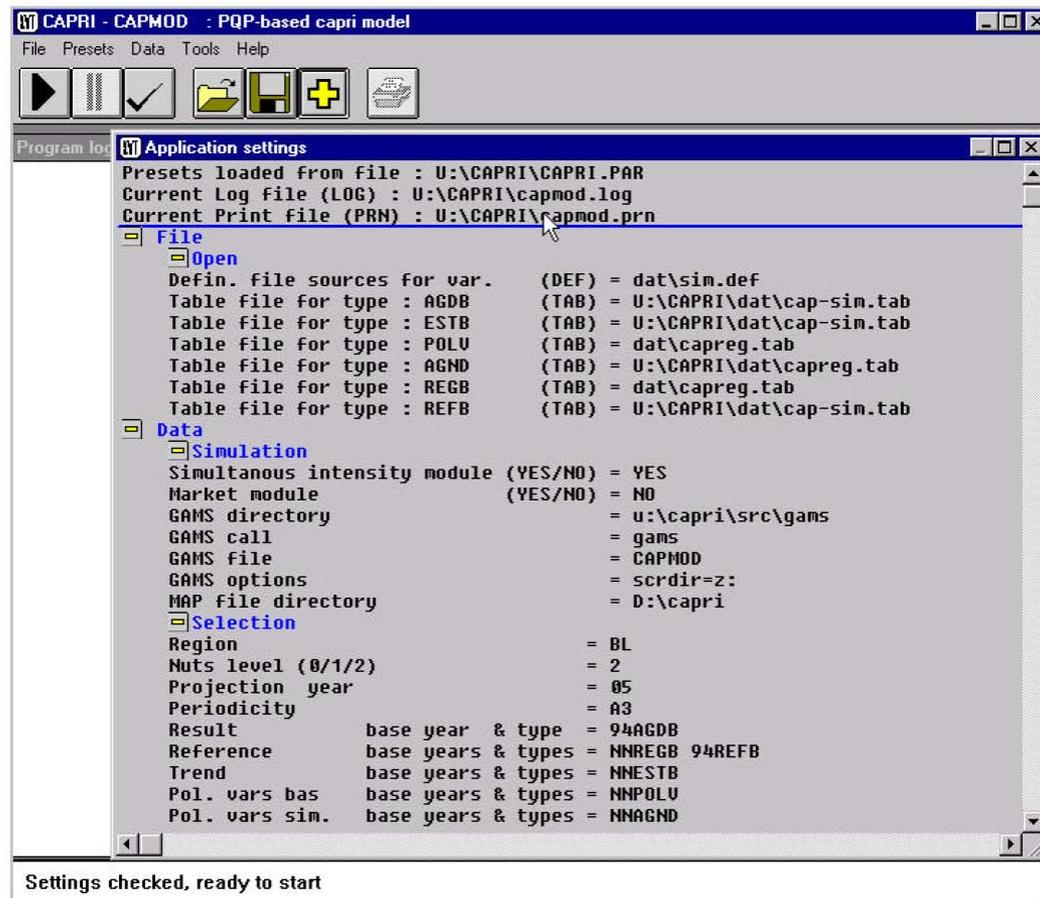
                Please enter key selection

Region          ( 3 ch.) => NL
                Rename =>
Sub-region      ( 2 ch.) => 00
                Rename =>
Current year    ( 2 ch.) => 60 : 88
                Rename =>
Periodicity     ( 2 ch.) => 00
                Rename =>
Base year       ( 2 ch.) => NN
                Rename =>
Type            ( 4 ch.) => COMC
                Rename => XXXC
Model area      ( 1 ch.) => S
                Rename =>

                Enter= ok  1= Help  3= Quit  4= Exit  11= Save/Load
```

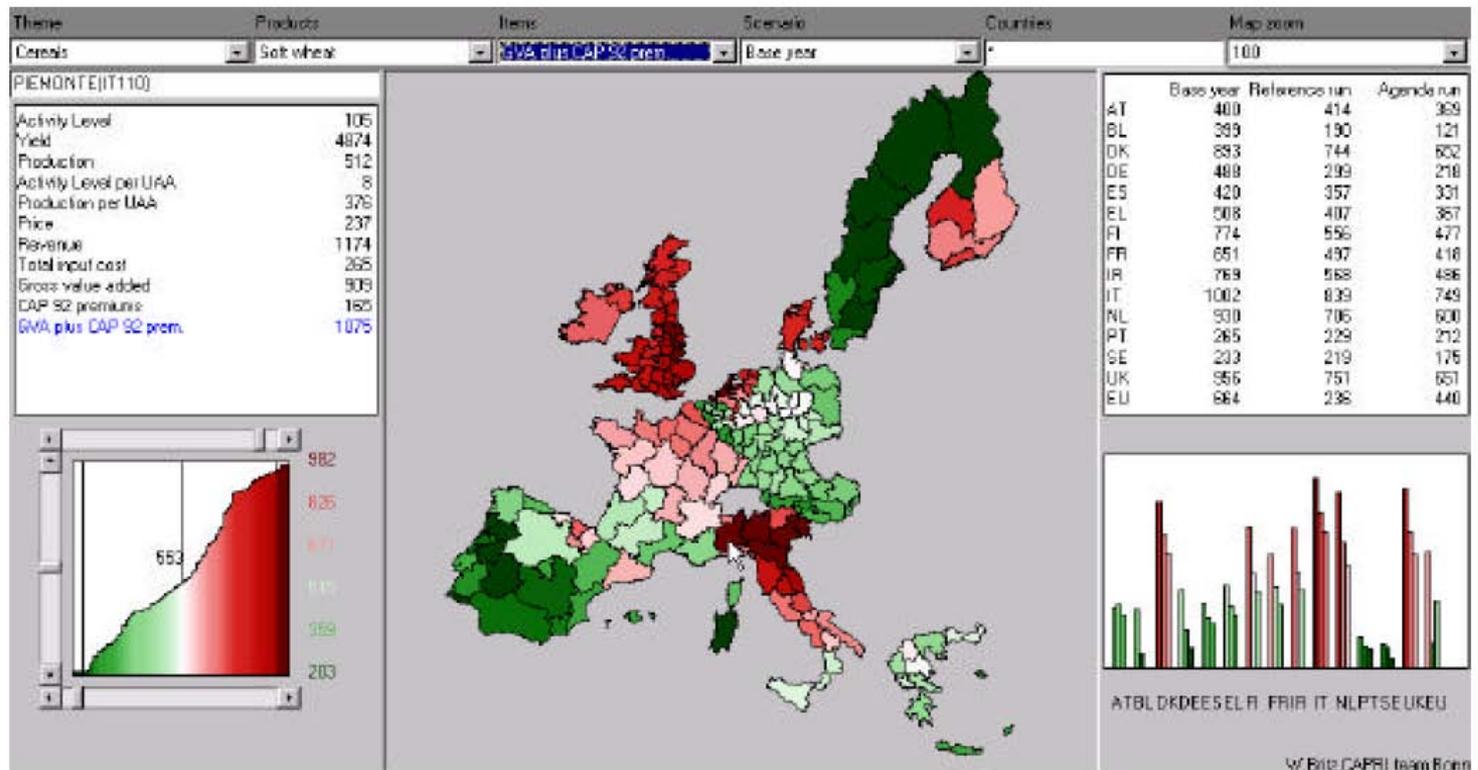
Some history

- First GUI of CAPRI based on C/FORTRAN



Some history

- 1999: Mapping tool in Java



Some history

- Since CAP-STRAT(2001-2004), CAPRI GUI in Java
 - Use of the CAPRI exploitation tools
 - e.g. in Multi-Commodity model for Benin (BenImpact) and Drâa valley river basin model (mid of nineties)
 - by staff members when at OECD, FAO ...
 - Table definitions in XML allowed to **port functionality** of CAPRI GUI (tables, maps, graphics ...) to **other models'** outputs
- => Same idea **now for model steering**

What is the GAMS Graphical Interface Generator (GGIG)?

- Compiled Java code
- which generate from a XML based text file (no Java programming needed)
 - a Graphical User Interface
 - with user operable controls such as check boxes, selection lists, tables
 - which translate the settings of these control into GAMS/R code in a include file
 - which can start GAMS/R programs, shows the log in a window
- allows to exploit the results stored in GDX files, explore them as tables, graphics, maps

Why GGIG

- **No Java programming needed** to generate or modify a GUI:
 - Interfaces efficient **also for smaller projects**
 - **Easy to add options**
 - Interface **portable** also to other platforms where GAMS and Java are running, such as MACs
- Some useful utilities accessible

Why GGIG: GAMS side

- Supports **structured programming** in GAMS:
 - Clear **distinction** between **user input** and **processing code**
 - “**One entry point**” strategy via include file to define **run specific settings** including definition of counterfactuals
- **No manual edits in GAMS** to change settings
- **Meta information** (who, when, what) automatically generated as a GAMS set
- GAMS code can still be run without the interface

Why GGIG

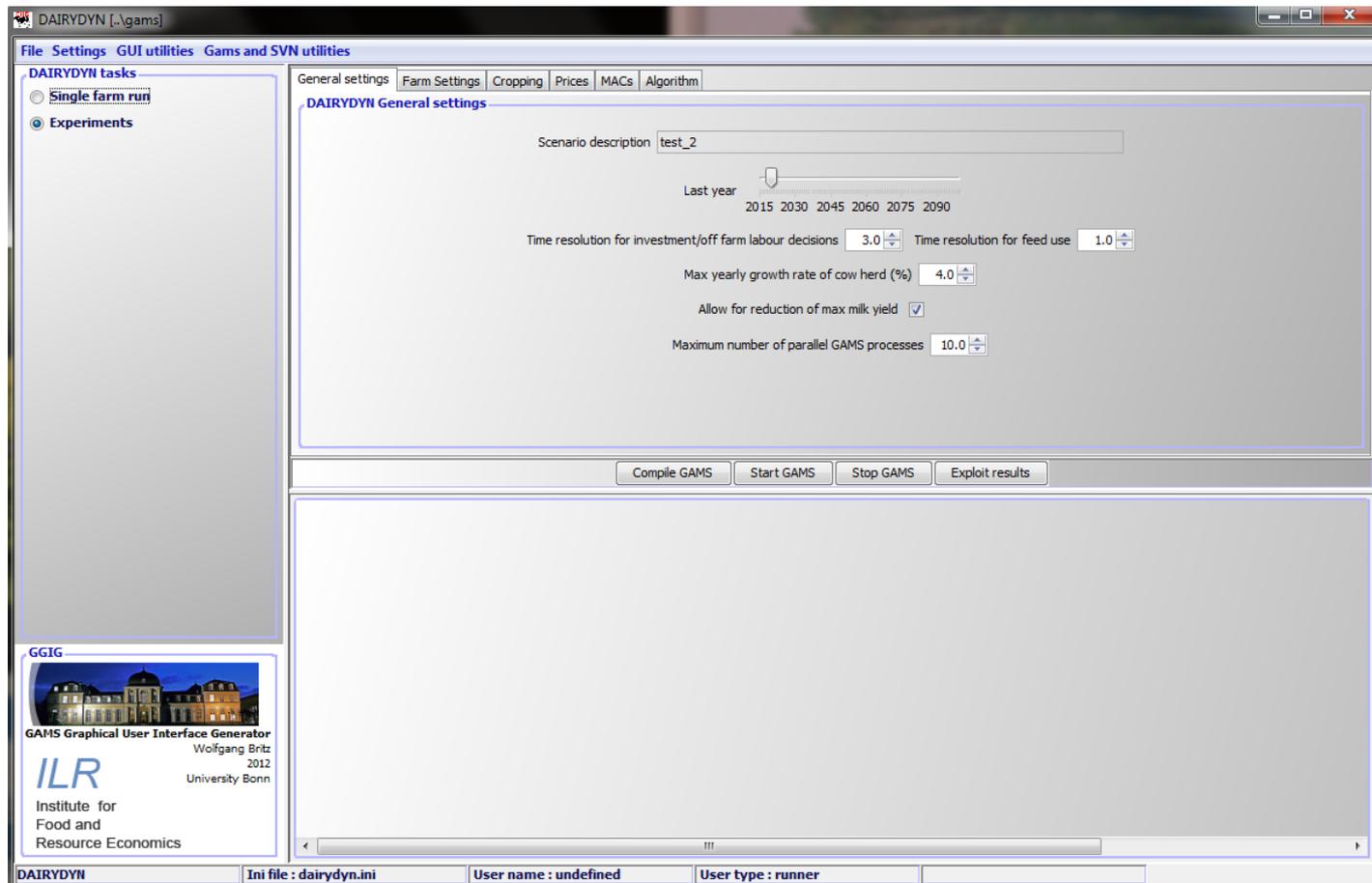
- Functionality of CAPRI GUI ported to other projects
 - distribute maintenance costs
 - existing utilities from CAPRI GUI become available: code documentation in HTML, exploitation tools, GDX Viewer, batch execution, equation and variable viewer ...
 - common touch & feel, especially important for the exploitation tools

Why GGIG

- Full functionality of CAPRI exploitation tools:
 - Based on **pre-defined views** stored in XML
 - **Tables**: pivot, select, show differences, statistics and outlier detection, hyperlinks to other tables, hide/show empty rows ...
 - **Maps**: different classification options, shapefile converter
 - **Graphs**: many types
 - In-built **machine-learning package**
 - Clipboard exports of tables, maps and graphs, e.g. to EXCEL or Word
 - Links to chapter in pdf-files possible
 -

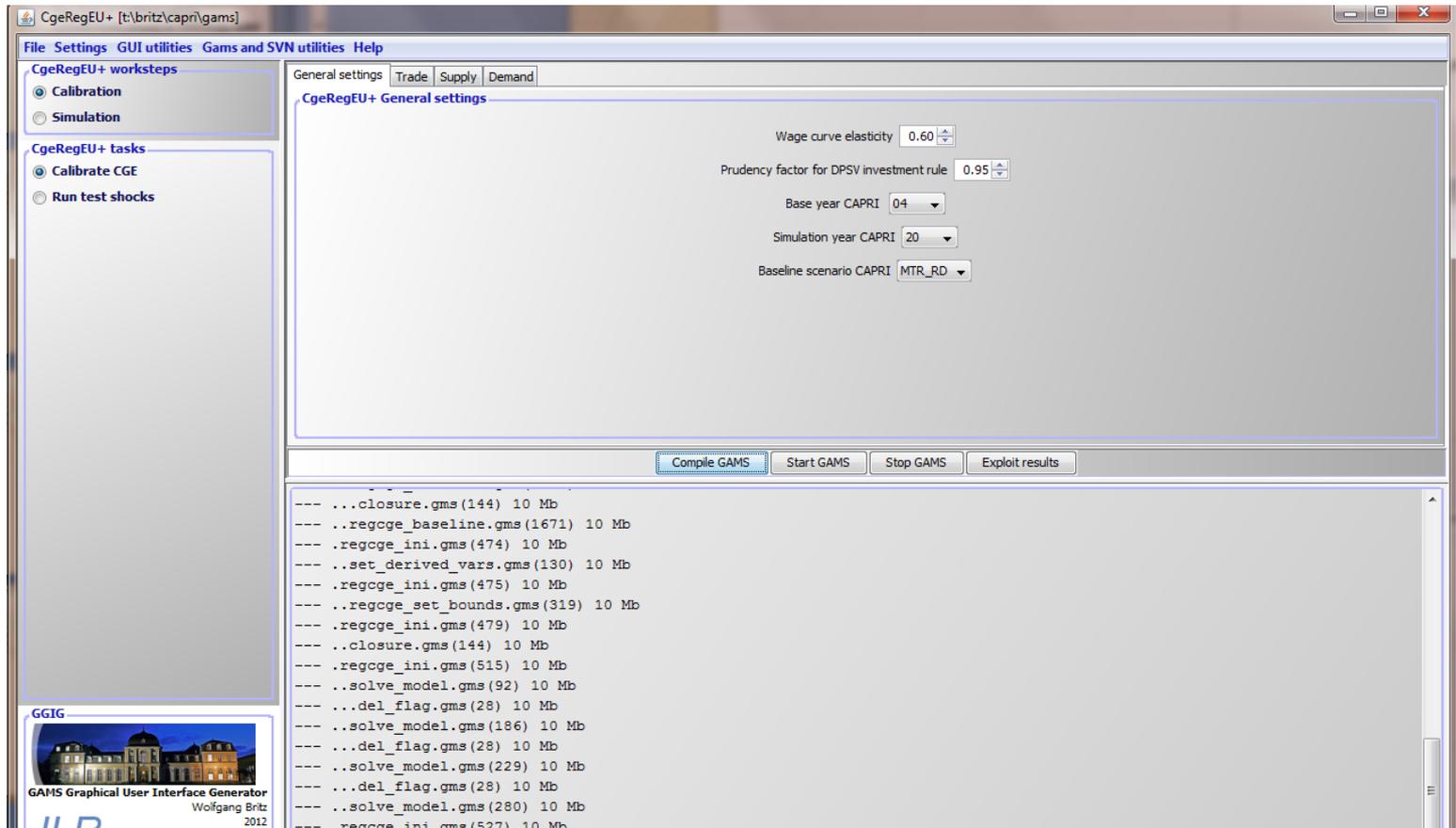
Where is GGIG currently used

- DairyDyn with Bernd Lengers



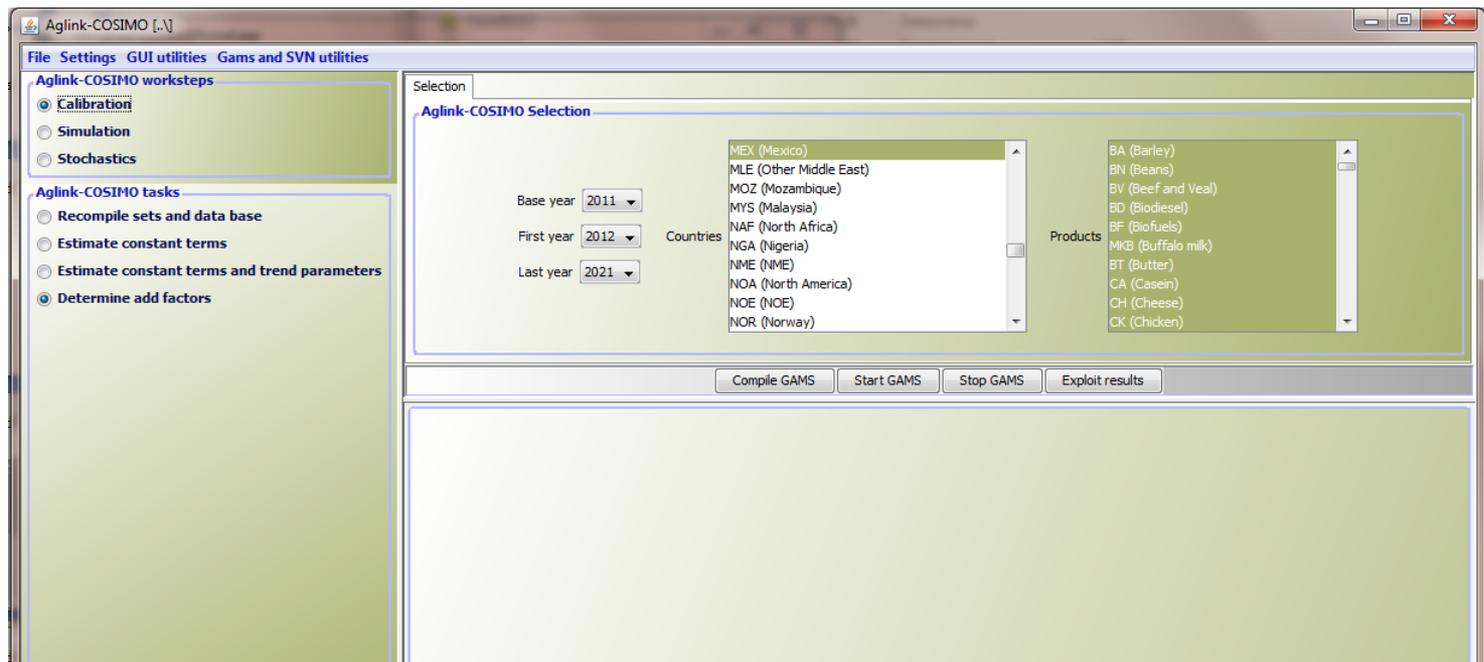
Where is GGIG currently used

- DairyDyn with Bernd Lengers
- RegCge stand-alone



Where is GGIG currently used

- DairyDyn with Bernd Lengers
- RegCge stand-alone
- AGLINK-COSIMO in GAMS stand-alone (future not clear, sensitive issue)



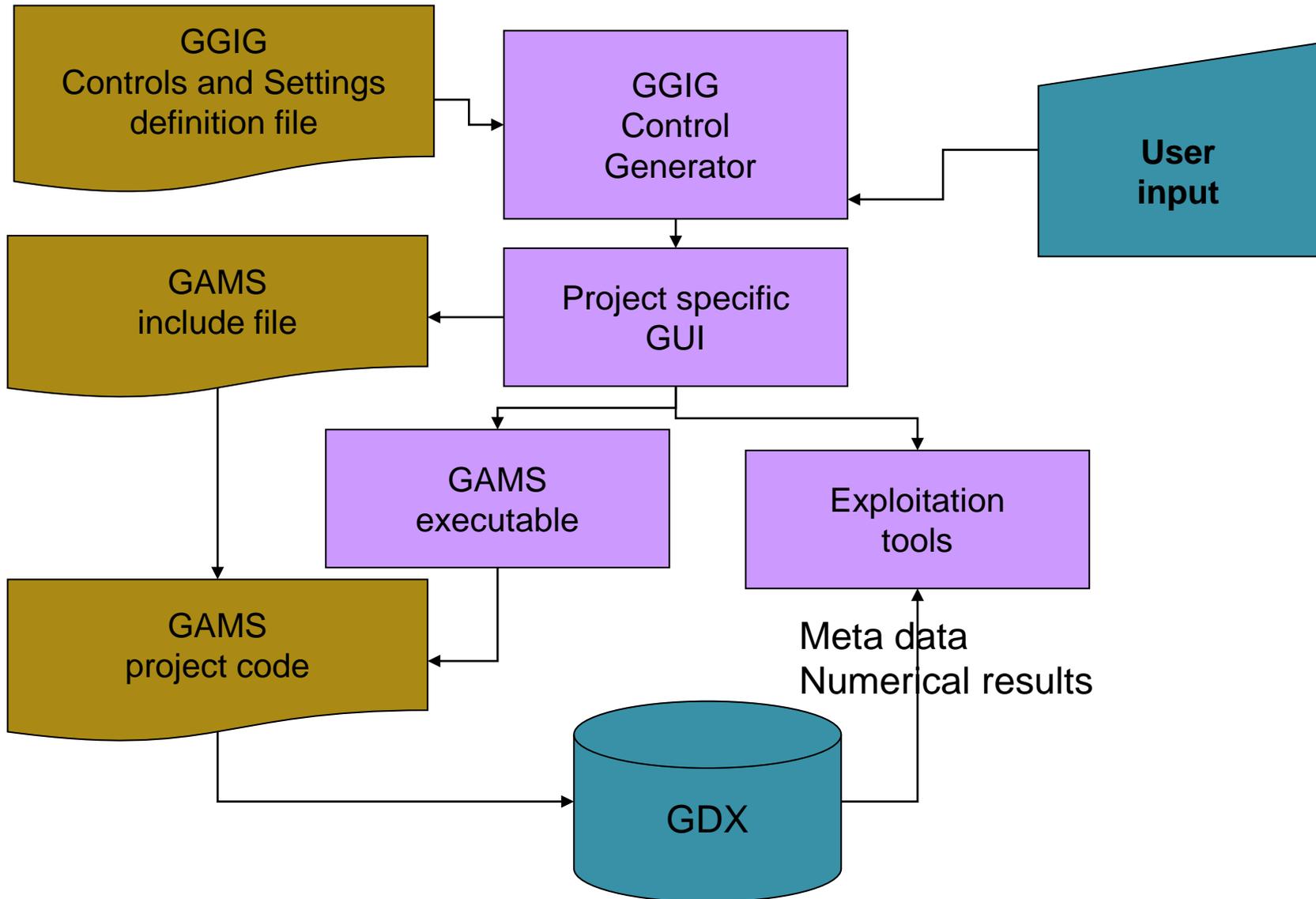
Where is GGIG currently used

- DairyDyn with Bernd Lengers
- RegCge stand-alone
- AGLINK-COSIMO in GAMS stand-alone (future not clear, sensitive issue)
- Latest CAPRI version, which includes the regional CGEs, spatial down-scaling to 1x1 km scales, farm types ...

GGIG further use

- GTAPinGAMS
- FADNTOOL user interface (extension to run R-scripts included)
- Spatial poultry model from NTM-Impact
- Recursive-dynamic model for markets of forestry products
- Sector model for Norway
- Agent Based Model for structural change (uses controls/exploitation part with odel running in Java)

Basic functioning of GGIG



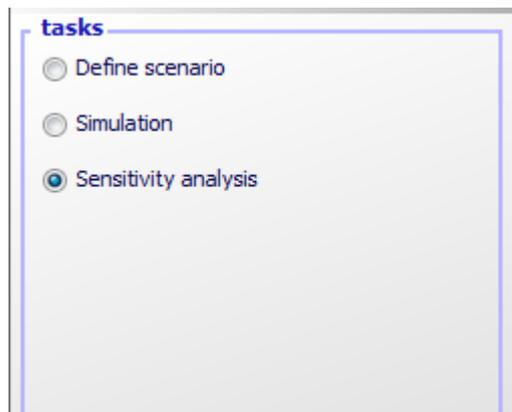
Basic concepts: Worksteps and tasks

- Work step: selection of task



```
<workstep>  
  <name>Data base compilation</name>  
  <pdflink>..\doc\GtapInGams with a GUI.pdf#Data base generation</pdflink>  
  <tasks>Convert FlexAGG to GDG  
          Convert GTAPAGG to GDG  
          Filter out small values  
          Split up products and sectors  
  </tasks>  
</workstep>
```

- Tasks



```
<task>  
  <name>Simulation</name>  
  <pdflink>..\doc\GtapInGams with a GUI.pdf#Running the scenario</pdflink>  
  <gamsFile>mrtmcp</gamsFile>  
  <incFile>model\mtrmcp_inc</incFile>  
  <curDir>model</curDir>  
  
  <regionDim>0</regionDim>  
  <dim5Dim>1,Items</dim5Dim>  
  <productDim>2</productDim>  
  <activityDim>3, Sectors and institutions</activityDim>  
  <dim6Dim>4,Origins</dim6Dim>  
  <dim7Dim>5,Version</dim7Dim>  
  <scenDim>6,Scenarios</scenDim>  
  
  <resdir>run</resdir>  
  <gdxSymbol>p_results</gdxSymbol>  
  <filemask>.*gdx$</filemask>  
</task>
```

Basic concepts: TASK

- **name** → `$$SETGLOBAL TASK Prepare national database`
`$$SETGLOBAL WORKSTEP Build database`
- **gamsfile**: the file called, e.g. capmod(.gms)
- **incFile**: the name of the include file
- **resdir**: where to search for results
- **filemask**: regex to find file in resdir
- **gdxSymbol**: name of symbol with results
- **regionDim ...**: position of logical dimensions in gdxSymbol
- **filters**: control e.g. to select regions, years when exploiting scenarios
- **userLevels**: to hide tasks

Basic concepts: controls

- **type**: checkbox, slider, table, singlelist, multilist ..
- **title**: description seen by user
- **options**: what the user can chose
- **gamsname**: \$setglobal gamsname ...
- **tasks**: which tasks use the controls
- **disable**: if true, control is blocked
- **userLevls**: to hide tasks
- some more special settings such as selection groups, tooltips, pdf links, dependencies with other controls, style options ...

Example: introduce a check box

Ini file

```
<control>  
  <Type>checkBox</Type>  
  <Title>Allow for endogenous reduction of max milk yield</Title>  
  <Value>true</Value>  
  <gamsName>mlkRed</gamsName>  
  <tasks>Single farm run, Calculate MACs,Experiments dairy</tasks>  
  <dependsOn>Farm branches:Dairy</dependsOn>  
</control>
```

Interface



Name of global
from ini file

Setting from
interface based on user input

GAMS

```
!$SETGLOBAL mlkRed true
```

All settings stored as textual information in s_META set

```
SET s_META /
```

```
'Allow for reduction of max milk yield' 'true'
```

Further functionalities

- SVN support

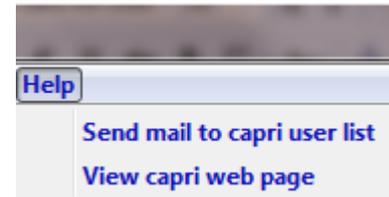
A screenshot of the "Option" dialog box in a software application. The dialog has a title bar with a minimize, maximize, and close button. Below the title bar, there are five tabs: "User Settings", "CAPRI System Settings", "GAMS", "SVN", and "Other options". The "SVN" tab is selected. The dialog contains several input fields:

- "SVN user id": A text field with 10 dots, indicating a masked password.
- "SVN password": A text field with 6 dots, indicating a masked password.
- "SVN URL for Gams": A text field containing the URL "https://svn1.agp.uni-bonn.de/svn/capri/trunk/gams".
- "SVN URL for results": A text field containing the URL "https://svn1.agp.uni-bonn.de/svn/capri/trunk/results/regcge".
- "SVN URL for restart": An empty text field.
- "SVN URL for data": An empty text field.

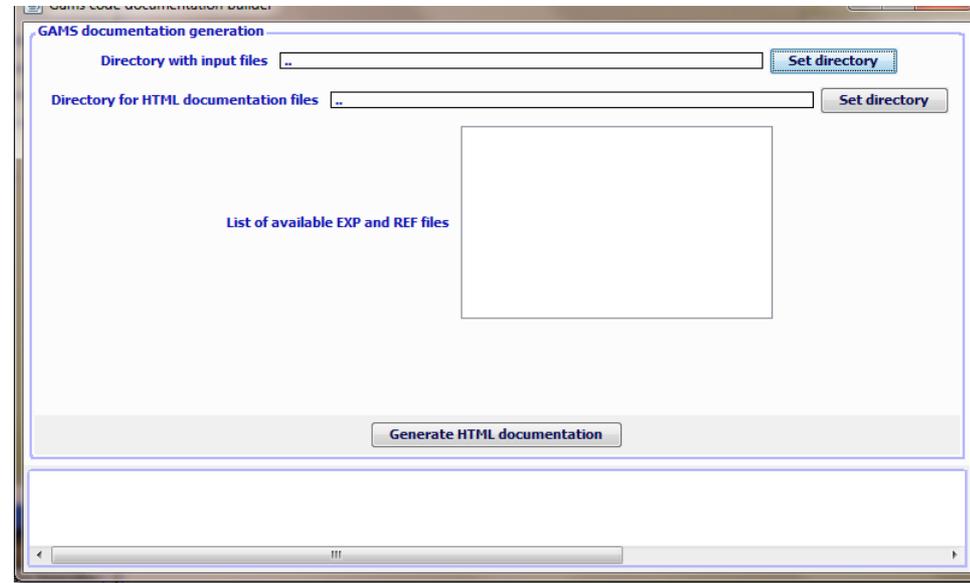
At the bottom of the dialog, there is a button labeled "Save in caprinew.ini".

Further functionalities

- Editable menu items to send e-mail and open web pages



- Utility to build documentation of GAMS code in HTML



Further functionalities

- Batch execution

Batch execution

Batch file to execute

Directory for exp/ref files

Generate EXP and REF files for HTML documentation Only compile the GAMS programs

Further functionalities

- Build scenario file from code snippets

The screenshot displays the CAPRI software interface. On the left, a sidebar contains 'CAPRI worksteps' (Build database, Generate baseline, Run scenario) and 'CAPRI tasks' (Define scenario, Run scenario with market model, Run scenario without market model, Downscale scenario results). Below this is a logo for 'GGIG - GAMS Graphical User Interface Generator' from the University of Bonn. The main window is titled 'Scenario description' and includes a text box for 'Enter scenario name' and a larger text box for 'Enter scenario description'. Below that is the 'Scenario elements' section, which features a tree view of 'Scenario categories' (base scenarios, bio fuels, demand shocks, etc.) and a text area for 'Define basis scenario file' containing the path 't:\britz\capri\gams\scen\base_scenarios\mtr_rd.gms'. The bottom right of the main window shows a GAMS code snippet with highlighted sections: 'Sontext' (yellow), 'Sofftext' (yellow), and a data definition line: 'DATA(RMS, "UVAD", fuel_rows, "PercentageChange") \$ (NOT sameas(fuel_rows, "CRDO")) = 50;'. A 'Store scenario' button is located at the bottom center. The status bar at the very bottom shows 'CAPRI', 'Ini file : caprinew.ini', 'User name : undefined', and 'User type : runner'.

Further functionalities

- Filters for scenario selections resp. in GDX cube

The screenshot shows a software interface titled "Result exploitation for Run scenario without market model". It features several selection controls:

- Country selection:** A list box containing the following countries: BL "Belgium and Luxembourg", DK "Denmark", DE "Germany", EL "Greece", ES "Spain", FR "France", IR "Ireland", IT "Italy", NL "The Netherlands", and AT "Austria".
- Bas year selection:** A text input field containing the value "08".
- Simulation year selection:** A list box containing the years 20, 21, 22, 23, 24, 25, 26, 27, 28, and 29.
- Scenario selection:** A list box with five scenarios:
 - Scenario 1
 - Scenario 2: RES_0_0420EU_CH_FREETRADE
 - Scenario 3: RES_0_0420MTR_RD
 - Scenario 4: RES_0_0420TEST
 - Scenario 5: RES_0_0420TSTCAL

At the bottom of the interface, there are two buttons: "Show meta" and "Show results".

Exploitation tools

- A relatively simple report generator for on-line views based on XML
- Support pivots, sorting, adding statistics, manual selection, relative/absolute differences to user chosen items ...
- Larger sets of graph type (bar / line / pie charts, histograms, scatter plots ...)
- Colored maps, flow maps
- Link to Machine Learning Package
- Export to clipboard and various file formats (GAMS, CSV, XLS, DBF ...)

Exploitation tools, tables

Model properties [0]

Version

View type
Table

NOSHOCK USER_SCENARIOS_GFT

# of sectors	11.00	11.00
# of factors	5.00	
# of regions	10.00	
Model type	CNS	
# of equations	13332.00	
# of variables	13332.00	
# Iterations	4.00	
# seconds solution time	0.20	
Lab Market	sluggish	
skl Market	sluggish	
capital Market	sluggish	
res Market	sluggish	
Ind Market	sluggish	

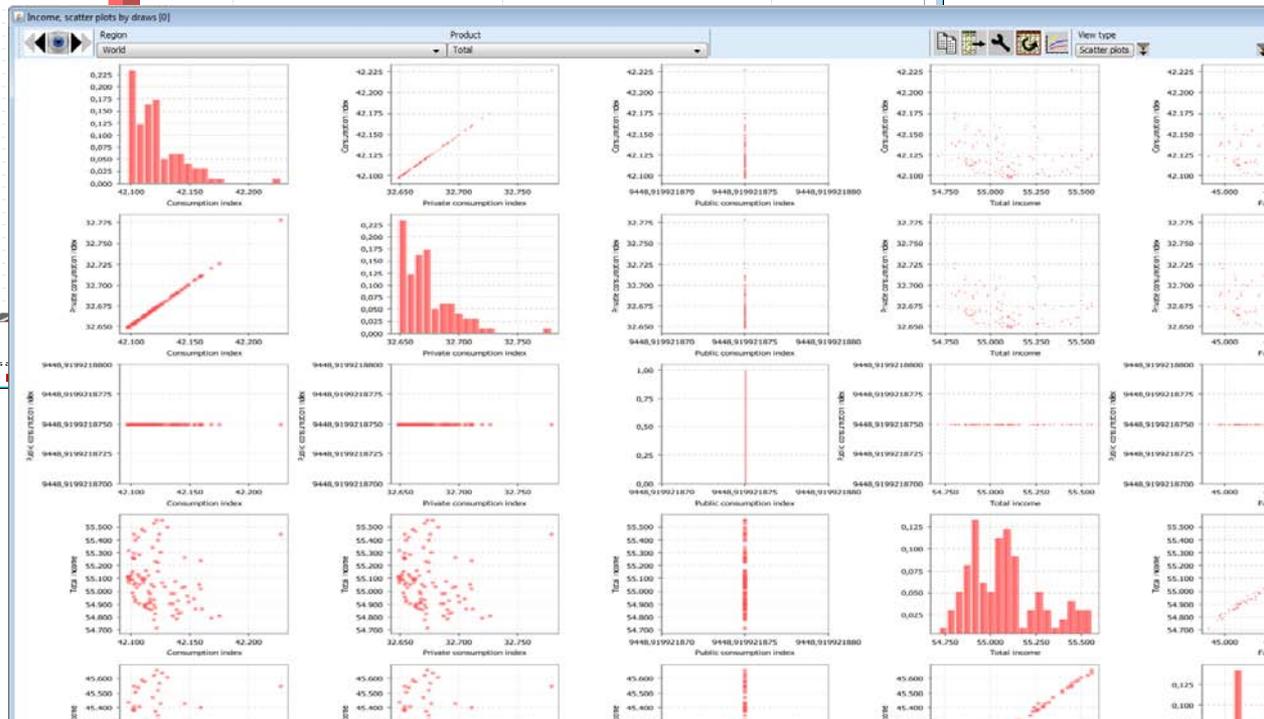
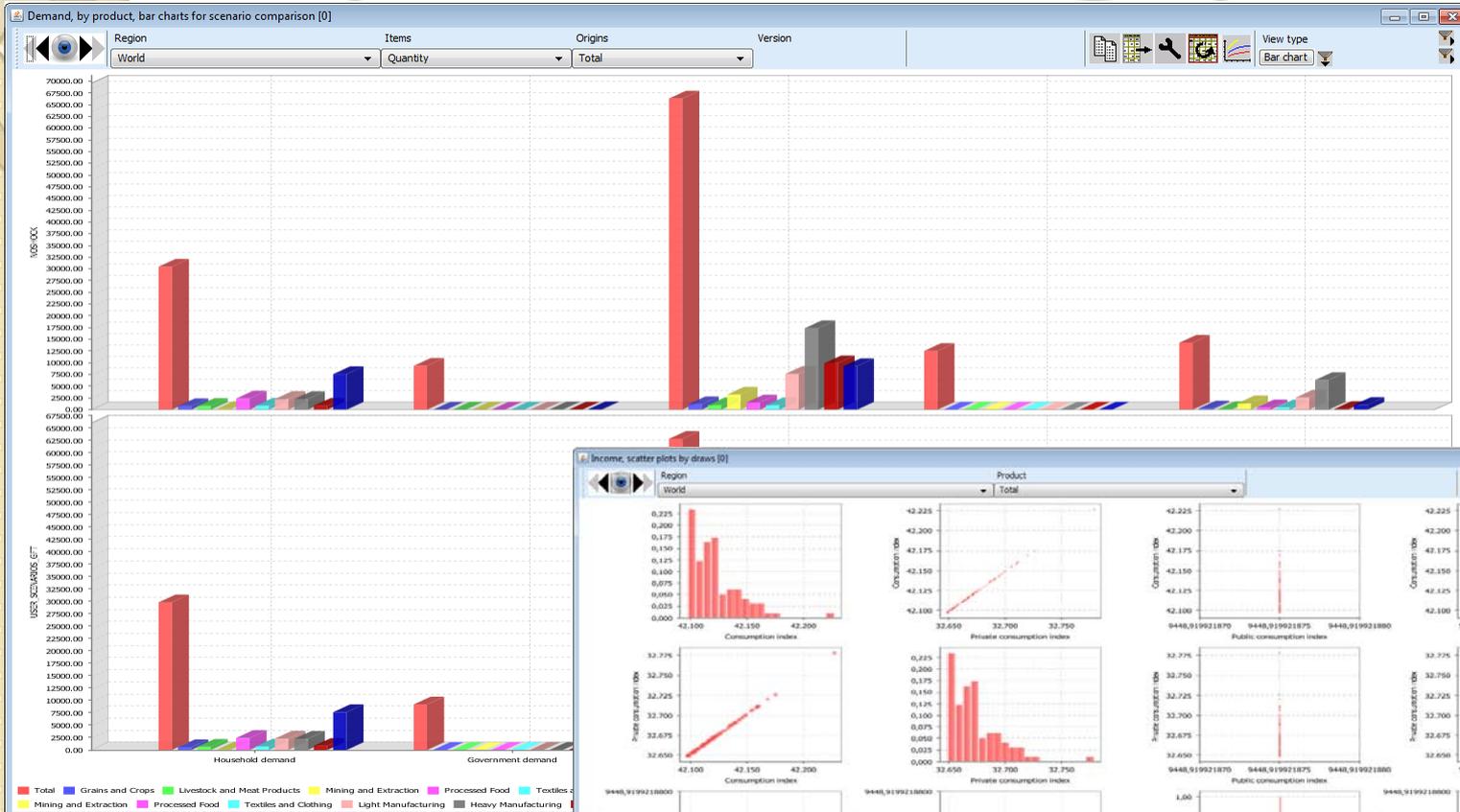
Sector overview [0]

Region: World Items: Quantity

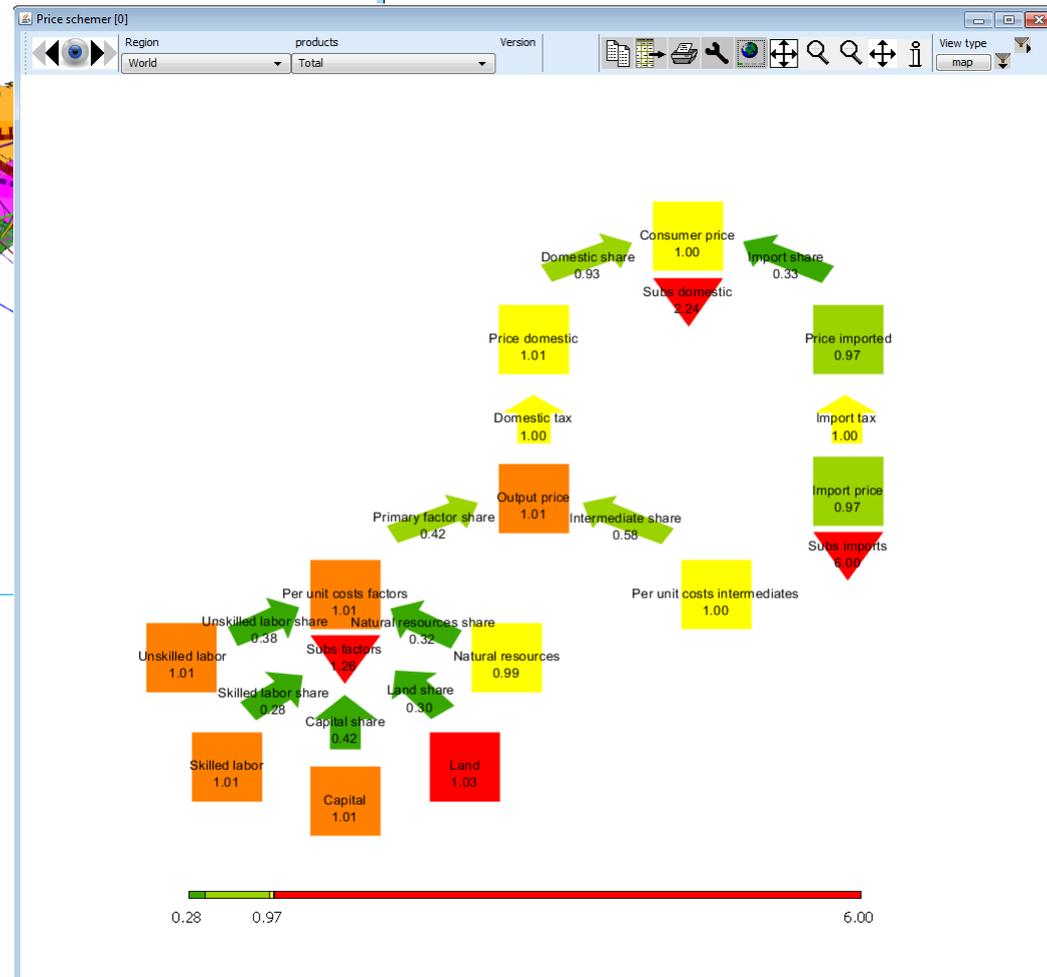
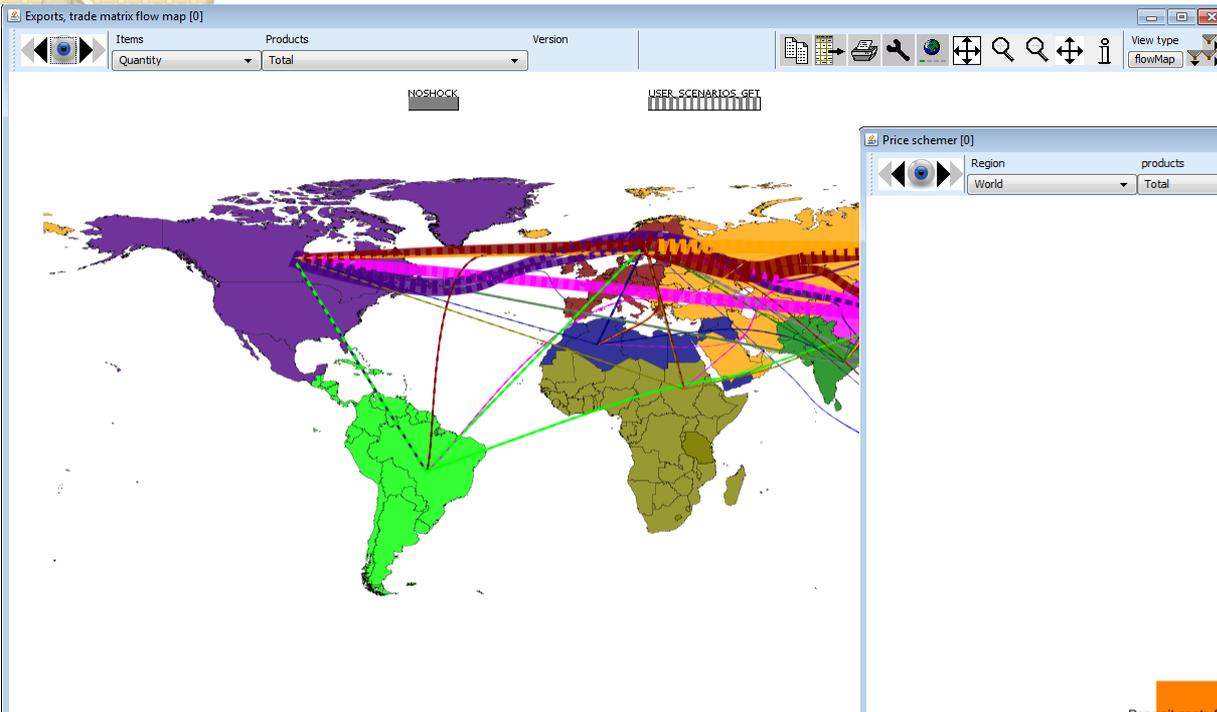
USER_SCENARIOS_GFT

Total	Grains and Crops	Livestock and Meat Products	Mining and Extraction	
Total output	116626.70	1305.26	1330.99	2822.
	-3.64%	-32.51%	-26.61%	-13.9
Output taxes	1986.06	-15.80	10.33	80.
	-3.30%	10.18%	-18.78%	-16.2
Total intermediate	64336.36	485.09	825.64	839.
	-5.27%	-37.19%	-28.47%	-20.6
Total intermediate	836.61	-45.41	-6.95	6.
	-0.32%	12.78%	44.91%	-32.9
Total factor taxes	4854.85	-125.01	-5.53	57.
	0.82%	7.77%	-2546.88%	-20.6
Total factor demand	44671.32	996.98	507.82	1839.
	-1.64%	-27.06%	-22.99%	-10.1
Total intermediate	64336.36	485.09	825.64	839.
	-5.27%	-37.19%	-28.47%	-20.6
Grains and Crops	747.09	179.96	99.28	
	-37.27%	-14.05%	-41.49%	
Livestock and Meat Products	668.74	16.50	393.12	
	-33.07%	-21.77%	-13.93%	
Mining and Extraction	2968.29			99.
	-10.31%			-19.2
Processed Food	1273.83	2.21	147.44	7.
	-19.41%	-78.17%	-25.17%	-55.1
Textiles and Clothing	641.68			
	-35.13%			
Light Manufacturing	7675.46		7.04	30.
	-1.72%		-71.65%	-52.1
Heavy	17305.07	142.20	33.33	260.

Exploitation tools, graphs



Exploitation tools, maps and schemers



Summary of GGIG

- Relatively easy to use tool to build an interface on a GAMS/R based model
- Powerful exploitation possibilities
- Benefits from 15 years developments for CAPRI