



STAGE_t Model: Overview



Single Country CGE, 2024 © cgemod 1

1



Outline

- Basic principles
- Processes
 - Data assembly and model adjustments
 - Data – a SAM (plus satellite accounts)
 - Model – standard `stg_t.gms`
 - ‘Backstory’ and policy scenarios
 - Implementing policy simulations
 - Analyse results
- Model Structure
- Notation
- SETGLOBAL



Single Country CGE, 2024 © cgemod 2

2

cgemod

STAGE

Basic Principles

- A standard model – `stg_t` – adapt as needed
- Model and Data are separable
- Data
 - SAM based
 - Satellite accounts – factor quantities, emissions, etc.,
- Modular
 - Group actions in discrete modules
 - Data entry
 - Parameter calibration
 - Variable initialisation
 - Equation declaration and assignment
 - Closure
- Separation of core model and simulations

Single Country CGE, 2024

© cgemod

3

3

cgemod

STAGE

Model Database

Single Country CGE, 2024

© cgemod

4

4

STAGE 1 SAM											
	Com'dities	Margins	Activities	Factors	I/Hold	Ent'prises	Taxes	Govt	Invest	RoW	Total
Commodities		Domestic Margins	Int'diate Inputs		Private demand			Govt Demand	Invest demand	Exports (fob)	Total Demand
Margins	Domestic Margins										Total Margins
Activities	Supply										Total Supply
Factors			Factor payments							Factor Incomes Abroad	Factor Incomes
Private I/Hold				Factor incomes		Dividend incomes		Transfers		Remittances	Household incomes
Enterprises				Factor incomes				Transfers		Dividend incomes	Enterprise Incomes
Taxes	Product taxes		Activity Taxes	Factor taxes	Income Taxes	Corporation Taxes					Tax Revenues
Govt							Tax revenue			Transfers	Government Incomes
Savings				Dep'tion	Savings	Savings		Savings		Current Acc balance	Total Savings
RoW	Imports (cif)			Factor Payments Abroad	Remittances	Dividend incomes		Transfers			Total Foreign Expenditure
Total	Total Supply	Total Margins	Total Output	Factor Payments	Household Expenditures	Enterprise Expenditures	Total Taxes	Govt Exp'tures	Total Investment	Total Foreign Income	

5

CGEMOD

STAGE_t RSA SAM

STAGE

The screenshot displays the STAGE_t RSA SAM software interface. It features a large data table with multiple columns and rows, organized into several color-coded sections: Yellow (intermediates and production), Orange (margin supply and demand), Purple (final demand), Green (exports and imports), Blue (tax instruments), Mauve (Value added & savings), Tan (Distribution of factor incomes), and Brown (transfers). The table includes various economic indicators such as GDP, consumption, investment, and savings, with values presented in scientific notation. The interface also includes a top menu bar and a bottom status bar.

YELLOW – intermediates & production

ORANGE – margin supply & demand

PURPLE – final demand

GREEN – exports and imports

BLUE – tax instruments

MAUVE – Value added & savings

TAN – Distribution of factor incomes

BROWN – transfers

Single Country CGE, 2024

© cgemod

6

cgemod

STAGE

Model Overview

Single Country CGE, 2024

© cgemod

7

7

cgemod

STAGE

Price System

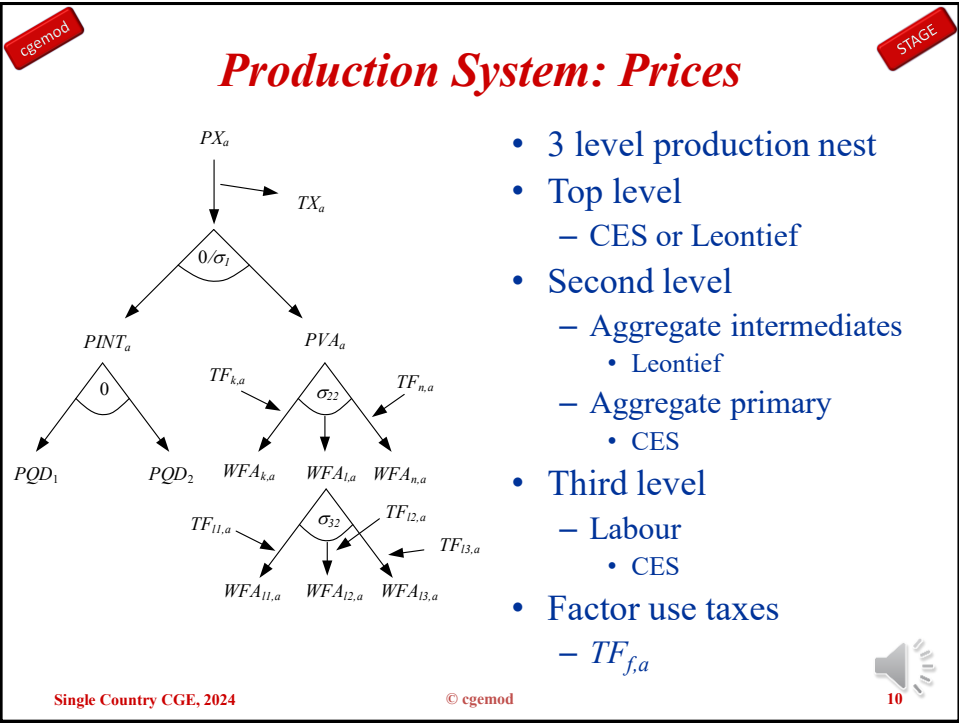
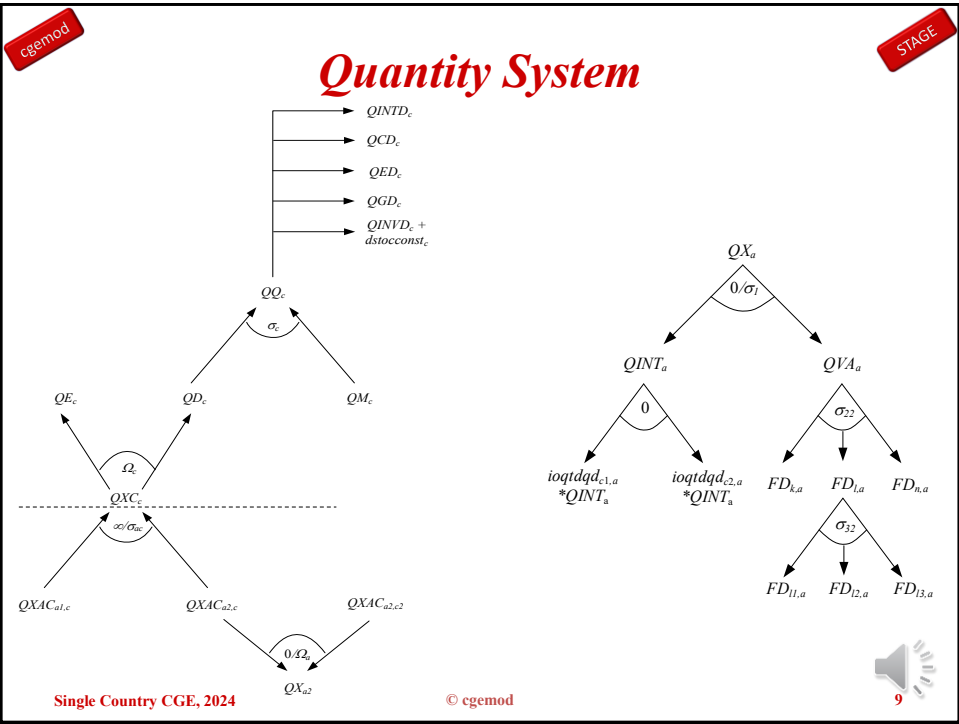
- Prices normalised on BASIC prices
 - PE, PD, PM (PXC, PQS)
- Multiple commodity taxes
 - TV, TEX, TS, TSS, TE, TM
- Domestic Trade and Transport margins
 - $ioqttqq$
- Multi product activities
 - $PXAC$
- Substitution at top level of production nest
 - $PINT, PVA$

Single Country CGE, 2024

© cgemod

8

8



cgemod

STAGE

Processes

Single Country CGE, 2024

© cgemod

11

11

cgemod

STAGE

Processes

Create Database

Generate Aggregation

Set up STAGE version

Adjust STAGE version

Verify STAGE version

Run Experiments

Check Shocks

Generate Results

Analyse Results

Generate Experiment Data

Code Experiment File

Determine 'Closures'

Set up Data Definitions

Source: SAM Database

SAM aggregator

stg_t_data_*.xlsx; (sam_*.gdx?)

stg_t.gms

CHECK model status

Assemble data for policy shocks

code policy shocks

stg_t_cl_**.inc

DISPLAY and GDX output

stg_t_DataDef_**.xls

GDX Viewer and PivotTables/Charts

Single Country CGE, 2024

© cgemod

12

12

cgemod

STAGE

Data Assembly and Model Verification

Single Country CGE, 2024

© cgemod

13

13

cgemod

STAGE

Data assembly & Model adjustments

Create Database

Generate Aggregation

Set up STAGE version

Adjust STAGE version

Verify STAGE version

Source: SAM Database

SAM aggregator

stg_t_data_*.xlsx; (sam_*.gdx?)

stg_t.gms

CHECK model status

1. SAM

2. SAMgator

3. stg_t_data.xlsx

4. stg_t

5. Exercise

Single Country CGE, 2024

© cgemod

14

14



cgemod

STAGE

Exogenous Data

- Elasticities
 - Armington (imports)
 - CET (exports)
 - CES (commodity supply)
 - Production
 - Top level (QVA/QINT)
 - Second level (Aggregate value added)
 - Third level (Aggregate factors)
 - CES/CET/Leontief multi-product activities
 - Consumption
 - Income elasticities of demand
 - Frisch parameter

Single Country CGE, 2024
© cgemod



15

15

cgemod

STAGE

Satellite Accounts

- Factor quantities
 - Labour (persons/hours/??)
 - Land (hectares/acres/??)
- *Energy use data*
 - *Volumes (mtoe)*
- *Emissions*
 - *CO₂, N₂O, CH₄, F-gases*
- Population
 - Households
 - Number of persons (simple vv adult equivalents)
- *Land Use*
 - *GHG emissions*
- *Biofuels*
 - *Ethanol, etc*

Single Country CGE, 2024
© cgemod



16

16

Model Structure

Single Country CGE, 2024

© cgemod

17

17

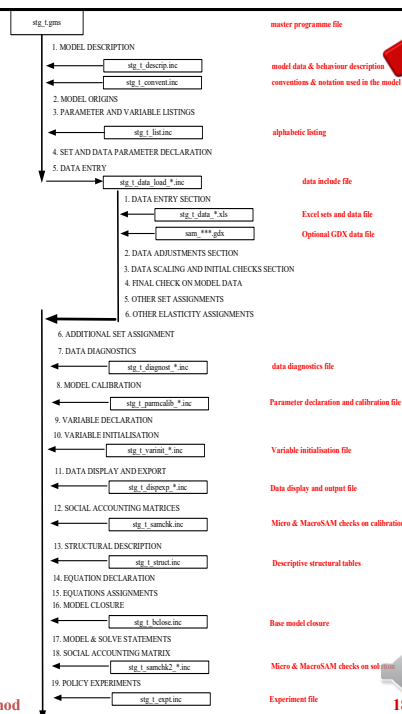
Model – Code Structure

- Documented
- Number of ‘include’ files
 - Reference file
 - \$SETGLOBAL
 - String substitution
 - mod_cont
 - Parameters to select features
- Concentration of data input
 - An Excel workbook
 - A GDX file
- Extensive model verification
 - Aborts, with error messages, if tests fail

Single Country CGE, 2024

© cgemod

18



18

cgemod

STAGE

Model Code – Data Entry

The flowchart illustrates the data entry process for the model. It starts with '5. DATA ENTRY' which points to the file 'stg_t_data_load_*.inc' (data include file). This leads to a list of sections: 1. DATA ENTRY SECTION (receiving 'stg_t_data_*.xls' (Excel sets and data file) and 'sam_***.gdx' (Optional GDx data file)), 2. DATA ADJUSTMENTS SECTION, 3. DATA SCALING AND INITIAL CHECKS SECTION, 4. FINAL CHECK ON MODEL DATA, 5. OTHER SET ASSIGNMENTS, and 6. OTHER ELASTICITY ASSIGNMENTS. The process then moves to '6. ADDITIONAL SET ASSIGNMENT', '7. DATA DIAGNOSTICS' (receiving 'stg_t_diagnost_*.inc' (data diagnostics file)), and finally '8. MODEL CALIBRATION'.

- Model data entry in one module (`stg_t_data_load_*.inc`)
- Data testing and automatic aborts
 - On entry (`stg_t_diagnost_*.inc`)
 - At calibration stage (`stg_t_samchk.inc`)
 - At replication stage (`stg_t_samchk.inc`)

Single Country CGE, 2024 © cgemod

19

19

cgemod

STAGE

Model Code – Parameters & Variables

The flowchart shows the parameter and variable initialization process. It begins with '8. MODEL CALIBRATION' (receiving 'stg_t_parmcalib_*.inc' (Parameter declaration and calibration file)), followed by '9. VARIABLE DECLARATION' and '10. VARIABLE INITIALISATION' (receiving 'stg_t_varinit_*.inc' (Variable initialisation file)). Then it goes to '11. DATA DISPLAY AND EXPORT' (receiving 'stg_t_dispexp_*.inc' (Data display and output file)), '12. SOCIAL ACCOUNTING MATRICES' (receiving 'stg_t_samchk.inc' (Micro & MacroSAM checks on calibration)), and finally '13. STRUCTURAL DESCRIPTION' (receiving 'stg_t_struct.inc' (Descriptive structural tables)).

- All parameters calibrated in one module (`stg_t_parmcalib.inc`)
- All variables initialised in one module (`stg_t_varinit.inc`)
- Check calibrated parameters and initialised variables are consistent with the data (`stg_t_disexp.inc` ; `stg_t_samchk.inc`)
- Produce structural tables that describe initial state (`stg_t_struct.inc`)

Single Country CGE, 2024 © cgemod

20

20

cgemod

STAGE

Model Code – Equations & Replication

Core of the Model

14. EQUATION DECLARATION

15. EQUATIONS ASSIGNMENTS

16. MODEL CLOSURE

17. MODEL & SOLVE STATEMENTS

18. SOCIAL ACCOUNTING MATRIX

19. POLICY EXPERIMENTS

stg_t_bclose.inc

stg_t_samchk2_*.inc

stg_t_expt.inc

Base model closure

Micro & MacroSAM checks on solution

Experiment file

- Equations/Behavioural relationships
 - Declaration
 - Assignment
- Impose base closure (stg_t_cl_base.inc)
- Check replicated solution is consistent with the data (stg_t_samchk.inc)
- Implement policy experiments (stg_t_expt.inc)

Single Country CGE, 2024

© cgemod

21

21

cgemod

STAGE

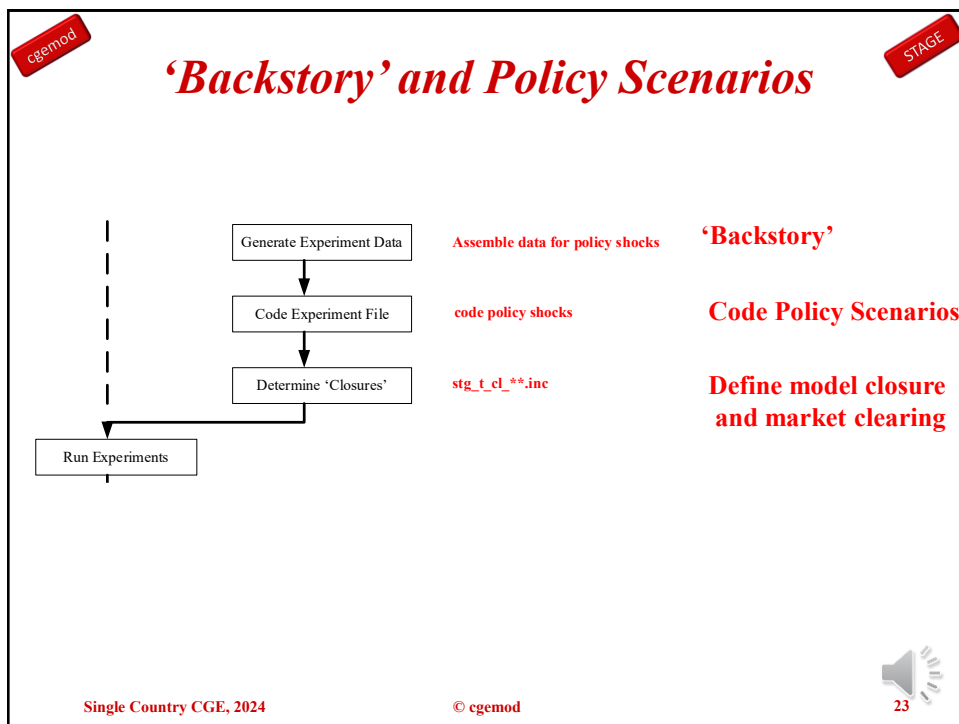
‘Backstory’ and Policy Scenarios

Single Country CGE, 2024

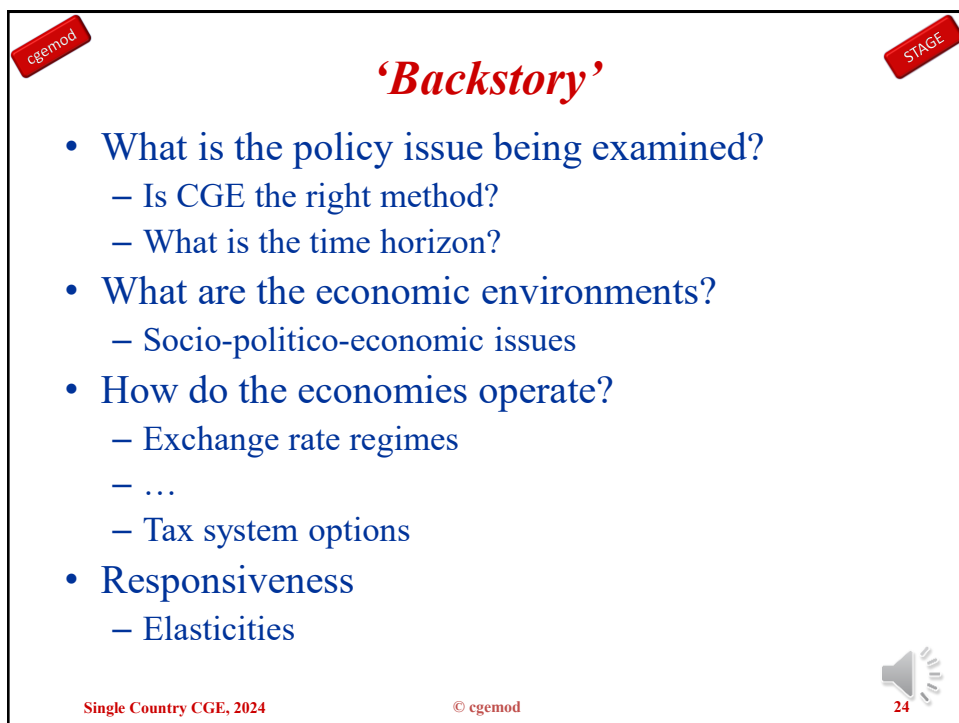
© cgemod

22

22



23



24

cgemod

STAGE

The Model

Do model and/or data need changing?

Behavioural issues: change the model

Data issues: change the database

It is (arguably) bad practice to change the data to fit the model

Single Country CGE, 2024

© cgemod

25

25

cgemod

STAGE

SAM Approach

```
graph TD; SD((SAM Database)) --> SMF((SAM Model Framework)); SMF --> MF((Model Formulation)); SMF --> SMD((SAM Model Database)); MF --> MC((Model Calibration)); SMD --> MC; CR((Closure Rules)) --> MC; PE((Parameter Estimation)) --> MC; MC --> MA((Model Analysis));
```

Single Country CGE, 2024

© cgemod

26

26



Policy Scenarios

- How should the policy issue be simulated?
 - Regime changes
 - Unilateral vv bilateral changes
 - Partial vv total changes
 - Simulation and reality are not necessarily identical
- How should the model be configured?
 - Macroeconomic closure
 - Sensitivity testing
 - Market clearing



Single Country CGE, 2024 © cgemod 27

27

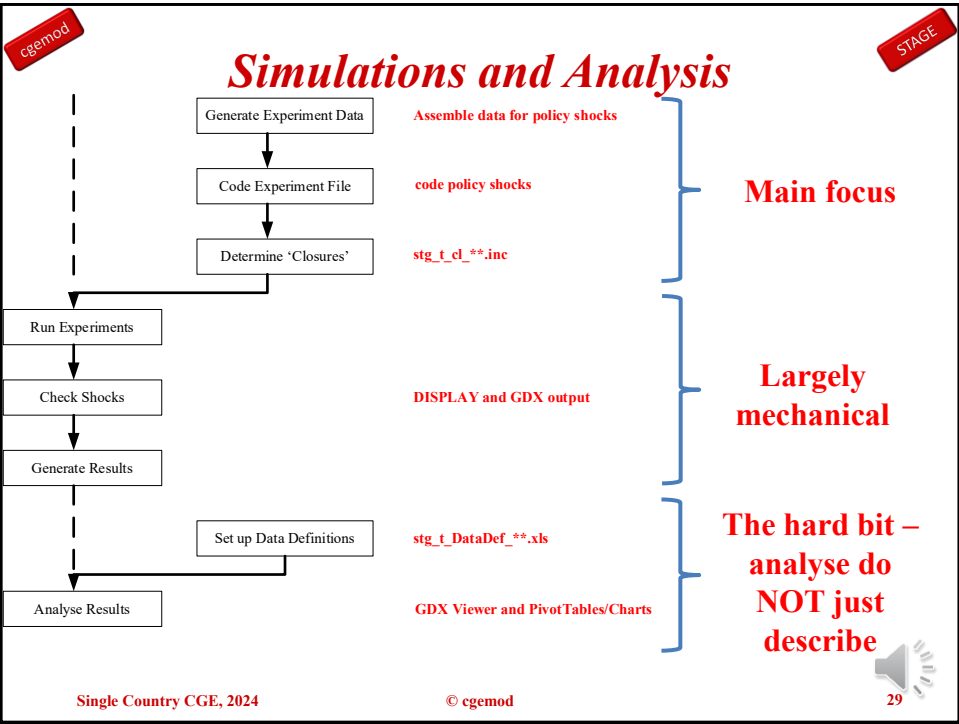


Simulation and Analyses

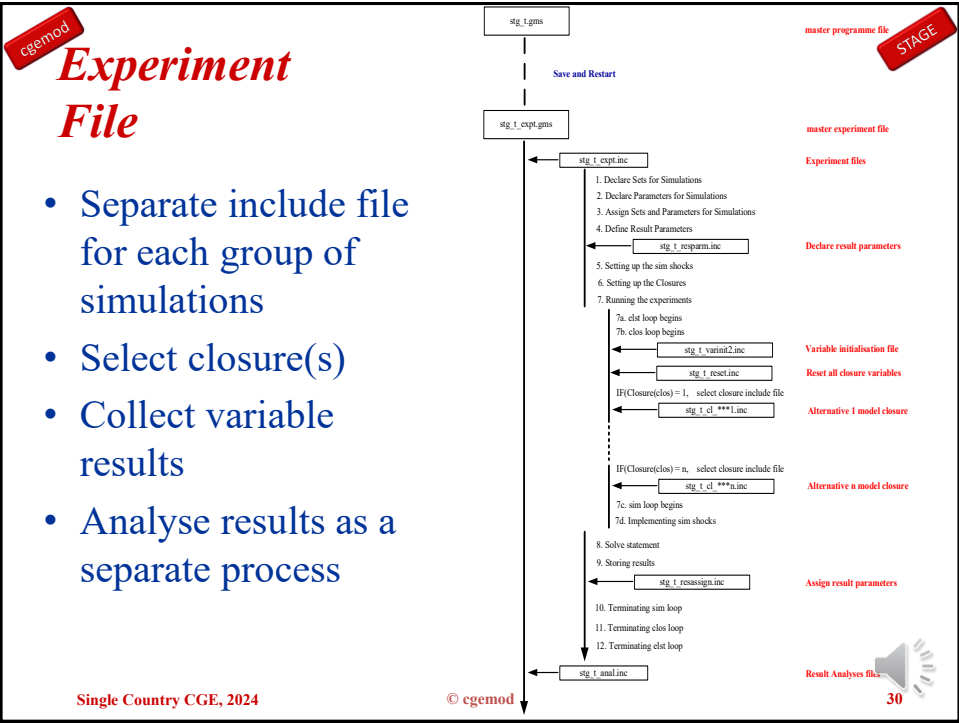


Single Country CGE, 2024 © cgemod 28

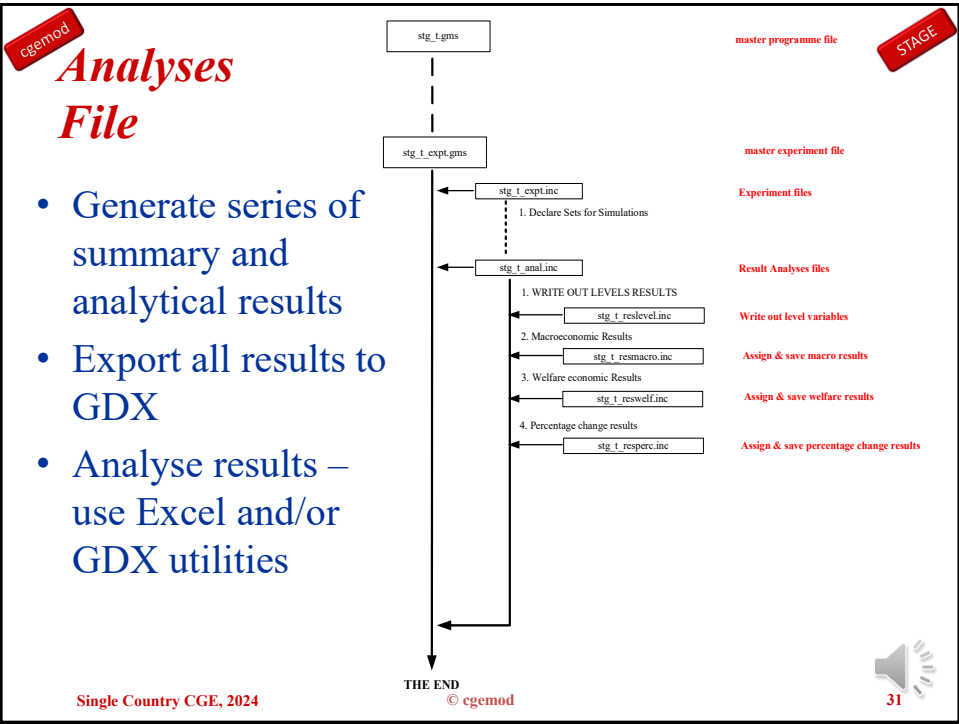
28



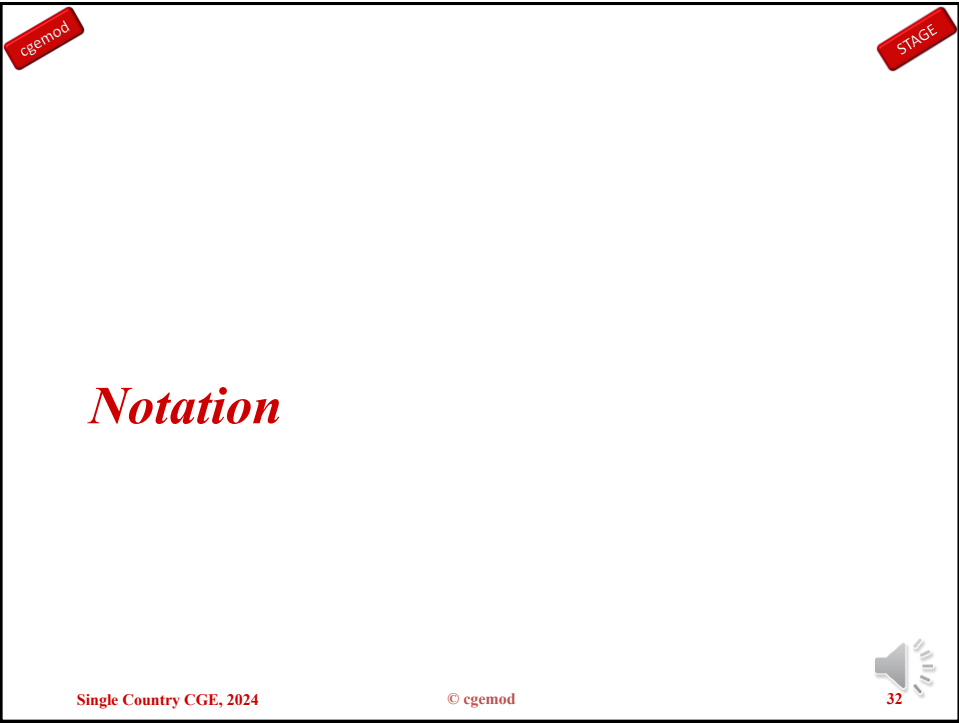
29



30



31



32

cgemod

STAGE

Notation

Accounts – first character used to identify grouping by major SAM accounts

Prefixes used: *c* – commodities

m – margins

a – activities

ff – factors

h – households

*t** – taxes

Single Country CGE, 2024

© cgemod

33

33

cgemod

STAGE

\$SETGLOBAL

Single Country CGE, 2024

© cgemod

34

34

cgemod

STAGE

Using \$SETGLOBAL

SETGLOBAL is a \$ command that, at **compile time**, allows string substitution. The syntax is

```
$SETGLOBAL    VARNAME    text
```

Use %VARNAME% which at compilation time is replaced by text,

Advantages

- Allows data file selection
- Allows INCLUDE file selection
 - Calibration
 - Experiments
- Can reduce the number of independent INCLUDE files
-

Disadvantages

- The code may not be as easily read
- Finding files can be more difficult
-

Single Country CGE, 2024

© cgemod

35

35

cgemod

STAGE

\$SETGLOBAL: Example 1

```
#### 2. GLOBAL VARIABLES THAT CONTROL FOLDERS AND FILES ####

*~~~~~ Set Comparative static data file name

$SETGLOBAL mod_data    stg_t_data_sam

Use - stg_t_data_load.inc

$CALL "GDXXRW i=1_1_Model_data/%mod_data%.xlsx
      o=1_1_Model_data/data_in.gdx index=Layout!A4 trace=3"

##### 19. POLICY EXPERIMENTS #####

* Set dimensions for the results analysis files

*$SETGLOBAL res_dimen    clos,simc

Use - stg_t_resparm.inc

resSCAL(scalres,%res_dimen%) table of scalar results
resPWE(c,%res_dimen%)       World price of exports in dollars
```

Single Country CGE, 2024

© cgemod

36

36

cgemod

STAGE

SETGLOBAL: Example 2

SAM CHECKS after Variable Initialisation

```

$SETGLOBAL ASAM_chk ASAM1
$SETGLOBAL SAM_chk SAM1
numerchk_samchk = 1.0 ;

$INCLUDE stg_t_samchk.inc

$DROPGLOBAL ASAM_chk
$DROPGLOBAL SAM_chk

```

SAM CHECKS after Solve

```

$SETGLOBAL ASAM_chk ASAM2
$SETGLOBAL SAM_chk SAM2
numerchk_samchk = numerchk ;

$INCLUDE stg_t_samchk.inc

$DROPGLOBAL ASAM_chk
$DROPGLOBAL SAM_chk

```

Single Country CGE, 2024
© cgemod



37

37

cgemod

STAGE

SETGLOBAL: Example 2

```

* ----- stg_t samchk -----
* This section checks that the model is calibrated with a balanced Macro SAM

##### TO CHECK FOR DATA CONSISTENCY, DISPLAY CALCULATED SAMG

%ASAM_chk%("COMMDTY","MARG")      = SUM(c,QTTD.L(c)*PQD.L(c)) ;
%ASAM_chk%("COMMDTY","HHOLDS")    = SUM((C,h),QCD.L(c,h)*PQCD.L(c)) ;
...
*----- Checking that a balanced and equal ASAMG is produced

%ASAM_chk%CHK(ss,ssp)$ASAM1(ss,ssp) = (%ASAM_chk%(ss,ssp))/ASAM0(ss,ssp);
...
*This section checks that the model is calibrated with a balanced Micro SAM

%SAM_chk%(c,a)                    = QINTD.L(c,a)*PQD.L(c);
...
...
%SAM_chk%CHK(sac,sacp)$SAM1(sac,sacp)
                                = %SAM_chk%(sac,sacp)/SAM1(sac,sacp) ;

```

Single Country CGE, 2024
© cgemod



38

38

cgemod

STAGE

STAGE_t Model: Overview

The End

Single Country CGE, 2024

© cgemod


39