

RUNNING MAMS IN GAMS: STEPS TO FOLLOW

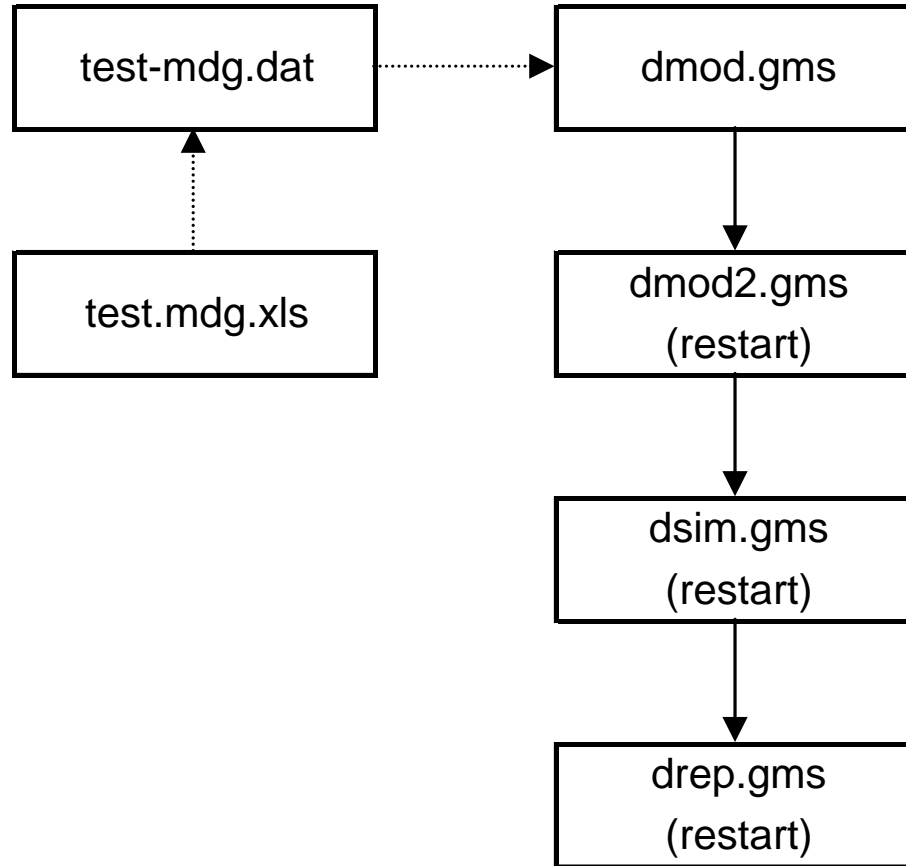
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Presentation for the Workshop of the UNDP – UNDESA – World Bank – LAS Project “Assessing Development Strategies to Achieve the MDGs in the Arab Region”, Cairo, April 2-5, 2007

OVERVIEW

- MAMS is coded in GAMS (General Algebraic Modeling System).
- MAMS ZIP folder.
- MAMS main files.
- How to (quickly) run MAMS using GAMS IDE.
- How to explore MAMS results.
- Some results.
- How to install GAMS 22.4.

MAMS MAIN FILES



MAMS MAIN FILES

- DMOD.GMS. First part of core model file. Country data set is read in and processed including SAM-balancing for rounding errors.
- DMOD2.GMS. Second part of core model file. Model is developed, including dynamic base run.
- DSIM.GMS. Simulation file. Restarted from DMOD2.GMS. All simulations are run in this file. The first simulation is the dynamic base run, which should be the same as the base run from DMOD2.
- DREP.GMS. Report file. Restarted from DSIM.GMS. File for: a) declaring parameters for the reports; and b) All the results are written to a GDX file called report. For viewing it use GAMSIDE.

SOME MAMS ANCILLARY FILES

- TEST-MDG.DAT. Include file for DMOD.GMS with MDG dataset designed to test the model. Data may be read in using three alternative methods.
- TEST-MDGGDX.INC. Include file for TEST-MDG.DAT that reads in data from Excel using a GDX LOADDC statement.
- TEST-MDG.XLS. Excel file from which TEST-MDGGDX.INC reads in data.
- DIAGNOSTICS-DATA.INC. Include file for DMOD2.GMS. It defines selected parameters and displays and generates information that may be useful when debugging a model.

MODEL FILE

- In DMOD2 two models are solved: i) LOGCALIBMOD to calibrate logistic functions; and ii) CGEMCPREC.
- The CGE model can be solved using two different methods: multi-pass (one year at a time); or single-pass (all years together).
- In DMOD2 the CGE model is solved with two alternative closures for TFP: i) TFP is endogenous and GDP growth is exogenous; and ii) TFP is exogenous and GDP growth is endogenous. Naturally, GDP growth rate in (ii) will be the same as in (i).

MAMS DATA FILES

- A MAMS database is comprised of the following two files: <country>-mdg.dat; and <country>-mdg.xls. (Notice that MAMS provides alternatives for reading the database).
- The MAMS modeling system comes with some example databases. The selection of the database to use is made in DMOD.gms. Search for the section labeled “INCLUDE ONE DATA SET”.
- As an example, we will use the database files test-mdg.dat and test-mdg.xls.

GAMS IDE (INTEGRATED DEVELOPMENT ENVIRONMENT)

- A general text editor with the ability to launch and monitor the compilation / execution of GAMS models.
- Progress of a compilation / execution can be monitored in the process window.
- The process window is also used as a navigation tool to locate syntax errors in the source code and to find various anchor points in the listing file.
- The IDE also facilitates the selection of default solvers and manages GAMS parameters on a file by file basis.
- (As an alternative, use a more powerful text editor as TextPad combined with DOS window to run GAMS).

FIRST TIME WITH MAMS

1. Save all model files in a dedicated directory.
2. Create a subdirectory named "save".
3. Create a file project in the MAMS folder (i.e., Use File | Project | New Project). All model files need to be in the project folder.
4. Select one of the accompanying country data sets in dmod.gms
5. Run the following GAMS model files using the save and restart feature:

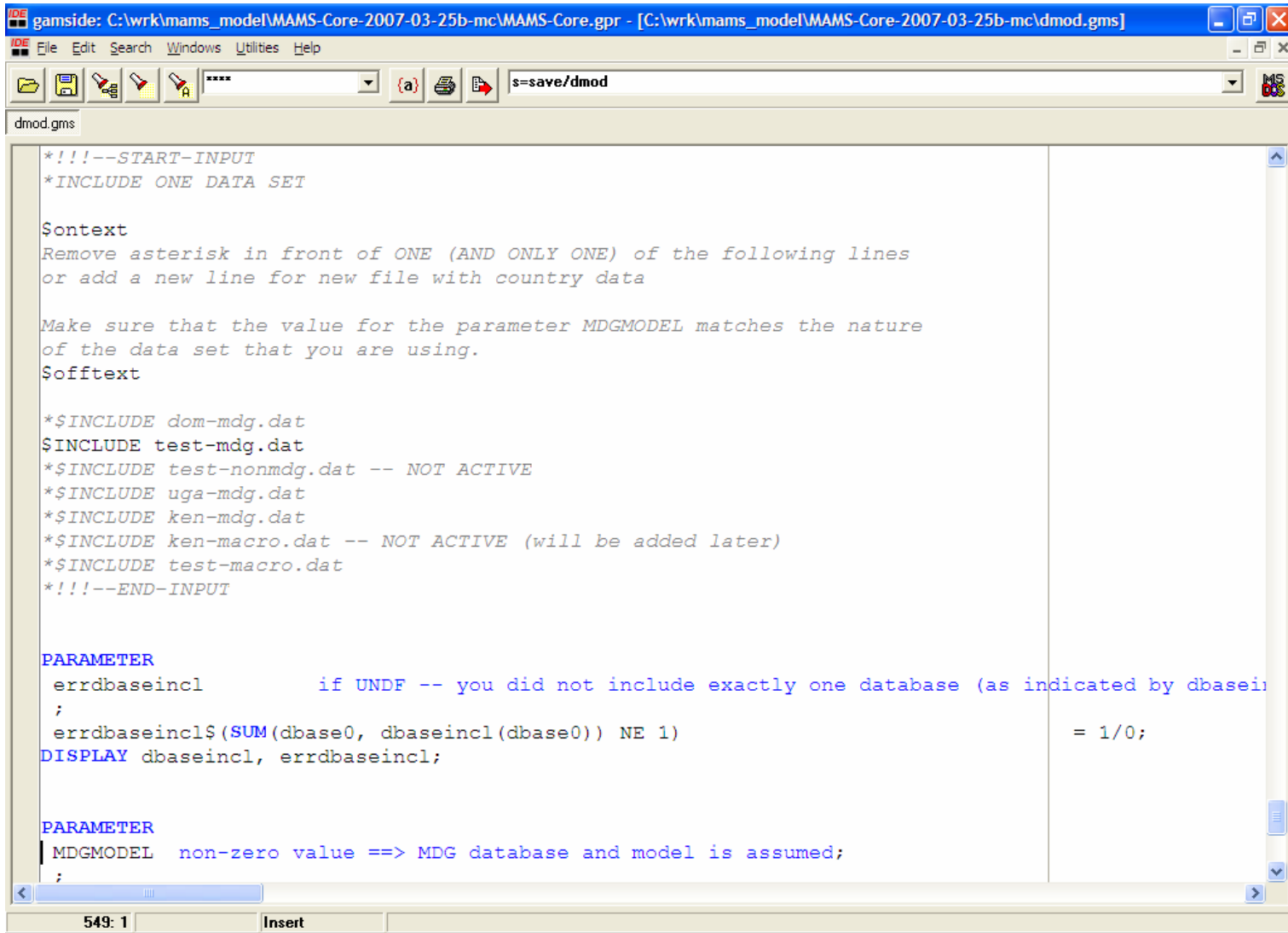
```
GAMS dmod s=save\dmod
```

```
GAMS dmod2 r=save\dmod s=save\dmod2
```

```
GAMS dsim r=save\dmod2 s=save\dsim
```

```
GAMS drep r=save\dsim s=save\drep
```

SELECTING A MAMS DATABASE



```
***
s=save/dmod
dmod.gms
*!!!--START-INPUT
*INCLUDE ONE DATA SET

$ontext
Remove asterisk in front of ONE (AND ONLY ONE) of the following lines
or add a new line for new file with country data

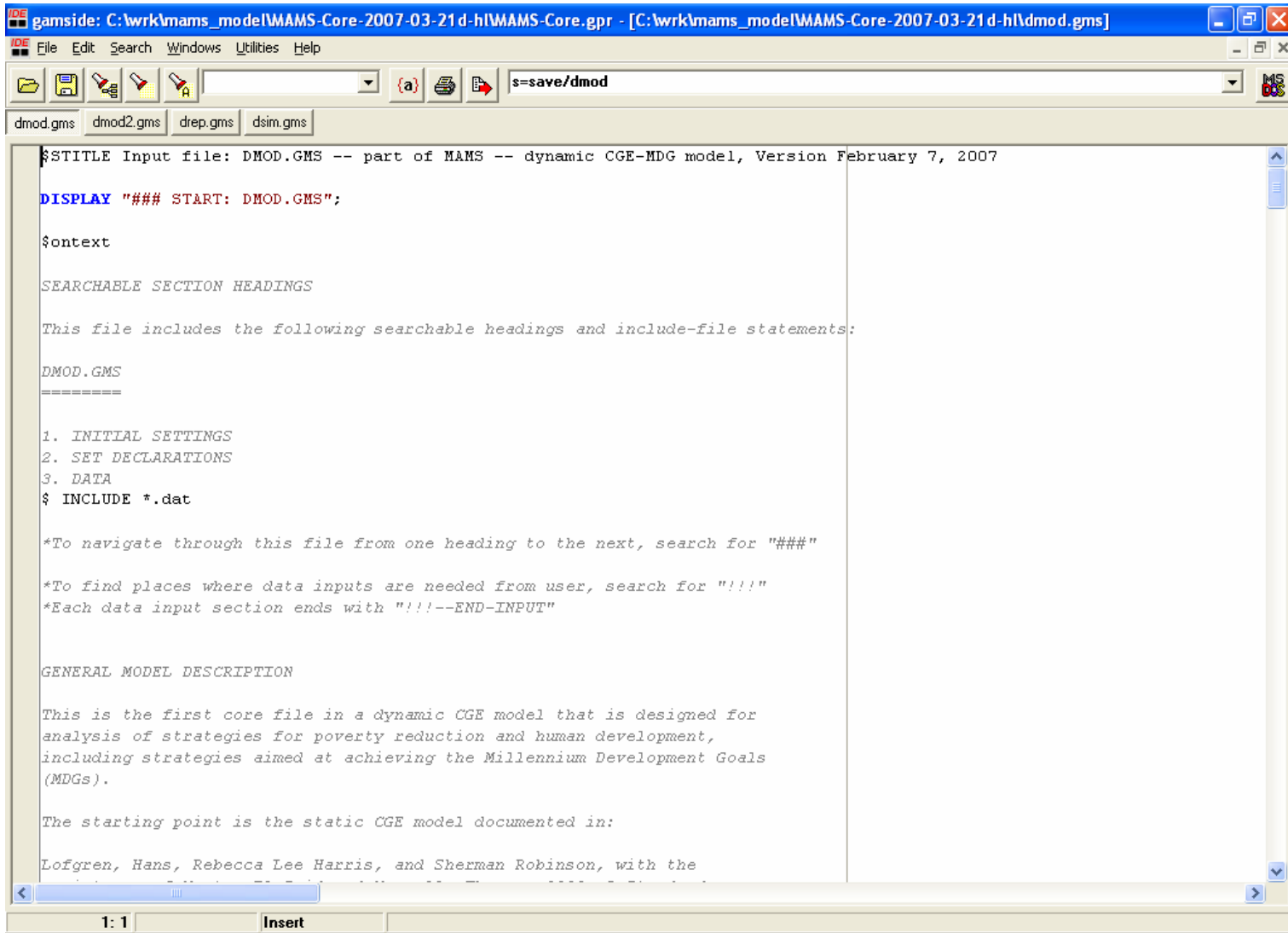
Make sure that the value for the parameter MDGMODEL matches the nature
of the data set that you are using.
$offtext

*$INCLUDE dom-mdg.dat
$INCLUDE test-mdg.dat
*$INCLUDE test-nonmdg.dat -- NOT ACTIVE
*$INCLUDE uga-mdg.dat
*$INCLUDE ken-mdg.dat
*$INCLUDE ken-macro.dat -- NOT ACTIVE (will be added later)
*$INCLUDE test-macro.dat
*!!!--END-INPUT

PARAMETER
  errdbaseincl          if UNDF -- you did not include exactly one database (as indicated by dbaseincl
  ;
  errdbaseincl$(SUM(dbase0, dbaseincl(dbase0)) NE 1)                = 1/0;
DISPLAY dbaseincl, errdbaseincl;

PARAMETER
  MDGMODEL non-zero value ==> MDG database and model is assumed;
  ;
```

RUNNING DMOD.GMS



The screenshot shows a GAMS IDE window titled "gamside: C:\wrk\mams_model\MAMS-Core-2007-03-21 d-h\MAMS-Core-2007-03-21 d-h\dmod.gms". The window contains the following text:

```
$STITLE Input file: DMOD.GMS -- part of MAMS -- dynamic CGE-MDG model, Version February 7, 2007

DISPLAY "### START: DMOD.GMS";

$ontext

SEARCHABLE SECTION HEADINGS

This file includes the following searchable headings and include-file statements:

DMOD.GMS
=====

1. INITIAL SETTINGS
2. SET DECLARATIONS
3. DATA
$ INCLUDE *.dat

*To navigate through this file from one heading to the next, search for "###"

*To find places where data inputs are needed from user, search for "!!!"
*Each data input section ends with "!!!--END-INPUT"

GENERAL MODEL DESCRIPTION

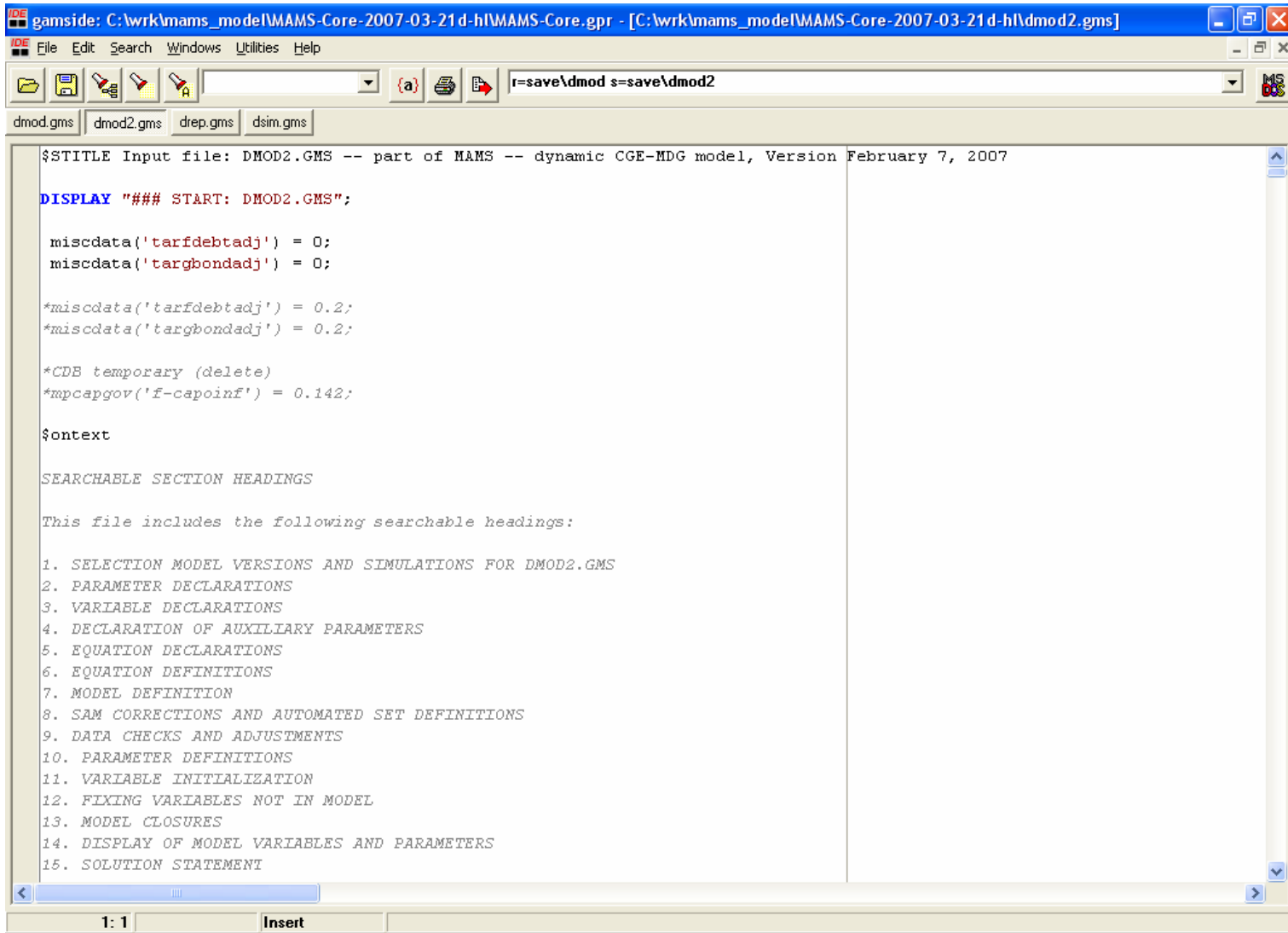
This is the first core file in a dynamic CGE model that is designed for
analysis of strategies for poverty reduction and human development,
including strategies aimed at achieving the Millennium Development Goals
(MDGs).

The starting point is the static CGE model documented in:

Lofgren, Hans, Rebecca Lee Harris, and Sherman Robinson, with the
```

The status bar at the bottom of the window shows "1: 1" and "Insert".

RUNNING DMOD2.GMS



The screenshot shows a GAMS IDE window titled "gamside: C:\wrk\mams_model\MAMS-Core-2007-03-21 d-h\MAMS-Core-2007-03-21 d-h\dmod2.gms". The window contains the following text:

```
$STITLE Input file: DMOD2.GMS -- part of MAMS -- dynamic CGE-MDG model, Version February 7, 2007

DISPLAY "### START: DMOD2.GMS";

miscdata('tarfdebtadj') = 0;
miscdata('targbondadj') = 0;

*miscdata('tarfdebtadj') = 0.2;
*miscdata('targbondadj') = 0.2;

*CDB temporary (delete)
*mpcapgov('f-capoinf') = 0.142;

$ontext

SEARCHABLE SECTION HEADINGS

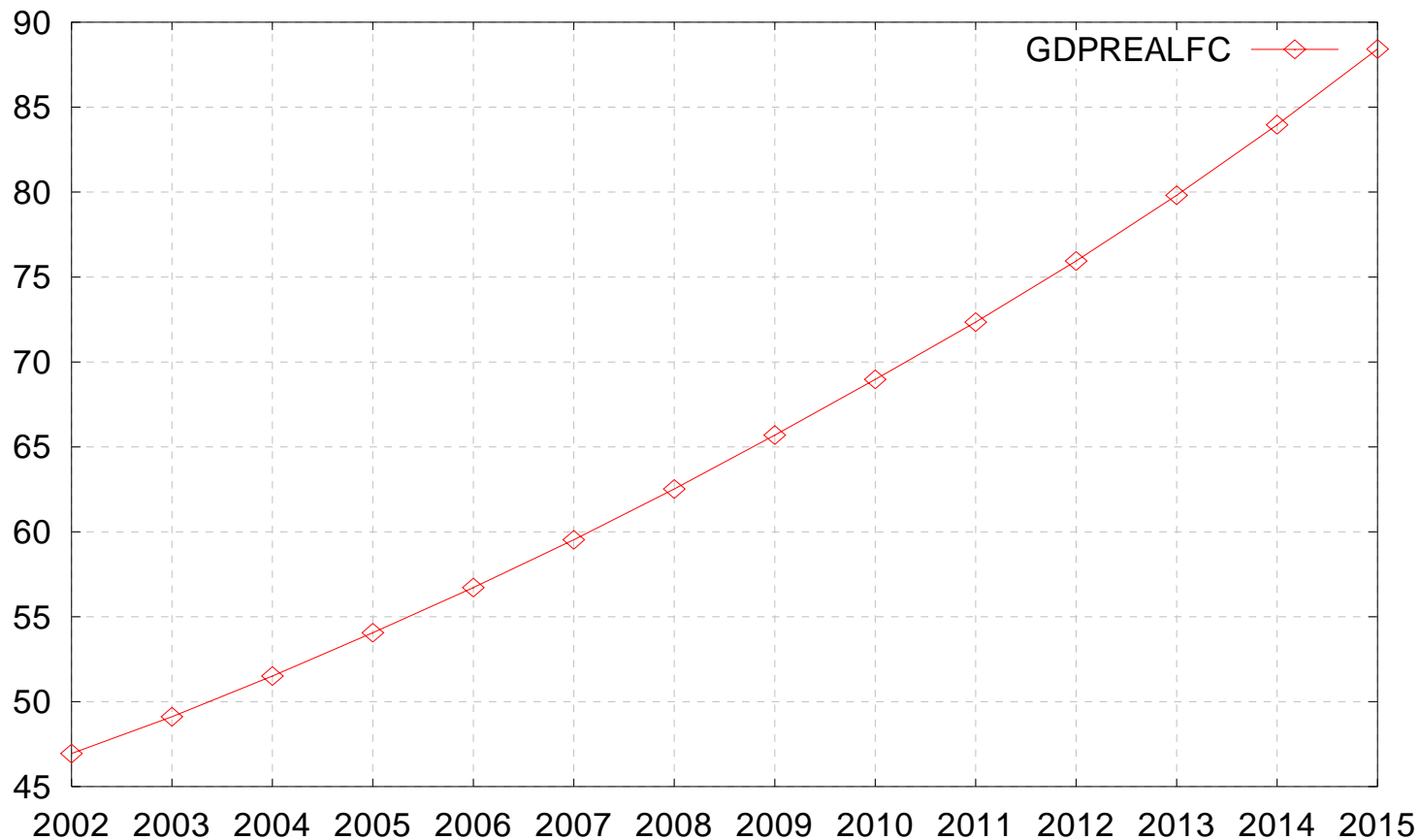
This file includes the following searchable headings:

1. SELECTION MODEL VERSIONS AND SIMULATIONS FOR DMOD2.GMS
2. PARAMETER DECLARATIONS
3. VARIABLE DECLARATIONS
4. DECLARATION OF AUXILIARY PARAMETERS
5. EQUATION DECLARATIONS
6. EQUATION DEFINITIONS
7. MODEL DEFINITION
8. SAM CORRECTIONS AND AUTOMATED SET DEFINITIONS
9. DATA CHECKS AND ADJUSTMENTS
10. PARAMETER DEFINITIONS
11. VARIABLE INITIALIZATION
12. FIXING VARIABLES NOT IN MODEL
13. MODEL CLOSURES
14. DISPLAY OF MODEL VARIABLES AND PARAMETERS
15. SOLUTION STATEMENT
```

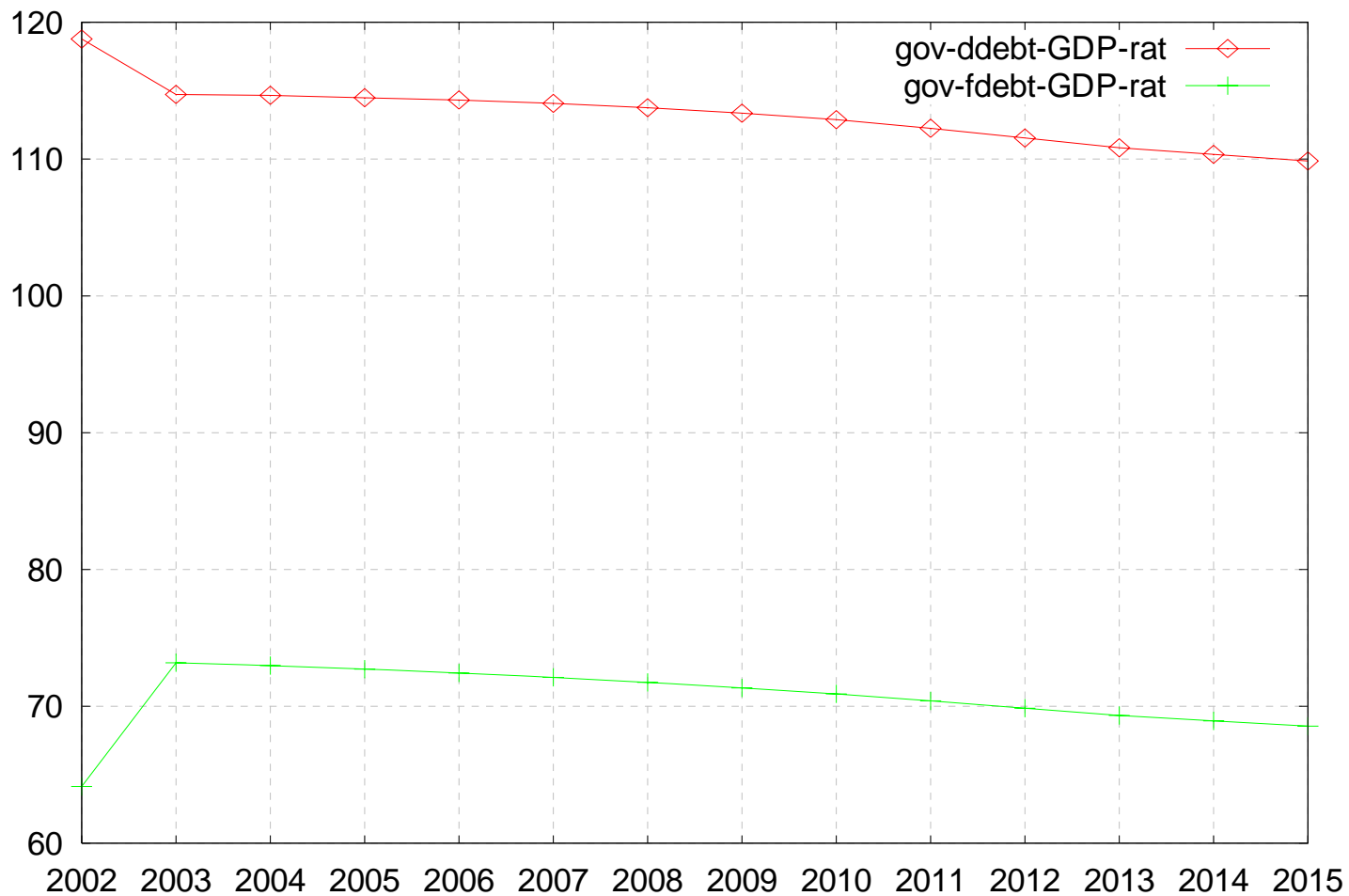
The status bar at the bottom of the window shows "1: 1" and "Insert".

THE BASELINE SCENARIO

real gdp factors cost



THE BASELINE SCENARIO

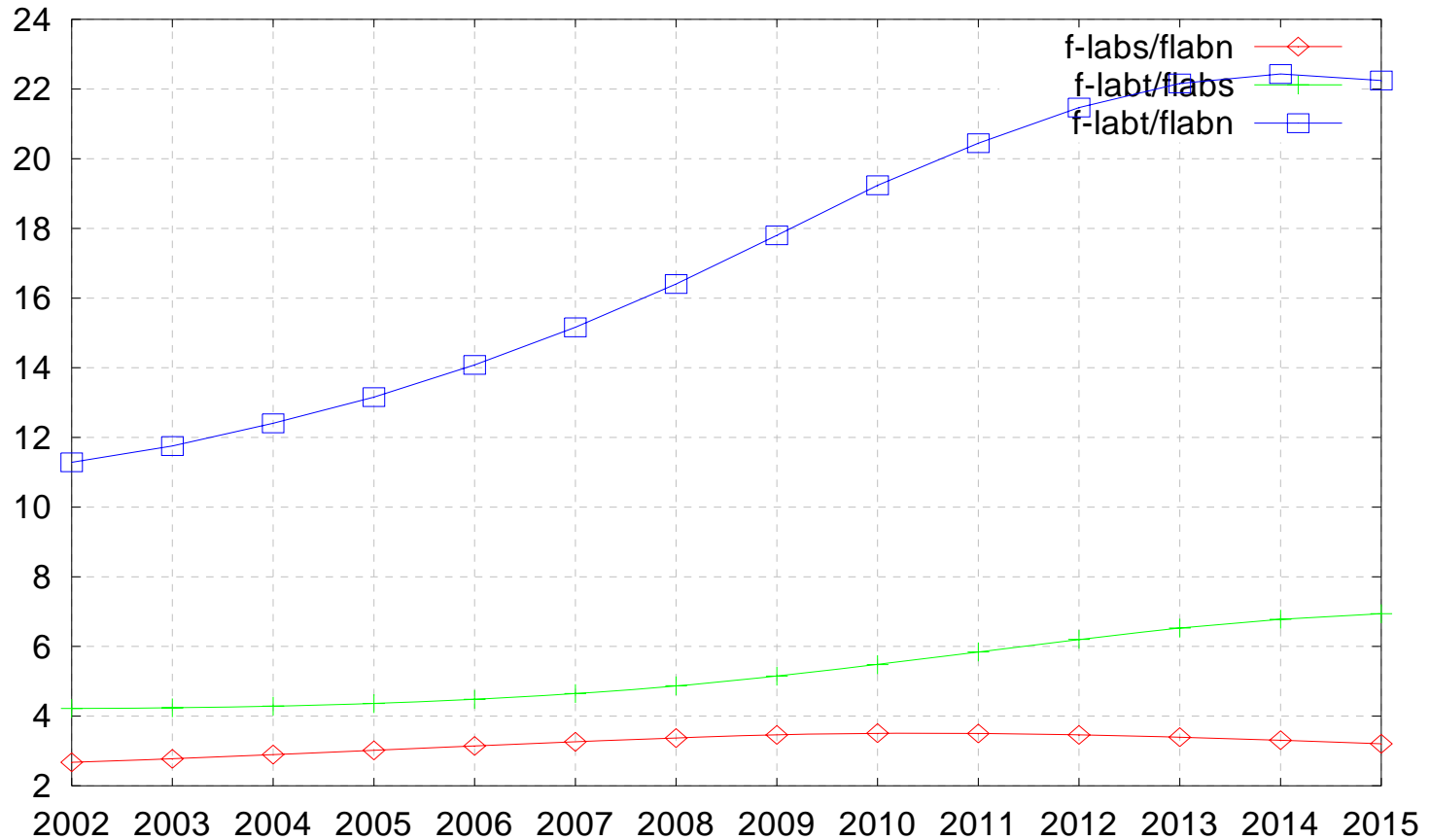


THE BASELINE SCENARIO

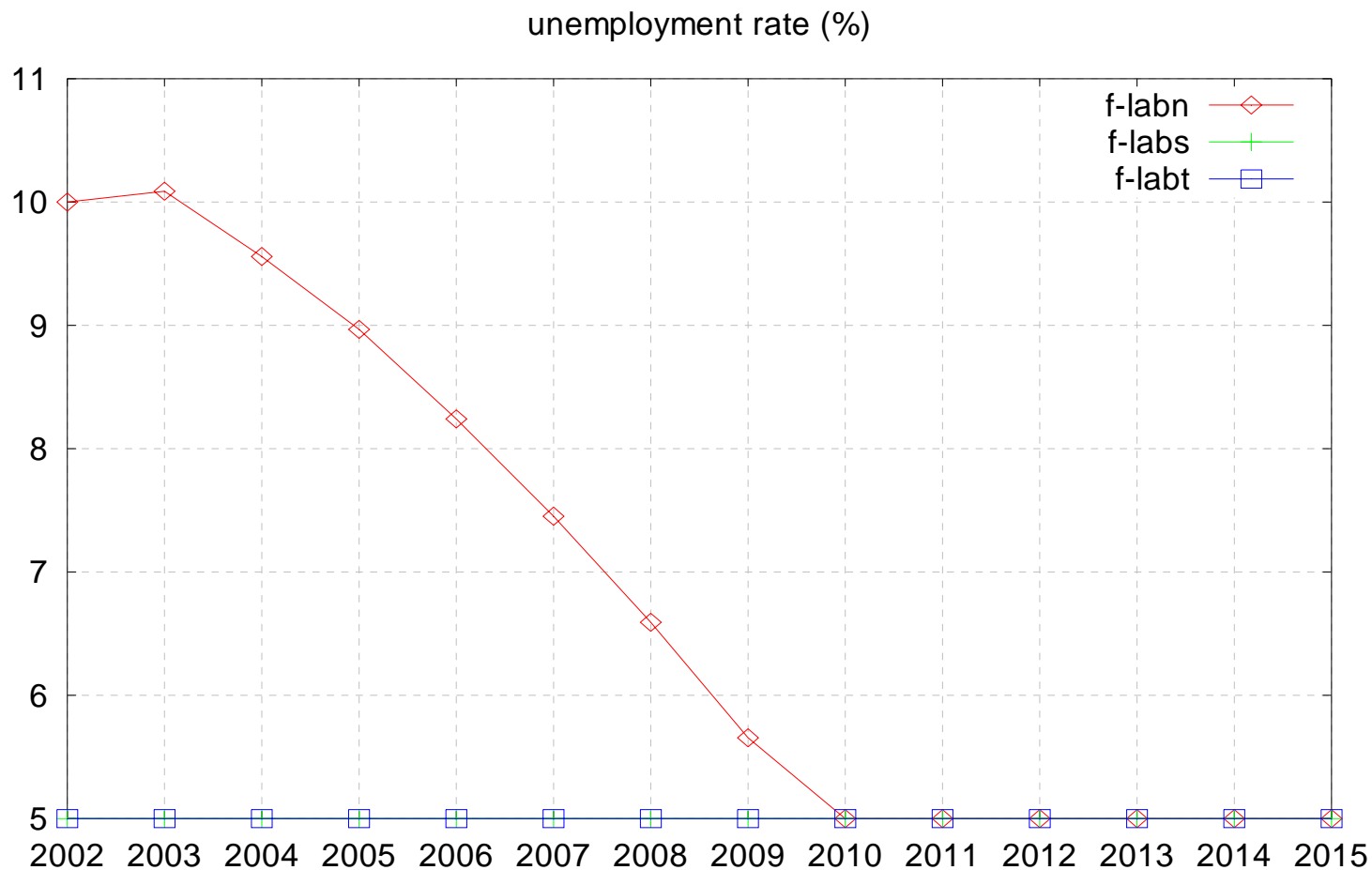


THE BASELINE SCENARIO

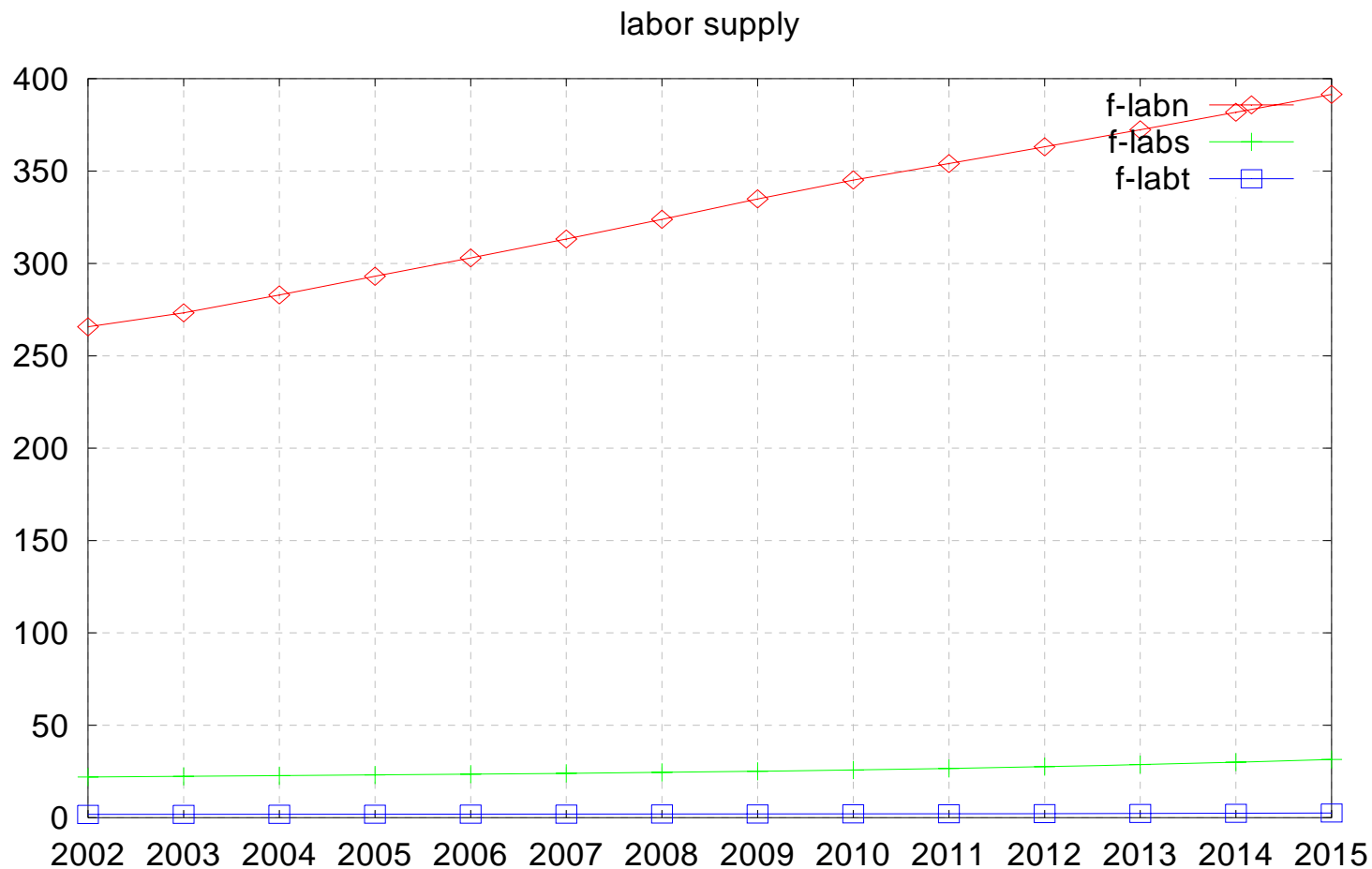
wage gaps



THE BASELINE SCENARIO

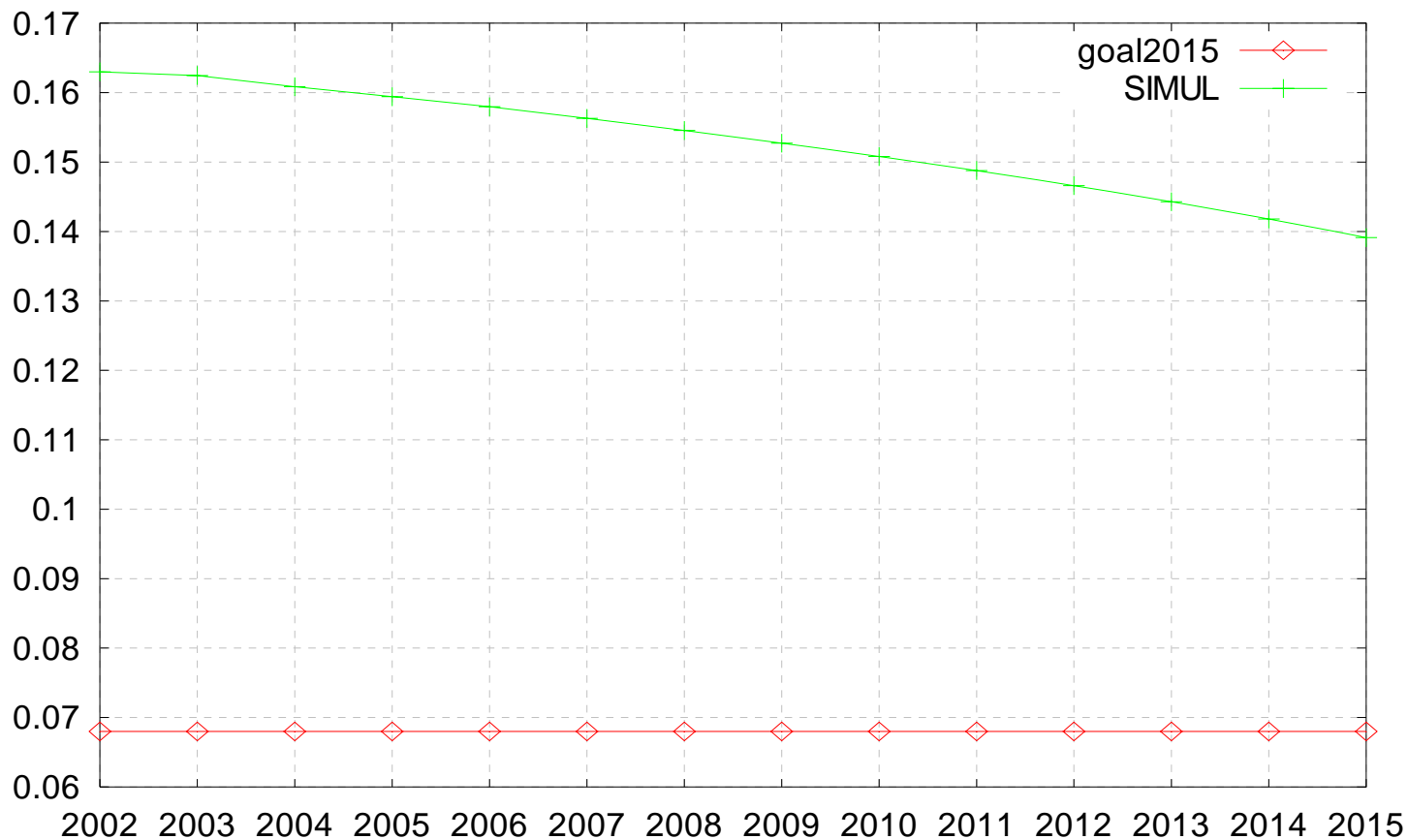


THE BASELINE SCENARIO



THE BASELINE SCENARIO

MDG 4: under five mortality rate



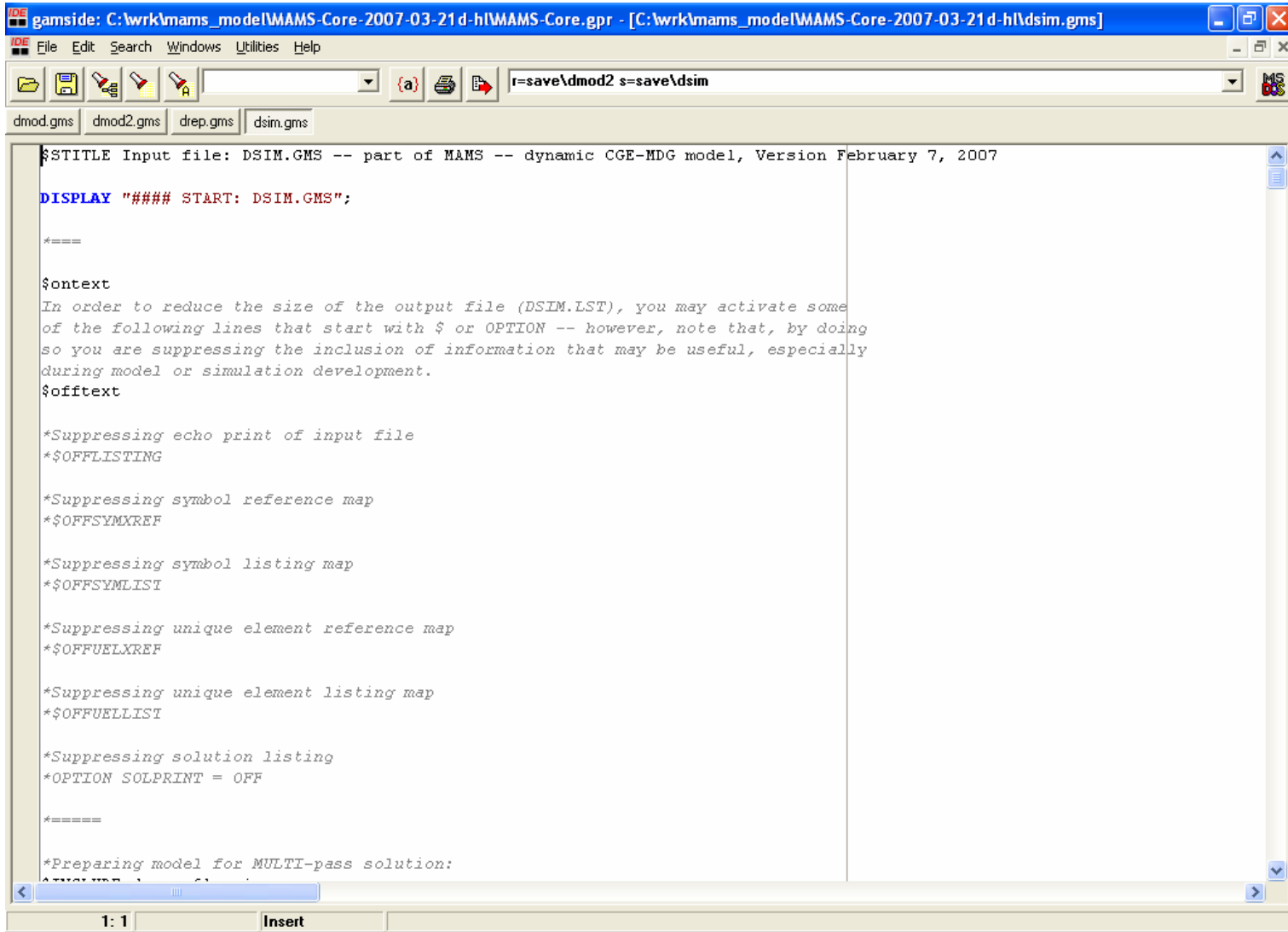
MACRO CLOSURE RULE BASELINE (DMOD2.GMS)

- Government. Direct taxes are endogenous. Government savings are a residual. Government investment necessary to cover capital needs. Government consumption is exogenous. Government debt follows an exogenous path.
- External Sector. Small open economy. RER adjusts to equilibrate the current account BoP. Savings from ROW is implicitly fixed because values are imposed for: foreign debt, transfers from/to ROW; and FDI.
- Savings-Investment. Private investment is a fixed proportion of absorption. The savings rates for domestic non-government institutions are endogenous.
- Factor Markets. Labor can be unemployed with a minimum wage. Labor supply depends on population growth and educational system.

DEFINITION OF MDG SIMULATIONS IN DSIM.GMS

NAME	TARGETED MDG	FINANCING
base	-	-
mdg2-fg	MDG2	foreign grants
mdg2-tax	MDG2	domestic taxes
mdg2-fb	MDG2	foreign borrowing
mdg2-db	MDG2	domestic borrowing
mdg45-fg	MDGs 4 and 5	foreign grants
mdg45-tax	MDGs 4 and 5	domestic taxes
mdg45-fb	MDGs 4 and 5	foreign borrowing
mdg45-db	MDGs 4 and 5	domestic borrowing
mdg7-fg	MDGs 7a and 7b	foreign grants
mdg7-tax	MDGs 7a and 7b	domestic taxes
mdg7-fb	MDGs 7a and 7b	foreign borrowing
mdg7-db	MDGs 7a and 7b	domestic borrowing
mdg-fg	all MDGs	foreign grants
mdg-tax	all MDGs	domestic taxes
mdg-fb	all MDGs	foreign borrowing
mdg-db	all MDGs	domestic borrowing

RUNNING DSIM.GMS



The screenshot shows a GAMS IDE window titled "gamside: C:\wrk\mams_model\MAMS-Core-2007-03-21 d-h\MAMS-Core-2007-03-21 d-h\dsim.gms". The window contains the following text:

```
$STITLE Input file: DSIM.GMS -- part of MAMS -- dynamic CGE-MDG model, Version February 7, 2007

DISPLAY "#### START: DSIM.GMS";

====

$ontext
In order to reduce the size of the output file (DSIM.LST), you may activate some
of the following lines that start with $ or OPTION -- however, note that, by doing
so you are suppressing the inclusion of information that may be useful, especially
during model or simulation development.
$offtext

*Suppressing echo print of input file
*$OFFLISTING

*Suppressing symbol reference map
*$OFFSYMREF

*Suppressing symbol listing map
*$OFFSYMLIST

*Suppressing unique element reference map
*$OFFUELXREF

*Suppressing unique element listing map
*$OFFUELLIST

*Suppressing solution listing
*OPTION SOLPRINT = OFF

=====

*Preparing model for MULTI-pass solution:
```

The status bar at the bottom shows "1: 1" and "Insert".

RUNNING DREP.GMS

```
$STITLE Input file: DSIM.GMS -- part of MAMS -- dynamic CGE-MDG model, Version February 7, 2007

DISPLAY "#### START: DREP.GMS";

$ONTEXT

a. displaying all report parameters declared in REPSETUP.INC
b. declaring and displaying parameters for the following reports:
(1) % annual growth from first period to last period for parameters
defined in reloop.inc. Syntax: RELOOP parameter name + PP (defined in
REPPERC-PP.INC).
(2) % annual growth from intermediate period to last period for parameters
defined in reloop.inc. Syntax: RELOOP parameter name + PPMID (defined in
REPPERC-PPMID.INC).
(3) % annual growth from between each pair of adjacent solution years
for parameters defined in RELOOP.INC. Syntax: RELOOP parameter name +
PY (defined in REPPERC-PY.INC).

All the results are written to a GDX files called report. For viewing it use
the GAMSIDE.

$OFFTEXT

PARAMETER
  tsolnb   no. of non-base years for simulations
  ;

*To incorporate possible changes in tmax, tsolnb, and
*tsolnbmid (due to changes in tsol), we redefined these
*three sets (which are used to generate report parameters).
  tmax(t1) = NO;
  tmax(t1)$ (ORD(t1) EQ SMAX(t1p$tsol(t1p), ORD(t1p))) = YES;
```

1: 1 Insert

REPORT.GDX

gamside: C:\wrk\mams_model\MAMS-Core-2007-03-21d-h\MAMS-Core-2007-03-21d-h\report.gdx

File Edit Search Windows Utilities Help

dmod.gms dmod.lst dmod2.gms dmod2.lst drep.gms drep.lst dsim.gms dsim.lst report.gdx

Entry	Symbol	Type	Dim	Nr Elem
2	alphavagx	Par	3	756
3	ALPHAVAX	Par	3	5,292
131	ALPHAVAXPP	Par	2	357
319	ALPHAVAXPPMID	Par	2	357
228	ALPHAVAXPY	Par	4	4,641
5	CALTFPGTX	Par	2	18
4	CALTFPGX	Par	1	0
6	CBBORTOTX	Par	2	234
132	CBBORTOTXPP	Par	1	0
320	CBBORTOTXPPMID	Par	1	17
229	CBBORTOTXPY	Par	3	204
7	CBBORX	Par	3	468
133	CBBORXPP	Par	2	0
321	CBBORXPPMID	Par	2	34
230	CBBORXPY	Par	4	408
8	CPIX	Par	2	252
134	CPIXPP	Par	1	0
322	CPIXPPMID	Par	1	0
231	CPIXPY	Par	3	0
9	DGBONDTOTX	Par	2	252
135	DGBONDTOTXPP	Par	1	17
323	DGBONDTOTXPPMID	Par	1	17
10	DGBONDXX	Par	3	504
136	DGBONDXXPP	Par	2	34
324	DGBONDXXPPMID	Par	2	34

DKINSX: change in capital stock (gross inv) ac owned by ins

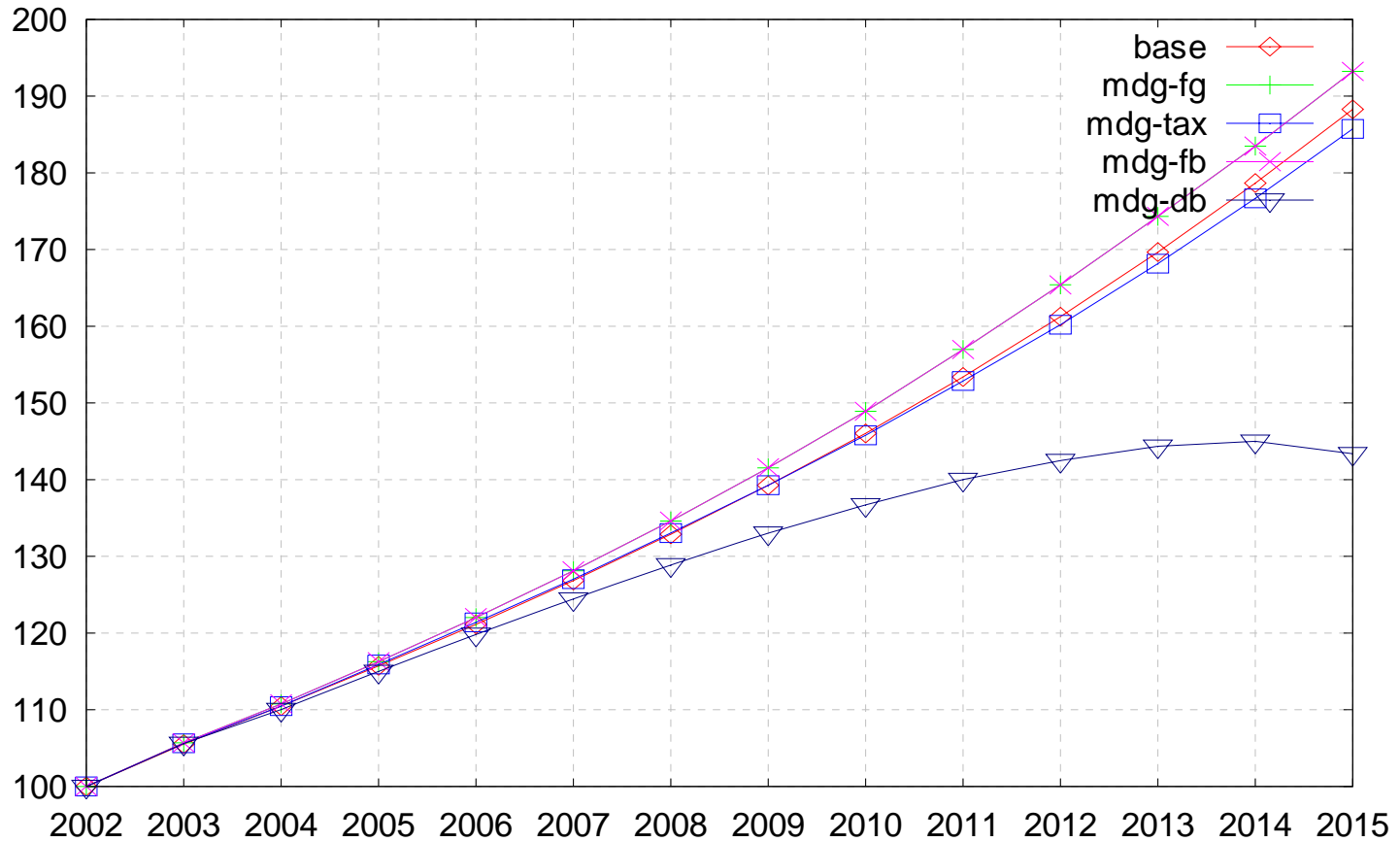
Plane Index (empty)

hhd-rurl	f-capprv	base00	2002	1.55449338187567
			2003	1.21381909278025
			2004	1.27577249733986
			2005	1.31963514902262
			2006	1.35919298856492
			2007	1.41419571558803
			2008	1.46920130710591
			2009	1.52722156181811
			2010	1.58852263369318
			2011	1.6528599264152
			2012	1.72507992394981
			2013	1.80556762279659
			2014	1.89802678067267
			2015	2.00349773034325
		base	2002	1.55449338187567
			2003	1.21381909278025
			2004	1.27577249733986
			2005	1.31963514902262

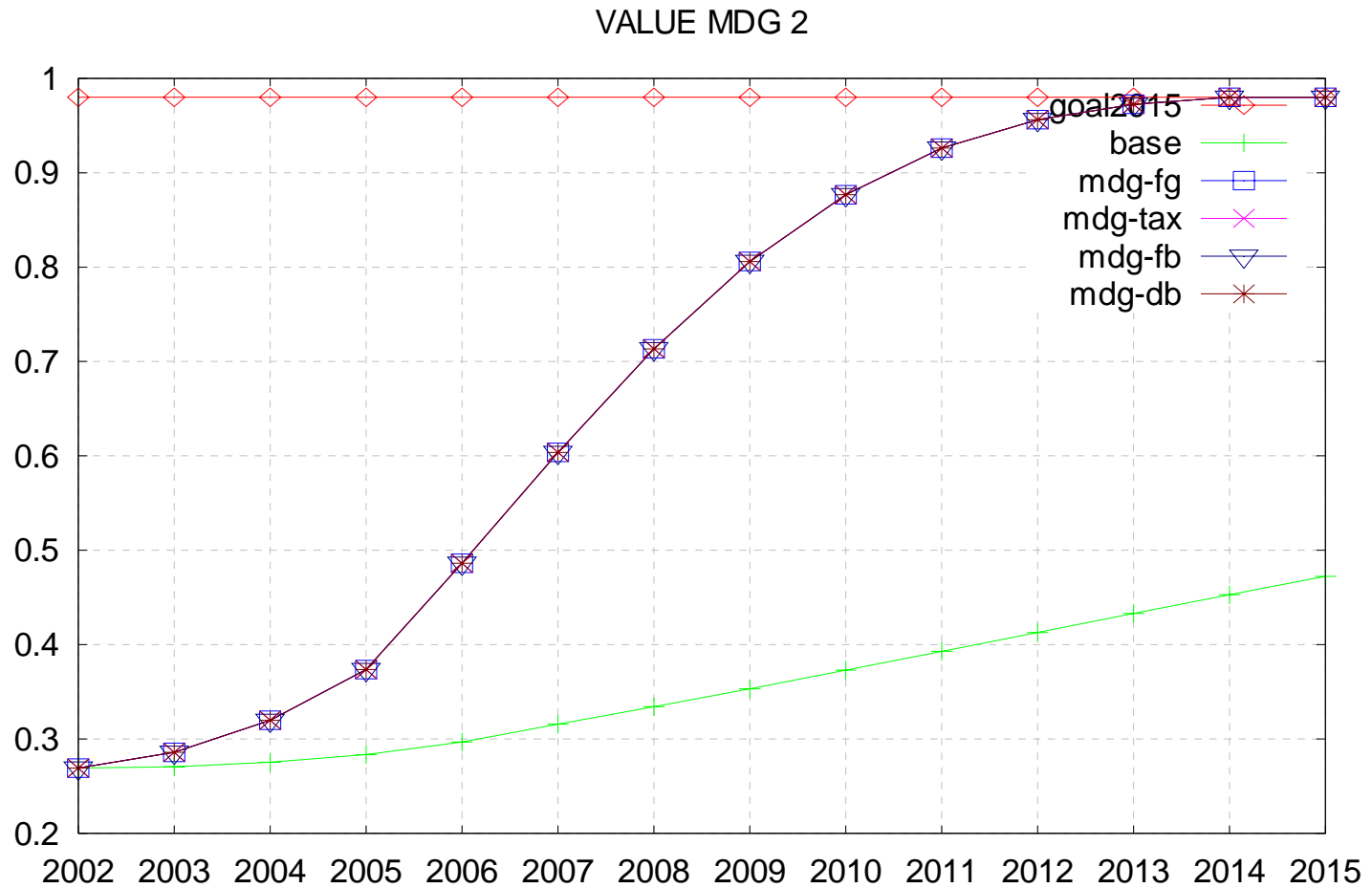
Reset Squeeze defaults Ordering: 1 2 3 4
 Decimals Search
 Sort <|> Max Next Prev

REAL GDP UNDER DIFFERENT SCENARIOS

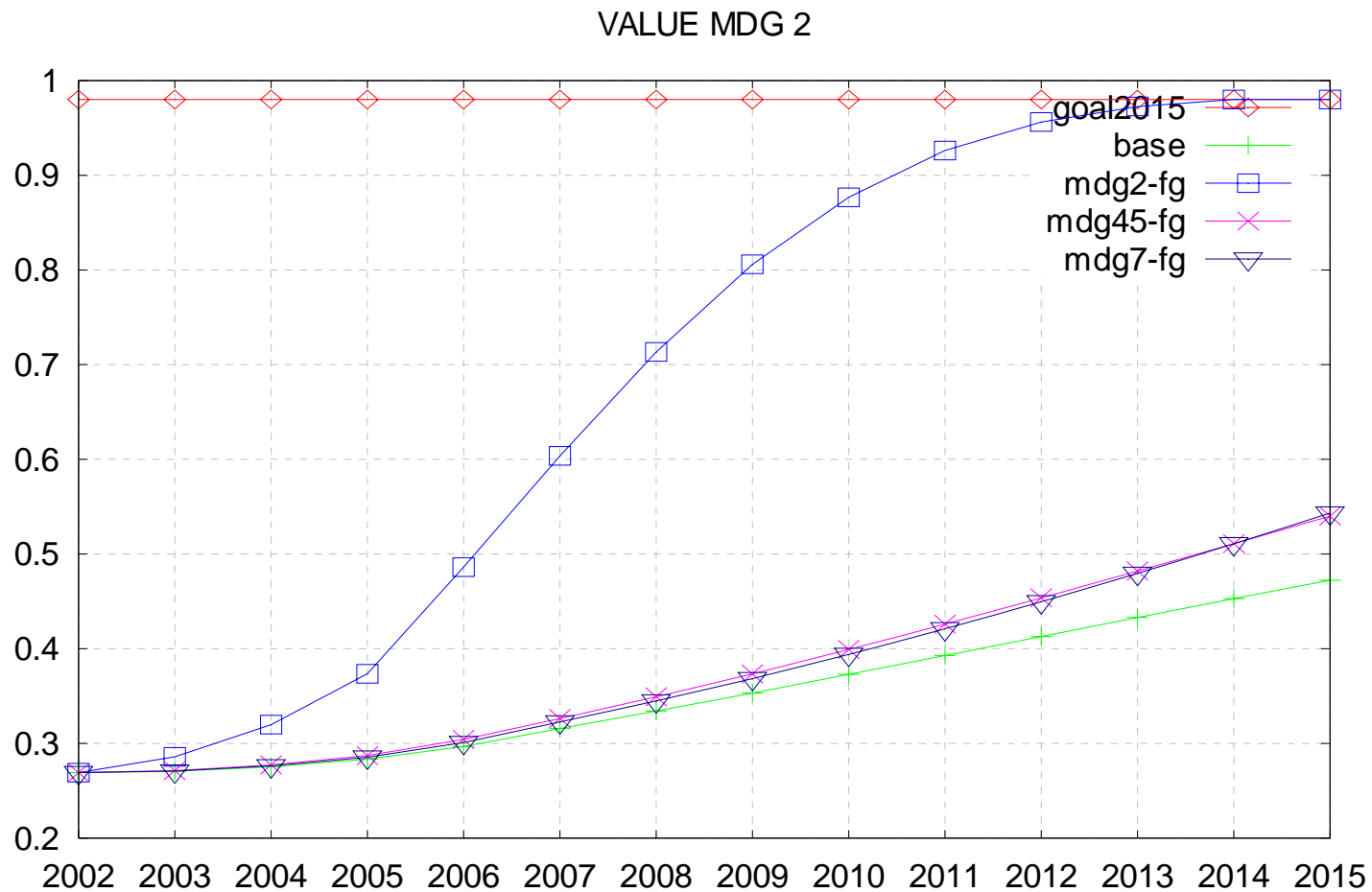
REAL GDP FACTOR COST (2003=100)



MDG 2 UNDER DIFFERENT SCENARIOS



MDG 2 UNDER DIFFERENT SCENARIOS



MDG 2 UNDER DIFFERENT SCENARIOS

EXPLORE RESULTS IN REPORT.GDX

INSTALLING GAMS

- The last version of GAMS (General Algebraic Modeling System) can be downloaded free of charge from <http://download.gams-software.com/>.
- The demo version comes with some restrictions on the model size. In order to run MAMS a GAMS license is needed.
- The GAMS software can be used to solve non-linear equations systems.

GAMS

Using common notation,

$$a = \{agr, mnf, svc\}$$

$$f = \{lab, cap\}$$

$$QA_a = \phi_a \prod_f QF_{fa}^{\delta_f}$$

Using GAMS notation,

```
SET
```

```
    a /agr, mnf, svc/
```

```
    f /lab, cap/
```

```
;
```

```
QA =E= phi(a)*PROD(f, QF(f,a)**delta(f,a));
```

REFERENCES

- Brooke, Anthony; Kendrick, David; Meeraus, Alexander and Raman, Ramesh (2006). GAMS: A User's Guide. GAMS Development Corporation.
- Kalvelagen, Erwin (????). Modeling with GAMS. Chapter 1. GAMS Development Corporation.
- GAMS (2006). Installation Notes for PC. GAMS Development Corporation.