Getting Started with GEMPACK : Hands-on Examples

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This is part of the documentation of the GEMPACK Software System for solving large economic models, developed by the IMPACT Project, Monash University, Clayton Vic 3168, Australia.

Abstract

This document is intended to be a starting tutorial for new users of GEMPACK who wish to familiarise themselves with the use of GEMPACK on a particular computer.

This document gives hands-on examples for several of the economic models usually supplied with GEMPACK. Detailed instructions are given with these examples.

This document contains separate chapters for

- those using WinGEM, the Windows interface to GEMPACK, on windows PCs, and
- those using GEMPACK on other computers, for example, those working under Unix or at the DOS Command prompt.

It also contains an introduction to RunGEM which is a Windows interface for carrying out simulations with models.

A description of the models usually supplied with GEMPACK and the associated model files is included.

Authors and Earlier Editions

Date	*Author(s)*	*Comment*
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Chapter 1

1. Models Usually Supplied With GEMPACK

The models usually supplied with GEMPACK are listed in section 1.3 of GEMPACK document GPD-1. Here we give a list of the associated files, with their usual file names (which may be different on some machines). The files referred to in this chapter are often contained in a subdirectory called EXAMPLES of the main GEMPACK directory (where GEMPACK files on your computer were installed). If in doubt, ask your GEMPACK Manager or consult your machine-specific documentation. For a Source-code version of GEMPACK on a PC, this is the GEMPACK document GPD-6. For an Executable-image version, this is GEMPACK document GPD-7.

For each of the models, we provide files which you can use to carry out certain simulations with the model. Of course, you can also carry out different simulations (varying the closures and/or shocks, and also the number of steps and/or solution method in multi-step simulations) and can also work with different condensations of the models.

When you start working with one of these models, we suggest that you create a new subdirectory for just this model (separate from the EXAMPLES subdirectory and from the directories containing the GEMPACK source and/or executable files); copy the relevant files from the examples subdirectory into it. (This avoids cluttering up the EXAMPLES directory and the directories containing the other GEMPACK files with model-specific files.)

The suggestions for hands-on computing in chapter 2 for WinGEM and chapter 3 for Unix / Command prompt use some of the models and files described here. You might like to try some of these examples to familiarise yourself with GEMPACK.

If you are working on a Windows PC which has WinGEM installed, you should work through the examples in chapter 2 to familiarise yourself with GEMPACK. Otherwise (for example, if you are working on a Unix machine or a DEC Alpha/VMS machine or at the DOS prompt), you should work through the examples in chapter 3 to familiarise yourself with GEMPACK.

Chapter 5 contains an introduction to RunGEM, a new (for Release 6.0) windows interface for carrying out simulations with models implemented via GEMPACK. Both new and experienced GEMPACK users may find that RunGEM helps them to carry out simulations easily and efficiently.

1.1 Stylized Johansen SJ

This is the small example general equilibrium model designed as an introduction to the issues involved in building and solving such models (see Chapter 3 of Dixon *et al* (1992), hereafter referred to as **DPPW**), and used for many of the examples in this document.
In Chapter 3 of GPD-1, there are three different TABLO Input files for Stylized Johansen:

- the mixed version described in section 3.3,
- the linearized version in section 3.5 and
- the levels version in section 3.6.

In the following **LN** in a file name means that this file is for the linearized version. Similarly **LV** implies the file is for the levels version. The files are

	Mixed	Linear	Levels
TABLO Input file	***SJ.TAB***	***SJLN.TAB***	***SJLV.TAB***

All versions use the same Header Array file as data file.

Header Array data file	***SJ.DAT***
Text data file (input to MODHAR)	***SJDAT.TXT***

SJDAT.TXT is the text file shown in section 3.4.1 of GPD-1 for creating the Header Array file via the 'at' command of MODHAR.

The following table summarises the Command files usually supplied for use with the different versions of the Stylized Johansen model.

	Command Files		
	Mixed	Linear	Levels
Program			
GEMSIM or TABLO-generated	***SJLB.CMF***	***SJLNLB.CMF***	***SJLVLB.CMF***
GEMSIM or TABLO-generated	***SJEQ.CMF***	-	-
SAGEM	***SJLBJ.CMF***	-	-
GEMSIM or TABLO-generated	***SJLABEL.CMF***	-	-
GEMSIM or TABLO-generated	***SJENV.CMF***	-	-

The Command files SJLB.CMF, SJLNLB.CMF and SJLVLB.CMF all carry out the example simulation from section 2.2.2 of GPD-1. The files SJEQ.CMF and SJLBJ.CMF are those used in section 2.10 of GPD-1. The Command file SJLABEL.CMF can be used to add set and element labelling to a version of the base data for Stylized Johansen, as described in Step 3 in section 3.4.1 of GPD-1. The Command file SJENV.CMF can be used to set up and save an Environment file for the mixed version SJ.TAB.

The following table summarises the Stored-input files and their uses. Only the files for the mixed version of Stylized Johansen are supplied in the model examples.

Program	**Stored-input Files**	Use
GEMPIE	***SJLBG.STI***	print out results
TABLO	***SJCOND.STI***	condense SJ model

SJLBG.STI can be used with GEMPIE to select just some of the results from the SJLBJ.CMF simulation to print. SJCOND.STI (and SJCONDGS.STI and SJCONDTG.STI) can be used to condense the Stylized Johansen model as in section 3.9.1 of GPD-1 to produce either output for GEMSIM or a TABLO-generated program.

An example of a TABLO Input file used to check whether the data base is balanced and all data is non-negative is given in ***SJCHK.TAB*** with associated Command file ***SJCHK.CMF***. This TABLO Input file carries out data manipulation but does not carry out any simulation.

1.2 Miniature ORANI MO

This is a pedagogical model designed to introduce some of the essential ideas behind the ORANI model of the Australian economy (see sections 3-9 of Dixon *et al* (1982)).

The files are

	Mixed	Linear
TABLO Input file	***MO.TAB***	***MOLN.TAB***
Header Array data file	***MO.DAT***	(same)
Command file	***MOTAR.CMF***	***MOLNTAR.CMF***
Stored-input file (condense)	***MOCON.STI***	
Command file (condensed)	***MOCONTAR.CMF***	

Run TABLO with the TABLO Input file *MO.TAB* to produce GEMSIM Auxiliary files or the TABLO-generated program. You can then use the Command file *MOTAR.CMF* to carry out the tariff simulation described in section 8.4 of Dixon et al (1982).

Alternatively run TABLO with the linearized TABLO Input file *MOLN.TAB*. The Command file *MOLNTAR.CMF* carries out the same simulation on the linear model.

The Stored-input file *MOCON.STI* will enable you to run TABLO to condense the mixed version of the model. With this condensed version, use Command file *MOCONTAR.CMF* to carry out the same simulation.

1.3 Trade Model TRADMOD

This is a flexible multi-country trade model documented in Hertel *et al* (1992).

The relevant files are

TABLO Input file	***TRADMOD.TAB***
Header Array data file	***TRADMOD.DAT***
GEMPACK Command file	***TRADSIM.CMF***

The TABLO Input file is as in Appendix B of Hertel *et al* (1992) and the data file is as described in Table 2 and Appendix A there. The Command file *TRADSIM.CMF* can be used with GEMSIM or the corresponding TABLO-generated program to carry out the simulation introducing a 20% subsidy on the output of US food (see section V and Table 3 of Hertel *et al* (1992)). This model is usually not condensed.

1.4 ORANI-type Single-Country Model ORANI-G

ORANI-G is a general-purpose version of the ORANI model which is used in Practical GE Modelling Training Courses, held at the Centre of Policy Studies, Monash University. It has been used for models of several countries, including Australia, Korea, South Africa, Taiwan and Thailand.

Documentation for this model is available on the GEMPACK Web site at address

http://www.monash.edu.au/policy/gempack.htm

The relevant files are

TABLO Input files	***ORANIG98.TAB***
Condensation files	***ORANIGGS.STI, ORANIGTG.STI***
Header Array data file	***ORANG867.HAR***
Command files	***ORANIGSR.CMF, ORANIGLR.CMF***

The TABLO Input file ORANIG98.TAB is as used in the Practical GE Modelling course held at Monash University in June 1998. Run TABLO with either of the Stored-input files ORANIGGS.STI (produces output for GEMSIM) or ORANIGTG.STI (produces a TABLO-generated program) to condense the model.

The data supplied in ORANG867.HAR is 23-commodity, 22-industry 1986/87 data for Australia.

The Command file *ORNG98SR.CMF* is for a simulation with a Short Run closure and *ORNG98LR.CMF* is a simulation with a Long Run closure.

1.5 Single Country Model of Australia ORANIF

This is a 22-sector version of the ORANI-F model of the Australian economy which was used over several years until about 1992 by Peter Dixon and colleagues for forecasting and policy analysis. This model contains limited dynamics, in that it tracks accumulation of capital and national debt over the period (often 6 years) of a simulation.

The ORANI-F model is essentially ORANIG (see the section above) with limited dynamics added. If you wish to build a single-country model, we strongly recommend that you start with ORANIG rather than ORANIF. [Dynamics can always be added later. The way this is done in ORANIF is perhaps no longer the preferred way of doing this.] For this reason, the ORANIF files are supplied on PCs in a single ZIP file ORANIF.ZIP rather than separately as for the other models. Use the command

```
pkunzip oranif
```

to unzip these files on a PC computer.

There are two versions of ORANIF supplied with GEMPACK.

The model is documented in Horridge *et al* (1993) [**HPP**] which gives the linearized TABLO Input file *ORANIF.TAB*. A second version is a mixed levels/linear version; this TABLO Input file *ORANIFM.TAB* is listed in Harrison *et al* (1993b) and discussed in Harrison *et al* (1993a).

The files are

	Linear	Mixed
TABLO Input file	***ORANIF.TAB***	***ORANIFM.TAB***
Header Array data file	***ORANIF.DAT***	(same)
Stored-input files	***ORANIF.STI***	***ORANIFM.STI***
	ORFJ8.STI	***ORFJ8MIX.STI***
	ORFG8.STI	***ORFG8MIX.STI***
GEMPACK Command files	***ORFJ8.CMF***	***ORFJ8MIX.CMF***
	ORFG8.CMF	***ORFG8MIX.CMF***

ORANIF.STI is the Stored-input file for TABLO to carry out the condensation of the linearized version of the model used for the simulations reported in section 7 of HPP. The GEMPACK Command files *ORFJ8.CMF* and *ORFG8.CMF* (used via the associated Stored-input files *ORFJ8.STI* and *ORFG8.STI* which also contain the data required "from the terminal") carry out, with this condensation of the linearized version, the Johansen and Gragg versions of the forecasting simulation reported in section 7 of HPP. In particular they produce the results in columns VIII and IX of Tables 4 and 5 of HPP.

Similarly *ORANIFM.STI* is the Stored-input file for the condensation of the mixed version.

1.6 Global Trade Analysis Project GTAP

GTAP, the Global Trade Analysis Project's model, can be used to analyse trade issues. It is a multi-regional model and is described in Hertel (1997). Several different aggregations (of commodities and/or countries) are available from the Project. Two of these aggregations are usually supplied with GEMPACK; these are the 3x3 aggregation and a 10x10 aggregation known as aggregation number 6 (see chapter 6 of Hertel (1997)).

The file GTAP94.TAB contains a 10-commodity, 10-sector version of the April 1995 version of GTAP (the Global Trade Analysis Project's model). Also supplied (for use with the Demonstration Version of GEMPACK or on machines with limited memory) is GTAP3X3.TAB which is a 3-commodity, 3-region version of GTAP94.TAB.

The GTAP files distributed with GEMPACK have had their names changed from the standard GTAP names. Those distributed with GEMPACK all have names beginning with the letter "G". For example, the files with standard GTAP names DAT2-01.HAR, SHK2-01.CMF, TP1010TG.STI and C2-06E1.CMF are called GDAT2-01.HAR, GSHK2-01.CMF, GTAP10TG.STI and GC2-06E1.CMF respectively when distributed with GEMPACK.

The relevant files are

TABLO Input files	***GTAP3X3.TAB***	***GTAP94.TAB***
Condensation files	***GTAP33TG.STI***	***GTAP10TG.STI***
	GTAP33GS.STI	***GTAP10GS.STI***
Header Array IO data files	***GDAT2-01.HAR***	***GDAT2-06.HAR***
Header Array set data files	***GSET2-01.HAR***	***GSET2-06.HAR***
Text Parameter files	***GPAR2-01.DAT***	***GPAR2-06.DAT***
Command files	***GNUM2-01.CMF***	***GC2-06E1.CMF***
	GTMSEU33.CMF	
	GCAPMRGE.CMF	
Shock file		***GTXS2-06.SHK***

Also supplied are TABLO Input files *GTAPCHK.TAB* and *GSHOCKS.TAB*. The first is for checking and reporting various features of the data base, while the second can be used to compute shocks for certain simulations of interest to trade modellers. Command files *GCHK2-01.CMF* and *GSHK2-01.CMF* can be used with these TABLO Input files.

More information about these files can be found in the file GTAP94.DOC distributed with GEMPACK.

The TABLO Input files and data files are those used in the 1995 Short Course in Global Trade Analysis, and are as documented in Hertel (1997). Modellers interested in using the GTAP model for serious policy work are advised to contact Professor Tom Hertel at Purdue University for more information about the Global Trade Analysis Project and up-to-date versions of this model and associated data.

1.7 Dervis, De Melo, Robinson Model of Korea DMR

This is the well-known Dervis, De Melo, Robinson model of Korea, as documented in Chapter 4 of DPPW.

The relevant files are

TABLO Input file	***DMR.TAB***
Header Array data files	(see below)
GEMPACK Command files	***DMREQ.CMF, DMRSIM.CMF***

For this model there are three Header Array data files, namely *DMRIO.DAT*, *DMRPAR.DAT* and *DMREXTRA.DAT*.

The TABLO Input file is a direct implementation of the linearized equations of the model as documented in Chapter 4 of DPPW. This implementation contains no UPDATE statements and so can only be used for Johansen simulations. The data files contain the data in Appendix 4.1 of DPPW.

Run TABLO with the TABLO Input file *DMR.TAB*. Then to produce an Equations file, run GEMSIM or the TABLO-generated program DMR taking input from the Command file *DMREQ.CMF*. The Command file *DMRSIM.CMF* can be used to run SAGEM (not GEMSIM or the TABLO-generated program - see section 4.1 and Figure 4.1 in GPD-1) to carry out the Johansen version of the simulation described in Exercise 4.15 of DPPW, the results of which can be found in Appendix 4.2 of DPPW.

1.8 Intertemporal Forestry Model TREES

This is a stylized model of forestry designed to show how intertemporal models are implemented within GEMPACK, described in Codsi *et al* (1992).

The relevant files are

TABLO Input file	***TREES.TAB***
Text base data file	***TREES20.DAT***
Time data file	***EVEN2080.DAT***
GEMPACK Command file	***TREESP.CMF***
Stored-input file	***TREESP.STI***

The TABLO Input file is as in Appendix of Codsi *et al* (1992) while the base data file *TREES20.DAT* contains the steady state data described in section 6 there. The Command file *TREESP.CMF* enables you to simulate the effect of a 10% increase in the price of trees in years 8 and onwards (announced at year 0), using a grid with 20 equal intervals over an 80 year time span. Note that this model requires input from the terminal - see the comments in TREESP.CMF. The Stored-input file TREESP.STI gives the relevant input to run the simulation in TREESP.CMF including terminal input and should be used to run the TREESP simulation if you are using WinGEM.

1.9 Single Sector Investment Model CRTS

This is a single-sector investment model, described in Wilcoxen (1989) or Exercises 5.1-5.4 of Chapter 5 of DPPW.

The relevant files are

TABLO Input file	***CRTS.TAB***
Text base data file	***CRTS20.DAT***
Time data file	***EVEN2080.DAT***
GEMPACK Command file	***CRTSDIV.CMF***
Stored-input file	***CRTSDIV.STI***

These files let you simulate a doubling of the dividend tax rate in years 8 to 80 (announced at year 0), using a grid with 20 equal intervals over an 80 year time span. (You might like to compare your results with those for Exercise 5.5(b) in DPPW.) (See section 6.6 of the READ.ME file supplied with Pearson (1992) to see why we recommend an 80 years time span rather than the 100-year time span in DPPW.) Note that this model requires input from the terminal - see the comments in CRTSDIV.CMF. The Stored-input file CRTSDIV.STI gives the relevant input to run the simulation in CRTSDIV.CMF including terminal input and should be used to run the CRTSDIV simulation if you are using WinGEM.

You can, of course, easily experiment with other grids.

1.10 Five Sector Investment Model 5SECT

This is a 5-sector investment model designed as an introduction to the issues involved in building and solving intertemporal models, also described in Wilcoxen (1989) or Part C of Problem Set 5 of DPPW.

The relevant files are

TABLO Input file	***5SECT.TAB***
Text base data file	***5SECT10.DAT***
Time data file	***GRIDH80.DAT***
GEMPACK Command file	***5SSIM.CMF***
Stored-input file	***5SSIM.STI***

The Command file is for carrying out a perfect foresight version of the dividend tax simulation described in Exercise 5.18(a) of DPPW - see also section 10.1 of Wilcoxen (1989). The grid in *GRIDH80.DAT* is an uneven, 10-interval grid over an 80 year time span (rather than the 100 year time span used in DPPW and Wilcoxen (1989)). (See section 6.6 of the READ.ME file supplied with Pearson (1992) to see why we recommend an 80 years time span rather than the 100-year time span in DPPW.) Note that this model requires input from the terminal - see the comments in 5SSIM.CMF. The Stored-input file 5SSIM.STI gives the input to run the simulation including the terminal input and should be used to run the simulation 5SSIM if you are using WinGEM.

Chapter 2

2. Getting Started with GEMPACK via WinGEM

WinGEM is the Windows version of GEMPACK. WinGEM runs on 80386/80486/pentium PCs running Windows 3.1, Windows 95 or Windows NT.

If you are working on a Windows PC which has WinGEM installed, you should work through the examples in this chapter to familiarise yourself with GEMPACK. Otherwise (for example, if you are working on a Unix machine or a DEC Alpha/VMS machine or at the DOS prompt), you should work through the examples in chapter 3 to familiarise yourself with GEMPACK.

This chapter shows you how to use WinGEM and GEMPACK by giving you detailed instructions for carrying out various modelling tasks. The models used are some of the models described in chapter 1.

We suggest that readers new to WinGEM work through all of the Stylized Johansen examples (those in section 2.1). Then go on to the Miniature ORANI examples (section 2.2), or the GTAP examples (section 2.3) or the ORANIG examples (section 2.4) depending on your modelling interests.

Then, if you have Release 6.0 (or later) of GEMPACK, you may like to try using RunGEM for carrying out simulations with one of these models. A hands-on introduction to RunGEM is given in chapter 5.

The version of GEMPACK used in conjunction with the WinGEM examples in section 2 below must be Release 5.2 or later. You can carry out these examples with a Source-code version or an Executable-image version of GEMPACK. The examples below rely on files which are in the **Examples subdirectory** of your machine (usually C:\GP\EXAMPLES). [If you installed GEMPACK in a directory different from C:\GP, your Examples subdirectory will be the subdirectory EXAMPLES of the directory into which you installed GEMPACK.]

This document assumes that you have GEMPACK and WinGEM already installed on your PC. If you have a Source-code version of GEMPACK, the instructions for installing GEMPACK and WinGEM are given in GEMPACK document GPD-6. If you have an Executable-image version, these instructions are in GPD-7.

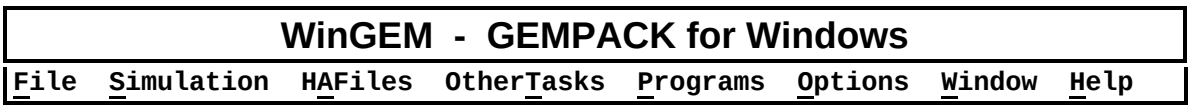
2.1 Examples using the Stylized Johansen Model SJ

This is the small example general equilibrium model designed as an introduction to building and solving such models (see Chapter 3 of Dixon *et al* (1992)). An introduction to this model is given in chapter 2 of the GEMPACK Document GPD-1 in section 2.2.1.

2.1.1 Starting WinGEM

If you are using Windows 95 or Windows NT and your Taskbar (it has the Start button on it) is along the top of your screen, we suggest that you move it to the bottom of the screen before running WinGEM. To move the Taskbar, click on it with your mouse, drag it towards the bottom of the screen and then let go.

In Windows or Windows 95, double click on the ***WinGEM*** icon to start GEMPACK for Windows. This should give the main WinGEM menu, as shown below, across the top of the screen.



You may need to look closely to see this since WinGEM is rather self-effacing and only occupies a small part of the top of you screen - the rest of the screen is as it was before you double-clicked on WinGEM.

2.1.2 Preparing a Directory for Model SJ

To keep all example files for the Stylized Johansen model together in one area, we show you how to create a separate directory **\SJ** for these files and how to copy the relevant files into this directory. This can be done by copying the files using File Manager in Windows 3.1 or Explorer in Windows 95 or NT, or by using either the DOS *copy* command.

To copy these files within Windows, change to File Manager in Windows 3.1 or Explorer in Windows 95 or NT by the usual Windows method. Use File Manager or Explorer to create a **new** folder or subdirectory called **\sj** and copy all the **sj*.*** files from the directory containing the GEMPACK model examples (usually C:\GP\EXAMPLES) to this directory **\sj**. Return to WinGEM to continue these examples.

Alternatively, to use DOS to copy the files, click on ***File*** in the main WinGEM menu. Select

Shell to DOS

to get to the DOS prompt. Then you can use the DOS Command

md \sj

to create this directory. To change to this directory and copy all the SJ*.* files from the directory containing the GEMPACK model examples (usually C:\GP\EXAMPLES), you can use the commands (you will need to change the second of these if your examples are not in C:\GP\EXAMPLES):

cd \sj
copy c:\gp\examples\sj*.*
dir

This should list about 20 files associated with the Stylized Johansen model.
Return from the DOS box to WinGEM by typing in ***Exit***

2.1.3 Setting the Working Directory

WinGEM uses the idea of a working directory to simplify choosing files and running programs. This working directory is where all the files for the model you are using are stored. It is important that you set the working directory before starting work on a model since then WinGEM knows in which directory the files for input are stored on the hard drive of your computer and in which directory it should write output files. These directories are known as the **default directories.**

For the Stylized Johansen model examples here, the working directory needs to be the directory **\SJ** you have just created. To set this, first click on

File

in the main WinGEM menu. This will produce a drop-down menu. In the drop-down menu, click on the menu item

Change both default directories...

The notation we use for this sequence of clicks is

File | Change both default directories...

In the file selection box that appears, choose drive **C:** (or the drive containing your directory \SJ if it is on a different drive). Then double-click on **C:** (this will be at the top of the list of directories shown) and then double-click on the subdirectory **SJ**. [Make sure that the directory name shown in blue above the selection box changes to C:\SJ (or D:\SJ etc if your \SJ directory is on another drive).] Click on the ***Ok*** button.

(This is similar to the DOS commands **C:** and **cd \sj**).

2.1.4 Editing Text Files in WinGEM

Now look at the TABLO Input file for the Stylized Johansen model. To do this, select

File | Edit file...

The Open box should list several files associated with the Stylized Johansen model.
If it doesn't list the files in directory SJ when the Open box appears, you should check that the working directory is set correctly (see the section 2.1.3 above) before proceeding.

Under the Edit File menu item, the type of files you can edit are all text (ASCII) files. (The editor you are using is called GEMEDIT which automatically saves files as text files.)

Select the TABLO Input file to edit:

SJ.TAB

Briefly look at this file since it is the starting point for the Stylized Johansen model. It contains the equations of the model in a form very like algebra. Search for the word **equation** by choosing on the GEMEDIT Menu bar ***Search | Find*** and typing in **equation** as the word to search for, and then typing a carriage-return. To search again after you have found the first occurrence of "GTAPDATA", you can either select ***Search | Search again*** from GEMEDIT's main menu or you can touch the **F3** key (near the top of your keyboard).[1] Use this technique to see the first 3-4 occurrences of equation. Look briefly at the equations listed in the section called "Formulas and levels equations" and also the linearized equations in the following section called "Equations".

Return to the top of the file (***Ctrl-Home*** goes to the top of the file[2], ***Ctrl-End*** to the bottom of the file) and ***Search | Find*** for the word **read** until you find the section called "Reads from the database". What is read in from file "iodata"?

Note that one way of marking text in GEMEDIT is to hold down the Shift key and use the Arrow keys to mark the text required. Then you can use ***Edit | Cut*** to cut and ***Edit | Paste*** to paste using the mouse, or use the familiar Windows keystrokes ***Ctrl - X*** to cut and ***Ctrl - V*** to paste.

Exit from GEMEDIT in the usual Windows way by ***File | Exit.***
(There are usually alternatives in terms of keystrokes instead of the mouse action. For example you can use keystrokes ***Alt*** followed by ***F*** followed by ***X*** in order to exit.)
[If you make any changes to SJ.TAB, make sure that you say "No" when asked if you want to save the changes.]

[1] This **F3** "keyboard shortcut" is indicated on the right-hand side of ***Search again*** under GEMEDIT's ***Search*** menu. You will find many other keyboard shortcuts indicated similarly in WinGEM's and GEMEDIT's main menus.
[2] For ***Ctrl-Home***, hold down the ***Ctrl*** key and then touch the ***Home*** key.

2.1.5 Looking at the Data Directly

Example 2.1.1 - Viewing the data directly using ViewHAR

The input-output data used in the Stylized Johansen model is contained in the data file SJ.DAT. This is a special GEMPACK *binary* file - called a **Header Array file** - so you cannot just look at it in a text editor. Instead you will look at SJ.DAT using one of the programs for reading Header Array files, called ViewHAR. Select from the main WinGEM menu :

HA Files | View VIEWHAR

The ViewHAR window will appear. Click on ***File | Open...*** and select the file SJ.DAT.

This will open the file SJ.DAT and show its contents on the Contents screen.

Each of the rows corresponds to a different array of data on the file. Look at the column under the heading Name to see what these arrays are.

	Header	Type	Size	Name
1	**CINP**	**RE**	**SECTxSECT**	**Intermediate inputs of commodities to industries..**
2	FINP	RE	SECTxFACT	Intermediate inputs of primary factors - dollar
3	HCON	RE	SECT	Household use of commodities - dollar values

The first array is the "Intermediate inputs of commodities to industries - dollar values".
The Header **CINP** is just a label for this array. (Headers can have up to 4 characters.)
The array is of Type **RE.** The **R** means this is an array of real numbers. The **E** means that this array has set and element labelling (see chapter 5 of GPD-4).

Double click on **CINP** to see the numbers in this array.
Compare these numbers with the input-output data for Stylized Johansen:

Input-Output Data Base for Stylized Johansen

		Intermediate Inputs to Industry 1	Industry 2	Households	Total Sales
Sectors	Commodity 1	4.0	2.0	2.0	8.0
	Commodity 2	2.0	6.0	4.0	12.0
Factors	Labor	1.0	3.0		4.0
	Capital	1.0	1.0		2.0
Total Costs		8.0	12.0	6.0	

To return to the Contents Screen, click on ***Contents*** in the ViewHAR menu.

Look at the other Header Arrays called **FINP** and **HCON** to see where their numbers fit in the Input-Output data base.

Close ViewHAR in the normal Windows way ***File | Exit.***

Example 2.1.2 - Looking at the data directly using SEEHAR

You may want to print out the data in the data files of a model. The program SeeHAR can be used to prepare a print file of all the data on a Header Array file.

In the WinGEM main menu, select

HA files | See SEEHAR...

A new SEEHAR window will appear.

In WinGEM you can have many windows open at once. (The only restriction is the size of the memory in your computer. If you want to close a particular window, for example the SEEHAR window, click on *File* | *Exit* in the SEEHAR menu. If you want to close all WinGEM windows, click on *File* | *Exit* in the main WinGEM menu.)

Click on the ***Select*** button and choose the file SJ.DAT.

Click on the ***Run*** button to run the program SeeHAR. When this has completed, click on the ***View File*** button to see the Print File SJ.SEE. The file SJ.SEE is a text file which could be printed out on a printer. (If an error occurs, you can use the View Log file button to see what has happened.)

Find the data at header **CINP** in this file, which should look like the box shown below.

```
Page 1 of Display of (all of) 'DVCOMIN(SECT,SECT)'.
This coefficient is of size 2x2.
(This data is at header 'CINP' on the file. Long name is
 'Intermediate inputs of commodities to industries - dollar values'.)
  ---------------------------------------------------------------

Next submatrix contains numbers from DVCOMIN(SECT,SECT) part,which are
  positions (1-2, 1-2) of DVCOMIN(SECT,SECT).

  COLUMN                1           2         ROW
  ROW                                         TOTALS
 No. Name             s1          s2
   1 s1             4.000000    2.000000    6.000000
   2 s2             2.000000    6.000000    8.000000
   COLUMN
   TOTALS           6.000000    8.000000   14.000000
```

DVCOMIN is the name used for this data in the TABLO Input file for the Stylized Johansen model.

The actual data in the file at this header is just the 2x2 matrix. SeeHAR calculates and shows the row and column totals. [You may have noticed in Example 1.1 above that ViewHAR also shows row and columns totals.]

Use the Page Down key to find the DVFACIN data at Header FINP and find out how much Labor is used by Sector s2.

Click on ***File | Exit*** to exit from the editor. Click on ***File | Exit*** to exit from the SeeHAR window.

2.1.6 Simulations with the Stylized Johansen Model

The following examples show you how to carry out simulations with an economic model. The Stylized Johansen model is a simple model used for teaching. An introduction to this model is given in chapter 2 of the GEMPACK Document GPD-1 in section 2.2.1.

As an example of a simulation, you will work below with a closure with supplies of the two factors, labor and capital, as exogenous variables. This means you will specify the percentage changes in the variable for supply for factors XFAC, (its percentage change is called p_XFAC), and solve the model to find the percentage changes in all the other variables. For this simulation you will increase the supply of labor by 10 percent and hold the supply of capital fixed.

2.1.7 TABLO-generated Program or GEMSIM?

If you have the source-code version of GEMPACK, you will usually carry out simulations using a TABLO-generated program; the steps in this case are spelled out in section 2.1.8 below. Alternatively, you could also use the GEMSIM method (as spelled out in section 2.1.9 below) so you might like to learn about this method also. Note that, except with small models, you will usually find that using a TABLO-generated program is quicker.

If you have an executable-image version of GEMPACK, or the Demonstration version of GEMPACK, you must carry out simulations using the program GEMSIM; the steps in this case are spelled out in section 2.1.9 below.

In either case we illustrate the steps for the Stylized Johansen simulation described in section 2.2.2 of GPD-1. Of course the simulation results are the same whichever method you use. If you don't have the Source-code version, please skip section 2.1.8 and go straight to section 2.1.9.

2.1.8 The Example Simulation using a TABLO-generated Program

From the WinGEM menu at the top of the screen choose ***Simulation***. In the drop-down menu the choices are

TABLO Implement
Compile & Link
Run TG Program
GEMSIM Solve
SAGEM Johansen Solve
GEMPIE Print

The items from this menu you will be using in this simulation are

TABLO Implement
Compile & Link
Run TG Program

GEMPIE Print

In the next three examples we are assuming that you have a Source-code version of GEMPACK and also have access to a Lahey Fortran compiler (either F77L3 or LF90) which should be on your DOS PATH.

However you may be using the Executable Image version of GEMPACK without a Fortran compiler. In this case the menu item "**Compile & Link**" will appear greyed out in the above menu. If so, please skip the rest of this section 2.1.8 and jump ahead to the section 2.1.9 headed "The Example Simulation using GEMSIM" where you will carry out the same simulation another way.

The reason why we give these examples first is that for large models it is faster to use TABLO-generated program method (Examples 2.1.3 - 2.1.5 below) than the alternative GEMSIM method (Examples 2.1.6 - 2.1.8 below).

In the TABLO-generated program method, the GEMPACK program TABLO is used to convert the algebraic equations of the economic model into a Fortran program specific to your model. The Fortran program written by TABLO (which is referred to as the **TABLO-generated program** or **TG Program** in the above menu) is compiled and linked to a library of GEMPACK subroutines. The executable image of the TABLO-generated program produced by the compiler is used to run simulations on the model (instead of using the program GEMSIM). This method provides faster execution times for large models but means you must have an appropriate Fortran compiler.

There are three steps involved in carrying out a simulation using GEMPACK.

Step 1 - Implement the model

Step 2 - Solve the equations of the model

Step 3 - Look at the results

WinGEM will guide you through these steps and indicate what to do next.

Example 2.1.3 - Step 1 - Implementing the model SJ using TABLO

The TABLO Input file is called **SJ.TAB**. It contains the theory of the Stylized Johansen model. Choose

Simulation | TABLO Implement...

A window for TABLO will appear. Click on the ***Select*** button to select the name of the TABLO Input file **SJ.TAB** (which you have looked at earlier in the editor). This is all TABLO needs to implement the model.

In the menu for the TABLO window, select ***Options*** menu item. Then in this menu choose

TABLO Options...

A new TABLO Options window will appear giving many and varied special options for TABLO. Ignore all options for now except the two in the top left hand corner which read

```
O   PGS  Generate GEMSIM auxiliary files
O   WFP  Generate Fortran code
```

There is a black dot in one of the buttons. Click on the second option **WFP** because we want you to create the TABLO-generated Fortran program. Then click on the ***Ok*** button to return to the TABLO window.

Click on the ***Run*** button. The program runs TABLO in a DOS box and when complete, returns you to the TABLO window with the names of files it has created: the Information file SJ.INF and the Log file. Look at both of these files by clicking the ***View*** buttons beside them.

The Information file SJ.INF gives information about the TABLO Input file such as whether there are any syntax or semantic errors found by the program TABLO when it was checking the TABLO Input file. Search the file for %% to see if there are any errors. Search the file for "syntax error" to see how many syntax errors and semantic problems there are (hopefully none). Go to the end of the file to see what actions can be carried out by the TABLO-generated program produced in this TABLO run.

When you have looked at these two files, click on the ***Go to Compile and Link*** button at the bottom of the TABLO window to run the Fortran compiler. (Alternatively you can start this window by choosing *Simulation | Compile and Link...* from WinGEM's main menu.)

In the Compile and Link window, the file SJ.FOR is already selected as the TG Program Name. Click on the button ***Compile and Link*** and wait a little while the compiler converts the Fortran file SJ.FOR into the executable image SJ.EXE.

When finished, click on the button ***Go to 'Run TG Program'*** to proceed to the next step in running a simulation: Step 2 - Solve the equations of the model.

Example 2.1.4 - Step 2 - Solve the equations of the model

The button takes you to the window for running the TABLO-generated program SJ.EXE. (Alternatively you can start this window by choosing *Simulation | Run TG Program...* from WinGEM's main menu.)

See Section 2.8 of the GEMPACK document GPD-1 for details on how to specify a simulation and the use of Command files.

First ***Select*** the Command file called SJLB.CMF. Since Command files are text files, look at this Command file in the text editor by clicking the ***Edit*** button.

How is the closure specified? What shock is applied? What is the name of the Solution file? What data file is used by this model? How many steps are used in the multi-step solution? (***File | Exit*** to return to the "Run TG Program" window.)

Click on ***Run*** to run SJ.EXE with the Command file SJLB.CMF.

[If there is an error, view the Log file and try to rectify the error.]

There is no point in trying to look at the Solution file directly because it is a binary file, not a text file. There are two ways of looking at the Solution results. The first is to view them with ViewSOL, the Windows solution viewer. The other is to use program GEMPIE to convert the solutions into a Print file that can be edited or printed out. The examples below show you these two alternatives.

Example 2.1.5a - Step 3 - Look at the results with ViewSOL

Click on the button ***Go to ViewSOL*** This will run ViewSOL and open the Solution file SJLB.SL4 created on the previous example. [An alternative way of running ViewSOL is to select from the main WinGEM menu *Other tasks* | *View Solution (ViewSOL)* and open the Solution file you want to view.]

You will see the **Contents** page listing many of the variables of the model. ViewSOL has 3 slightly different formats for this Contents list. Select ***Format...*** from ViewSOL's main menu and there click on ***Arrange vectors by name*** (in the panel headed Vector options); then click ***Ok*** which will put you back to the Contents list.

To see the results of one of these variables listed by name, just **double-click** on the corresponding row in the Contents list. First double-click on the **p_XCOM** row to see the results for this variable (quantity of household consumption of the two commodities). Select 3 decimal places (see the third drop-down list box along the top row of the current ViewSOL window - the only one with a single figure in it). Then you should see something like the following:[3]

p_XCOM	sjlb	Pre sjlb	Post sjlb	Chng sjlb
s1	5.885	8.000	8.471	0.471
s2	6.899	12.000	12.828	0.828

Across the **s1** row you see the percentage change result (5.885%), the pre-simulation levels value (8.000), the post-simulation levels value (8.471) and the change (0.471); these are the results for the total supply of commodity **s1**.

Then click on ***Contents*** to return to the Contents list.

To see the **p_XFAC** results, double-click on this row. You will see

p_XFAC	sjlb	Pre sjlb	Post sjlb	Chng sjlb
labor	10.000	4.000	4.400	0.400
capital	0	2.000	2.000	0

This time all the numbers are in red which is used to remind you that, for this simulation, both components of this variable p_XFAC are exogenous. You should easily be able to understand all of these results.

Then click on ***Contents*** to return to the Contents list.

To see the **p_XC(i,j)** results [intermediate inputs of commodity i into industry j], double-click on this row. Now you see

p_XC	s1	s2
s1	5.885	5.885
s2	6.899	6.899

and, in the second drop-down box you should see "**1 sjln**". This indicates that you are just seeing the linearized simulation results (the percentage changes in the four components of this variable). You can't see the pre- and post-simulation levels results at the same time since this variable p_XC is a matrix variable. To see the pre-simulation levels results, click on the second drop-down list

[3] You will only see the levels results if you are using Release 6.0 of GEMPACK.

box (the one showing "1 sjln") and select the second alternative ("2 Pre sjln"). Then you will see the pre-simulation levels results. You might also like to look at the post-simulation levels results and the changes.

Then click on ***Contents*** to return to the Contents list.

To see the effects of another useful way of listing the variables in the **Contents** page, select ***Format...*** from ViewSOL's main menu and there click on ***Arrange vectors by size AND set*** (in the panel headed Vector options); then click ***Ok*** which will put you back to the Contents list. You should see something like:

```
Variable        Size     No.    Name
Macros          1        1
Vectors size:   2 FAC    2
Vectors size:   2 SECT   4
p_XC            2*2      1      Intermediate inputs of commodity i
                                          to industry j
p_XF            2*2      1      Factor inputs to industry j
p_DVCOMIN       2*2      1      Dollar value of inputs of commodity
                                       i to industry j
p_DVFACIN       2*2      1      Dollar value of factor f used in industryj
```

To see the results for all variables with a single argument ranging over the set **FAC**, double-click on the second of the rows above (the one below "Macros"). This time you will see the linear (percentage-change) results for the two such variables, p_PF and p_XFAC. Again you can see the other results by making a selection in the drop-down list box controlling which lot of results you are viewing (the one showing "1 sjln" at present). When you have finished looking at these results, click on ***Contents*** to return to the Contents list.

When you have finished looking at the results, exit from ViewSOL. This will return you to the screen for the simulation and you can use the other method of looking at the results by using the program GEMPIE.

Example 2.1.5b - Step 3 - Look at the results using GEMPIE

Click on the *Go to GEMPIE* button in the TABLO-generated program window from Example 2.1.4 above; this will take you to a GEMPIE window.
(Alternatively you can start this window by choosing *Simulation | GEMPIE Print...* from WinGEM's main menu.)

The Solution file is already selected. Click on ***solutions?*** to see what solutions are available for printing. Click the ***Ok*** button to continue.

Click on ***Run*** to run the program GEMPIE. Check that a GEMPIE Print file (called SJLB.PI5) has been created.

To see your results, examine the results in file SJLB.PI5 using ***View File***. What are the percentage changes in the prices of the two factors, labor and capital? (***File | Exit*** to return to the GEMPIE window.)

This completes the simulation. We suggest that you close all open windows (the GEMPIE, Run TG Program, Compile & Link, and TABLO windows) by selecting ***File | Exit*** in each one. But leave WinGEM running.

2.1.9 The Example Simulation using GEMSIM

In the previous section 2.1.8 we assumed that you have a Source-code version of GEMPACK and also have access to a Lahey Fortran compiler (either F77L3 or LF90) which should be on your DOS PATH.

However if you are using the Executable-image version or the Demonstration version of GEMPACK, the TABLO-generated program method used in that section is not available to you.

Now we will go on to show you an alternative method for carrying out a simulation using the program GEMSIM which is available for Source-code, Executable-image and Demonstration versions. GEMSIM can solve the equations of the model in essentially the same way as the TABLO-generated program SJ.EXE used in the previous examples. The difference is that the program SJ.EXE is specific to the Stylized Johansen model but the program GEMSIM can be used for any model.

In the WinGEM menu at the top of the screen choose ***Simulation***. In the drop-down menu the choices are

TABLO Implement
Compile & Link
Run TG Program
GEMSIM Solve
SAGEM Johansen Solve
GEMPIE Print

The items from this menu you will be using in this simulation are

TABLO Implement

GEMSIM Solve

GEMPIE Print

TABLO, GEMSIM and GEMPIE are the names of programs used to carry out the three steps of a simulation :

Step 1 - Implement the model

Step 2 - Solve the equations of the model

Step 3 - Look at the results

WinGEM will guide you through these steps and indicate what to do next.

Example 2.1.6 - Step 1 - Implementing the model SJ using TABLO

The TABLO Input file is called **SJ.TAB**. It contains the theory of the Stylized Johansen model. Choose

Simulation | TABLO Implement...

A window for TABLO will appear. Click on the ***Select*** button to select the name of the TABLO Input file **SJ.TAB** (which you have looked at earlier in the editor). This is all TABLO needs to implement the model.
In the menu for the TABLO window, select the ***Options*** menu item. Then in this menu choose

TABLO Options...

A new TABLO Options window will appear giving many and varied special options for TABLO. Ignore all options for now except the two in the top left hand corner which read

```
O   PGS  Generate GEMSIM auxiliary files
O   WFP  Generate Fortran code
```

There is a black dot in one of the buttons. Click on the first option **PGS** because we want you to create the GEMSIM Auxiliary files. Then click on the ***Ok*** button to return to the TABLO window.

By "implement" we mean convert the TABLO Input file into binary computer files which are used in the simulation program GEMSIM in the next step. These files are referred to as Auxiliary files (or sometimes as the GEMSIM Statement and Table files) and in this case, are called SJ.GSS and SJ.GST.

Click on the ***Run*** button. The program TABLO runs in a DOS box and when complete returns you to the TABLO window with the names of files it has created: the Information file SJ.INF and the Log file. Look at both of these files by clicking the ***View*** buttons beside them.

The Information file SJ.INF gives information about the TABLO Input file such as whether there are any syntax or semantic errors found by the program TABLO when it was checking the TABLO Input file. Search the file for %% to see if there are any errors. Search the file for "syntax error" to see how many syntax errors and semantic problems there are (hopefully none). Go to the end of the file to see what actions GEMSIM can carry out with the Auxiliary files produced in this TABLO run.

When you have looked at these two files, click on the ***Go to GEMSIM*** button at the bottom of the TABLO window to go on to the next step in running a simulation: Step 2 - Solve the equations of the model.

Example 2.1.7 - Step 2 - Solve the equations of the model using GEMSIM

The *Go To GEMSIM* button takes you to the GEMSIM window. (Alternatively you can start this window by choosing *Simulation | GEMSIM Solve* from WinGEM's main menu.)

See section 2.8 of the GEMPACK document GPD-1 for details on how to specify a simulation and the use of Command files.

First ***Select*** the Command file called SJLB.CMF. Since Command files are text files,

look at this Command file in the text editor by clicking the ***Edit*** button.

How is the closure specified? What shock is applied? What is the name of the Solution file? What data file is used by this model? How many steps are used in the multi-step solution? (***File | Exit*** to return to the GEMSIM window.)

Click on ***Run*** to run GEMSIM with the Command file SJLB.CMF.

[If there is an error, view the Log file, and try to rectify the error.]

There is no point in trying to look at the Solution file directly because it is a binary file, not a text file. There are two ways of looking at the Solution results. The first is to view them with ViewSOL, the Windows solution viewer. The other is to use program GEMPIE to convert the solutions into a Print file that can be edited or printed out. The examples below show you these two alternatives.

Example 2.1.8a - Step 3 - Look at the results with ViewSOL

Click on the button ***Go to ViewSOL*** This will run ViewSOL and open the Solution file SJLB.SL4 created on the previous example. [An alternative way of running ViewSOL is to select from the main WinGEM menu *Other tasks* | *View Solution (ViewSOL)* and open the Solution file you want to view.]

Then proceed exactly as in Example 2.1.5a above.

When you have finished looking at the results, select ***File | Exit*** to exit from ViewSOL. This will return you to the screen for the simulation and you can use the other method of looking at the results by using the program GEMPIE.

Example 2.1.8b - Step 3 - Look at the results using GEMPIE

Click on the *Go to GEMPIE* button in the GEMSIM window from Example 2.1.7 above; this will take you to a GEMPIE window.
(Alternatively you can start this window by choosing *Simulation* | *GEMPIE Print* from WinGEM's main menu.)

Then proceed exactly as in Example 2.1.5b above.

Note that this Examples 2.1.8a and 2.1.8b are identical with Examples 2.1.5a and 2.1.5b above, when you were using the TABLO-generated program method.

This completes the simulation. We suggest that you close the windows for GEMPIE, GEMSIM, TABLO by choosing ***File | Exit*** in each separate window except the main WinGEM one. (Alternatively you can choose *File* | *Exit* in the main WinGEM window which will shut down all windows at once and exit from WinGEM.)

2.1.10 Source-code Version : Use GEMSIM or TABLO-generated Program?

Readers with a Source-code version of GEMPACK have the choice of using GEMSIM or the TABLO-generated program. (Readers with the Executable-image or Demonstration versions should ignore the following paragraph since they must use GEMSIM.)

For small models such as Stylized Johansen (section 2.1 here), Miniature ORANI (see section 2.2 below) or 3-region, 3-commodity GTAP (see section 2.3), GEMSIM is quite fast. TABLO-generated programs only give their great advantage with large models and/or more disaggregated data sets (see chapter 4).

2.1.11 The Updated Data - Another Result of the Simulation

Example 2.1.9 - Looking at the Updated Data

The line

```
updated file iodata = sjlb.upd ;
```

in the Command file SJLB.CMF means that, when you ran the simulation (Step 2, Examples 2.1.4 and 2.1.7 above), the software produced the so-called **updated data file SJLB.UPD**. This file contains the data as it would be after the shocks (in this case, the increase in labor supply) have worked their way through the model. This data represents the state of the economy after the shocks, which is why the updated data is sometimes referred to as the **post-simulation data**.

Use ViewHAR (Example 2.1.1) or SEEHAR (Example 2.1.2) to look at the updated data in file SJLB.UPD. You should see the values in the Table 2.1.11 (which are shown to 3 decimal places).

		Industry		Households	Total Sales
		1	2		
Commodity	1	4.235	2.118	2.118	8.471
Sectors					
Commodity	2	2.118	6.353	4.235	12.707
Labor	3	1.059	3.177		4.235
Factors					
Capital	4	1.059	1.059		2.118
Total Production		8.471	12.707	6.353	

Table 2.1.11: Updated Input-output Data in File SJLB.UPD

You can check that these post-simulation values are consistent with the results of the simulation as seen in Examples 2.1.5a,b or 2.1.8a,b above, and as discussed in section 2.7 of GPD-1. For example, the p_DVHOUS results show that the value of household expenditure on commodity s2 increased by 5.8853 percent from its pre-simulation value of 4 to its post-simulation value of 4.2354 (which agrees with the Commodity 2 Households value in the table above).

The most obvious results of a simulation are the percentage changes in the variables. The updated data (which is always obtained when you run a simulation) is another important "result" of the simulation, one which is sometimes overlooked. You can look at this updated data to see how the data base has changed as a result of the simulation.

2.1.12 Different Closures and/or Shocks

Example 2.1.10 - Changing the Closure and Shocks.

Several simulations can be carried out on the same model by changing the closure and/or the shocks as described in the Command file. The following example shows you how to make a new Command file in the text editor and then run another simulation using SJ.EXE (or alternatively GEMSIM).

To change the command file SJLB.CMF, copy it to a new name SJLB2.CMF as follows:
In the main WinGEM menu, choose ***File | Edit File...*** then open the file SJLB.CMF.
Click on ***File | Save As...*** and save the file under the new name SJLB2.CMF.

Then use the text editor to modify this file, following the steps below.

In the original closure, both components of p_XFAC (supplies of labor and capital) are exogenous. Here you keep the supply of capital exogenous, but set the price (rather than the supply) of labor exogenous. [p_PF is the variable in the model denoting the percentage change in the price of the factors, labor and capital.]

(1) Find the statement

exogenous p_xfac ;

and change this to

exogenous p_pf("labor") p_xfac("capital") ;

(Be careful not to leave a space between the variable name p_pf and the bracket. It does not matter if you use upper or lower case, or a mixture, in Command files.)

(2) Shock p_pf("labor"), the price of labor, by 3 per cent and
shock p_xfac("capital"), the supply of capital, by 10 per cent.
You will need **two** separate shock commands. The first is

shock p_pf("labor") = 3 ;

[Remember to put a semicolon **;** after each statement.]

(3) Change the name of the Solution file to **sjlb2**. Change the name of the updated file "iodata" to **sjlb2.upd.**

(4) Change the verbal description to describe the new closure and shocks. [This starts after "verbal description =" and ends with a semi-colon ";". There can be several lines of text in it.]

Exit from the editor after saving your changes.

Example 2.1.11 - Running the simulation with the new closure and shocks

If you have a Source Code version, click on ***Simulation | Run TG program...***
Then ***Select*** the TG Executable to be SJ.EXE.

If you have an Executable Image version, click on ***Simulation | GEMSIM Solve...***

Now both cases continue in the same way.

Select the Command file SJLB2.CMF.

Run the program with this Command file SJLB2.CMF. This is Step 2 of the simulation steps listed earlier.

If there are errors when this runs, you will see a window headed "Error during Simulation". To correct the errors in the Command file, click on the button ***Edit Command file*** to use split screen editing. The Command file SJLB2.CMF will be shown in the top part of the screen and the LOG file in the bottom part of the screen. Correct each error in the Command file and then click on the button ***Next error*** to go to the next one. When you have corrected all errors, use ***File | Exit*** and save the changes you have made to the Command file SJLB2.CMF. Then close the error window by clicking on ***Close*** in it. Now click on ***Run*** to run the simulation again.

When SJ.EXE (or GEMSIM) has run successfully, click on ***Go to GEMPIE*** and then run GEMPIE to prepare a Print file of the solution (Step 3 of the simulation). Look at the results of the simulation in the Print file SJLB2.PI5. [Alternatively, click on ***Go to ViewSOL*** and use ViewSOL to look at the results.]

Close the windows that are open using ***File | Exit.***

2.1.13 Correcting Errors in TABLO Input Files

Example 2.1.12 - Correcting errors in SJERROR.TAB

When you build your own model, you will need to correct errors in your TABLO Input file. In this example, we show you how to do this with a version of SJ.TAB which has a couple of the sorts of errors that all modellers make.

To begin, use ***File | Edit file...*** to open the file SJERROR.TAB. Then use ***Save As...*** to change the name to SJ3.TAB and then exit from the editor. [We ask you to do this so that the file SJERROR.TAB remains as it is for others to access on your machine.]

Now open a TABLO window via ***Simulation | TABLO Implement...*** and then, in this window, ***Select*** this TABLO Input file SJ3.TAB. Click on ***Run*** to run TABLO. Of course this run will find errors and so you will see a new window titled **Error running TABLO**. In this window, click on ***Edit TABLO file***. This will put you into an edit window in which the TABLO file SJ3.TAB is in the top part and the Information file SJ3.INF is in the bottom part. And the cursor is positioned in SJ3.TAB at the place where the first error is found.

You should see that the cursor is positioned at the start of the third of the three lines shown below.

```
VARIABLE (all,f,FAC)   PF(f)   # Price of factor f #
                               ! This is p:i (i=3,4) in DPPW !
VARIABLE (all,i,SECT)  XCOM(i)
```

The first two lines are the declaration of VARIABLE PF(f) and the third line is meant to be the start of the declaration of VARIABLE XCOM(i). But we have left out the semicolon required at the end of the second of these three lines (a very common error in TABLO Input files). So you should correct this error by adding a semicolon **;** at the end of the second of these three lines in the top part of the screen.

Now click on ***Next error*** to go to the next error. You will see that the cursor is now pointing in the top part of the screen to just before the "FACT" in the line below.

```
COEFFICIENT (all,f,FACT)(all,j,SECT)   ALPHAFAC(f,j)
```

In the Information file in the bottom part of the screen, the error is recorded as

```
87   COEFFICIENT (all,f,FACT)(all,j,SECT)   ALPHAFAC(f,j)
                          ?
 %% Semantic problem.
 Unknown set.
```

The **?** points just below "FACT" suggesting that this is where the error is. Indeed, this error has occurred because the set **FAC** has been incorrectly spelled (another common error) as **FACT** (with an extra T). Correct this error by deleting (in the top half of the screen) the extra T.

Now click on ***Next error*** to go to the next error. You will see, in the Information file

```
109   FORMULA (all,i,FAC) PF(i) = 1.0 ;
                           ?
 %% Semantic problem.
 Unknown coefficient or variable.
```

The **?** is pointing to **PF** and the message indicates that this is an unknown coefficient or variable. We know that this error is a consequence of the first error since a semicolon was omitted at the end of the declaration of this variable. You have already fixed that earlier error and there is nothing else to correct here. If you continue looking at the remaining errors you will see that they are all consequences of the first two errors which are now corrected. Thus you should use ***File | Exit*** to exit from SJ3.TAB, saving the changes. Then close the error window by clicking on ***Close***.

This should put you back to the TABLO window where you can click on ***Run*** to run TABLO again with the modified SJ3.TAB file. Hopefully this time you will find no errors.

This illustrates the procedure for removing errors from TABLO Input files. Run TABLO, use split screen editing to remove some errors and then rerun TABLO until all errors are eliminated.

2.1.14 Several Johansen Simulations

The GEMPACK program SAGEM can be used to carry out a simulation, and indeed, as we shall see in this section, several simulations at once. However these simulations produce somewhat less accurate solutions than the multi-step calculations carried out earlier, since the linearized equations of the model are only solved once.
Nonetheless, carrying out these simulations, which are referred to as **Johansen simulations** [4], can be quite revealing.

In many cases, the results are sufficiently accurate to produce the right qualitative results. Being able to compute several such solutions as quickly as one multi-step solution has its advantages, especially for a new model whose behaviour you are just beginning to understand.

The starting point is always the Equations file for the model which is produced by running the TABLO-generated program SJ.EXE or GEMSIM. The **Equations file** contains the numerical linearized equations of the model.

Example 2.1.13a - Preparing an Equations file for use by SAGEM

An Equations file for Stylized Johansen can be created by running the TABLO-generated program SJ.EXE or GEMSIM and taking inputs from the Command file **SJEQ.CMF.** You might like to look at this Command file in GEMEDIT (via ***File | Edit file…***). This file is discussed in section 2.10.1 of GPD-1.

In the main GEMPACK menu, select ***Simulation.*** Then select either ***GEMSIM Solve*** (or alternatively select ***RunTGProgram*** and select the TG Executable SJ.EXE)**.**

Select the Command file **SJEQ.CMF** and ***Run*** the simulation. Click on the button ***View Log File*** and look near the end of this file to see that the Equations file SJ.EQ4 has been created.

Example 2.1.13b - Carrying out the Johansen simulations with SAGEM

You will use the Command file **SJLBJ.CMF** for running SAGEM to carry out these simulations. This gives shocks of 1 percent to supplies of both labor and capital. We suggest that you first carry out the simulation, as described below. We will then discuss the results and tell you about the statements in this Command file.

Click on ***Simulation | SAGEM Johansen Solve...*** in the main WinGEM window.

Select the file SJLBJ.CMF and ***Edit*** to check that this Command file tells SAGEM

(i) to use the equations file SJ.EQ4 (made by the TABLO-generated program SJ.EXE or GEMSIM in the previous example)

```
use equations file sj ;
```

(ii) to create the Solutions file called SJLBJ.SL4 (the Command file just says "sjlbj" but SAGEM will automatically add the standard Solution file suffix ".SL4")

```
solution file = sjlbj ;
```

[4] The name pays tribute to Johansen who pioneered this way of obtaining useful, approximate solutions of general equilibrium models around 1960.

(iii) to give uniform shocks of 1 percent to supplies of the two factors using the command:

```
shock p_xfac = uniform 1 ;
```

(iv) to retain all individual column results using the command:

```
individually-retained exogenous %all ;
```

Then ***File | Exit*** to exit from the Command file.

To run this Johansen simulation, ***Run*** the program SAGEM.

Click on ***Go to GEMPIE*** (not *Go to ViewSOL* this time - see below) to create a print file of the results. You will be asked whether you want the individual column solutions or the totals solution. Select the ***individual column*** solutions.

Run GEMPIE to create the Print file SJLBJ.PI5. ***View file*** to see the results of the simulation. [You might like to check that your results are the same as those shown in Table 2.10.3 of GPD-1.]

How many columns of results are there? Each column contains a different solution. What are the shocks associated with each of the columns? [The first column contains the results of a 1% increase in the supply of labor, holding the supply of capital fixed. These results in more detail in section 2.10.3 of GPD-1.]

Note that in this case, where the most interesting results are individual column results, we suggested that you use GEMPIE rather than ViewSOL for looking at the results. This is because ViewSOL can only look at the single Totals solution (in this case, the combined effect of the shocks to supplies of both labor and capital). However, you can use GEMPIE to look at either the individual column results or the Total solution.

This completes the Johansen simulation. Use ***File | Exit*** to close the GEMPIE and SAGEM windows.

2.1.15 Creating the Base Data Header Array File

[This topic is discussed in section 3.4.1 of GPD-1.]

Example 2.1.14 - Making a data file for Stylized Johansen using MODHAR

In the editor (use ***File | Edit file...*** in WinGEM's main menu), view the text file SJDAT.TXT. This is a text version of the data base for Stylized Johansen (see Example 2.1.1 above). What are the sizes of the arrays in this file? What are the Headers called for the three arrays?

Here we show you how to run the program MODHAR to convert the data in the text file SJDAT.TXT to a Header Array file.

Choose ***Programs | Run programs interactively...*** from the main WinGEM menu.

Start the program MODHAR running by clicking on the ***MODHAR*** button.

To run programs listed under the Programs menu item, you need to respond to prompts from inside the program. The User Input is shown below but you do not need to type in the exclamation mark ! or anything after it on a line. (Comments start with an exclamation mark.)

Type in the User Input as shown in the box below (just the bold text).

Input for MODHAR to Recreate Data File for Stylized Johansen

```
<carriage-return>     ! Use default program options
n                     ! Not based on old file (creating a new one)
sj2.dat               ! Name of file to be created
at                    ! Add arrays from a text file
sjdat.txt             ! The name of the text file
a                     ! Add all arrays from this file
ex                    ! Exit (There is no more data to add.)
<Your name>           ! Your name
Standard input-output data for Stylized Johansen model. ! History
**end                 ! end the history
y                     ! Yes, this history is what I wanted
```

When MODHAR finishes running, you need to press any key to close the DOS box.

You may wish to check that the file SJ2.DAT has been created. You can examine the data on it by running ViewHAR or SEEHAR.

[Full details on using the program MODHAR to create or modify data files are given in the GEMPACK document GPD-3.]

Example 2.1.15 - Adding Set and Element Labelling to this file

Ideally Header Array files include set and element labelling (see chapter 5 of GPD-4). Then, when the data on these files is examined (for example, via the programs SEEHAR or ViewHAR), this labelling makes it clearer which commodities (etc) the data correspond to. The file SJ2.DAT produced above does not yet have this labelling.

There are various ways of adding the labelling. Perhaps the simplest is to run a simulation in which zero shocks are given. The updated data will then be identical (in values) to the original data. However, the software adds set and element labelling to this updated data.

To do this for the Stylized Johansen data, you can use the Command file SJLABEL.CMF.

First look at this file to see that it gives a zero shock and to check the name of the updated data it will produce.

Then carry out a simulation (as in Step 2 Examples 2.1.4 or 2.1.7), taking inputs from this Command file SJLABEL.CMF. You can then use the "updated" data file SJLABEL.DAT in place of SJ2.DAT since it has the same data and also set and element labelling.[5]

[5] If you wish, you use ViewHAR to see the difference between the unlabelled SJ2.DAT produced after Example 2.1.14 and the labelled SJLABEL.DAT produced after Example 2.1.15.

2.1.16 Modifying Data on a Header Array File

The program MODHAR is used to modify data on a Header Array file.

Example 2.1.16 - Modifying a data file using MODHAR

Once you have created the Header Array file or files for your model, you may wish to change the data. You can do this either by editing the text file used with MODHAR to create the original file (as in the example 2.1.14 above) and then re-running MODHAR, or by running MODHAR to modify the data on the Header Array file directly.

Here is a simple example of the second method, showing how you can use MODHAR to modify data on the Header Array file *SJ.DAT*. Suppose that you want to change the input-output data base for Stylized Johansen so that industry 2 uses an input of 7 (million) dollars' worth of commodity 2 (rather than 6 as in the standard data above).

If you run MODHAR and give the following responses, the new file (SJMOD.DAT) created will have this change incorporated in it.

Example of Responses to MODHAR to Modify Data for Stylized Johansen

```
<carriage-return> ! Use default program options
y                 ! Is based on existing file
sj.dat            ! Existing file (as created above)
sjmod.dat         ! New file to be created, containing modified data
               (A typical set of responses to change data in one array)
mw                ! Modify and write one array
CINP              ! Header whose associated data is to be modified
m                 ! Modify the data
r                 ! Replace (not scale)
o                 ! One entry
2  2  7.0         ! Replace entry in row 2 and column 2 by value 7.0
w                 ! Write the modified data
n                 ! Do not use this as basis for another array
                 (Now exit, transferring unchanged the other 2 arrays)
ex                ! Exit
a                 ! Transfer all other arrays
<Your name>       ! Your name
Modified input of commodity 2 to industry 2       ! History
from 6 to 7.                                      ! History
**end             ! End of history
y                 ! Yes, this is what I want
```

More complicated changes would require more complicated responses. But the general idea should be clear from the above. Note that, when you actually run MODHAR, it gives you information confirming initial values and new (modified) ones.

As you will be aware. changing just one value on an input-output table (as we have suggested you do above) is not usually a good idea since it is likely to upset the balance of the data (though, in fact, the change above does not). So, while the example above is a good introduction to MODHAR, you should not make isolated changes to input-output data without taking the steps required to re-balance the data, if necessary.

Complete documentation for MODHAR is given in GPD-3.

2.1.17 Condensing the Model

Example 2.1.17 - Condensation of Stylized Johansen using TABLO

When large models are implemented, it is usually necessary to **condense** the model. This means carrying out algebraic substitutions to reduce the size of the system of linear equations solved at each step of a multi-step calculation. The concept of condensation is discussed in section 3.9 of GPD-1.

An example of condensation of the Stylized Johansen model is given below (although this is such a tiny model that it does not need to be condensed). This condensation is carried out by TABLO after the CHECK stage and before the TABLO-generated program or GEMSIM Auxiliary files are produced.

First select in the main WinGEM menu,

File | Change both default directories

Check that the working directory is the subdirectory \SJ where you installed the files for Stylized Johansen. Then from the main WinGEM menu choose

Simulation | TABLO Implement...

to open a TABLO Window.

In doing a condensation, you need to say which variables are to be condensed out and which equations are to be used. This information has been prepared in a Stored-input file (or STI file). To tell TABLO to use this file, choose **in the menu for the TABLO window**

Options | Run from STI file

and then ***Select*** the name of the Stored-input file. If you have a Source-code version of GEMPACK and want to create the TABLO-generated program, choose file SJCONDTG.STI. Alternatively choose SJCONDGS.STI, which will produce GEMSIM output.

Run TABLO. When TABLO has finished, view the Log file and the Information file to see that TABLO has completed successfully.

If you produced the TABLO-generated program SJCOND.FOR ***Go to Compile and Link*** and create the executable image SJCOND.EXE.

Example 2.1.18 - Running a simulation for Condensed SJ

To make a new Command file to run the simulation for the condensed model, copy the Command file SJLB.CMF to file SJCOND.CMF. To do this, choose from the main WinGEM menu

File | Edit file...

and select the file SJLB.CMF. Choose from the editor menu

File | Save As...

and save the file as SJCOND.CMF.

Edit the file SJCOND.CMF to change the name of the Auxiliary files and of the Solution file to SJCOND. Also change the name of the updated file iodata to **sjcond.upd**. Save these changes and exit from the editor.

Run the program SJCOND.EXE or GEMSIM by choosing from the main WinGEM menu

Simulation | TG program... (or alternatively ***Simulation | GEMSIM Solve...***)

In the TG program case, you need to ***Select*** the TG Executable to be SJCOND.EXE.

In both cases, ***Select*** the new Command file SJCOND.CMF and ***Run*** the program.

[If there are errors during this run, edit the Command file following the method in Example 2.1.11 above and then rerun the simulation.]

Choose ***Go to GEMPIE*** and ***Run*** GEMPIE with the new Solution file SJCOND.SL4 to make a Print file SJCOND.PI5.

Compare the two Print files SJCOND.PI5 and the Print file from the original simulation called SJLB.PI5. In the editor GEMEDIT using Split Screen Editing, you can have one file open in the main window and a second file open in the View Window and compare the two files. Or alternatively you can have two GEMEDIT windows open at once.

Alternatively you can use ViewSOL. First open one solution and then, without closing ViewSOL, open the second solution. Being able to have two or more solutions open at once is a useful feature of ViewSOL.

The results from the two simulations should be the same but not all variables are present in SJCOND.PI5. [For example, the p_XH results are not in SJCOND.PI5 since the variable p_XH has been substituted out via the instructions in Stored-input file SJCONDTG.STI or SJCONDGS.STI. You will see more about this in the example below.]

Example 2.1.19 - Backsolving using TABLO

If you have a Source-code version, edit the file SJCONDTG.STI and save it to a new name SJBACKTG.STI.

If you have an Executable-image version, edit the file SJCONDGS.STI and save it to a new name SJBACKGS.STI.

Then edit this new STI file (SJBACKTG.STI or SJBACKGS.STI) to

(1) change the "s" above p_XH to a "b" so that the variable p_XH is backsolved for, instead of being substituted out.

(2) change the name of the Information file and the Auxiliary files to SJBACK.

Exit from the STI file saving changes.

You also need a new Command file SJBACK.CMF to run a simulation with this version of the model. To create this, use ***File | Edit file...*** to edit SJCOND.CMF and then ***Save As...*** to

change the name to SJBACK.CMF. In this file, change all occurrences of **sjcond** to **sjback**. Now exit from SJBACK.CMF, saving the changes.

Now repeat the steps in the previous two examples replacing SJCOND by SJBACK throughout. That is,

(a) Run TABLO as in Example 2.1.17.

(b) If you have a Source-code version, compile and link to produce SJBACK.EXE.

(c) Run the program SJBACK.EXE or GEMSIM by choosing from the main WinGEM menu

Simulation | TG program... (or alternatively ***Simulation | GEMSIM Solve...***)

and ***Select*** the new Command file SJBACK.CMF and ***Run*** the program.

Choose ***Go to GEMPIE*** and ***Run*** GEMPIE with the new Solution file SJBACK.SL4 to make a Print file SJBACK.PI5.

Compare the files for SJCOND.PI5 and SJBACK.PI5 in the text editor (or ViewSOL) to see whether p_XH is present. Also note that the results for variables p_XC and p_XF are not in SJBACK.PI5 since these are still substituted out (as you can see by checking SJBACKTG.STI or SJBACKGS.STI).

You might like to look at section 3.9 of GPD-1 to check again about the difference between substituting and backsolving for a variable, and to see the reasons why these make it easier to solve large models.

2.1.18 Transferring Simulation Results to a Spreadsheet

Example 2.1.20 - Using SLTOHT to transfer Solution results to a Spreadsheet

The program SLTOHT is used to convert results on a Solution file to either a Header Array file or a text file (CSV file) suitable for importing the results into a spreadsheet program such as Excel. In this example we will convert the results from the file SJLBJ.SL4 created in Example 2.1.13b to a text file in CSV format (Comma Separated Values) where the numbers in the array are separated by commas. A spreadsheet program will usually place the values of an array separated by commas into separate cells in the spreadsheet.

Select from the WinGEM menu

Other tasks...| Solution file to Header/Text (SLTOHT)

In the SLTOHT window, select from the menu,

Options | SLTOHT Options

A screen of SLTOHT option choices will appear. Click on

SS Spreadsheet Output

and select a Comma as separator. (A comma is the default choice.)

Select to ***output all Solutions on the Solution file***. Click on ***Ok*** to accept these options and return to the main SLTOHT screen.

Click on the ***Select*** and choose the Solution file SJLBJ.SL4. Choose to print **All solutions**. Click the ***Ok*** button.

Run the program SLTOHT. This will create the CSV text file called SJLBJ.CSV. When the program has completed, ***View*** the text file.

You can also try starting your spreadsheet program (for example Excel) and opening the file SJLBJ.CSV (as a text file with commas for separators). Look at the arrays of results (ignoring rows that start with an exclamation mark which are comments).

Each column is a different solution and each row is a component of a variable.

There are various other ways of running the program SLTOHT, for example by using a **spreadsheet mapping file** as described in GPD-1 Chapter 8. More recent improvements to SLTOHT are described in chapter 6 of GPD-4.

This completes the Stylized Johansen examples. We suggest that you exit from WinGEM (which will close all WinGEM windows also).

You may wish to continue learning about WinGEM by working with one of the other models in the remaining sections of section 1.

Alternatively, if you have Release 6.0 of GEMPACK, you may like to try using RunGEM to carry out simulations with Stylized Johansen; if so, a hands-on introduction is given in section 5.1 below.

2.2 Miniature ORANI Model Examples

The following examples are based on the Miniature ORANI model MO. This is a pedagogical model designed to introduce some of the essential ideas behind the ORANI model of the Australian economy (see sections 3-9 of Dixon *et al* (1982)).

Preparing a Directory for Model MO

To keep all examples files for this model together in one area, create a separate directory \MO and copy all MO*.* files in you examples directory (usually C:\GP\EXAMPLES) to this subdirectory. You can use File Manager or DOS commands as in the examples for Stylized Johansen (see section 2.1.2 above). In DOS, use the commands (the third of which you will need to change if your examples directory is not C:\GP\EXAMPLES):

```
md \mo
cd \mo
copy c:\gp\examples\mo*.*
dir
```

Set the working directory

First set the working directory to be this directory \MO by choosing

File | Change both default directories

and select the directory MO on the appropriate drive. [See section 2.1.3 above for more details.]

Examine the TABLO Input file MO.TAB in the text editor to see the theory of the Miniature ORANI model - the variables used, the data read in, and the equations to be solved. Choose

File | Edit file... and open the file MO.TAB. [See section 2.1.4 above for more details.]

Example 2.2.1 - Examine the database for MO

The data for this model is in the file MO.DAT. Since this is a Header Array file use ViewHAR to look at the arrays of data which it contains. Choose

HA files | View VIEWHAR

as you did with the data file for Stylized Johansen (see section 2.1.5).

Example 2.2.2 - Implementing the model MO using TABLO

As in Example 2.1.3 or 2.1.6 - *Step 1 - Implementing the model*, open a TABLO window

Simulation | TABLO Implement...

Select the TABLO Input file MO.TAB and then ***Run*** TABLO. If you have a Source-code version and produced a TABLO-generated program, click

Compile & Link

to create the Executable image of the TG program MO.EXE.

When the model has been implemented successfully, select ***Go to 'Run TG program'*** (or ***Go to GEMSIM)*** to go on to the simulation (*Step 2).*

Example 2.2.3 - Simulation using the Command file MOTAR.CMF

Select the Command file MOTAR.CMF and ***Edit*** the file.

Examine the closure and shocks applied in the simulation. Exit from the editor and then ***Run*** MO.EXE (or GEMSIM) to solve the equations. Prepare a Print file MOTAR.PI5 using GEMPIE similarly to Step 3 in Examples 2.1.5a or 2.1.8a above, or, alternatively, use ViewSOL to look at the results.

The simulation is a multistep 2-step, 4-step, 6-step using the Gragg method followed by extrapolation.

To estimate the accuracy of this solution an Extrapolation Accuracy file called MOTAR.XAC is produced, as discussed in section 2.11.3 of GPD-1. Choose

File | Edit file...

in the main WinGEM menu and examine MOTAR.XAC in the text editor. The first column contains the results for a 2-step solution, the second for a 4-step one, the third for a 6-step and the fourth column contains the extrapolated solution which is an accurate solution of the non-linear model.

Example 2.2.4 - Several Johansen Simulations using SAGEM

In the editor (use ***File | Edit new file*** from WinGEM's main menu), look at the Command file MOSAGEM.CMF (usually supplied with GEMPACK). Check that MOSAGEM.CMF contains the text below:

Command file MOSAGEM.CMF

```
use equations file mo ;
solution file = mosagem ;
use environment file mo ;

individually-retained exogenous  %all  ;

shock P_T 2  =  1 ;
shock p_phi = 1 ;
shock p_fwage  =  -2.38 ;
shock p_cR = 2.76 ;

verbal description  = MO  standard closure ;
```

Then run SAGEM with the file MOSAGEM.CMF by selecting

Simulation | SAGEM Solve...

If there are any errors, click on ***Edit Command file*** to give split screen editing with the LOG file in the View Window. Look in the LOG file for the ***Next Error*** and correct the error in the Command file (at the top of the screen). [More details about this procedure can be found in Example 2.1.11 above.]

If there are no errors, ***Go to GEMPIE*** (not ViewSOL - see section 2.1.14 above) and create a Print file containing the

Individual column solutions.

Examine the results in the Print file MOSAGEM.PI5. Each column corresponds to a different shock.

Example 2.2.5 - Homogeneity Test using SAGEM

To test whether models are homogenous, you can shock nominal variables by 1 percent and leave all quantity variables unshocked. (See section 8.1.2 of GPD-1 and section 13.8 of GPD-4 for more information.) This example carries out one such homogeneity test for model MO.

Copy the Command file MOSAGEM.CMF to a new file MOHOMOG.CMF and edit MOHOMOG.CMF so that only the exchange rate **p_phi** is shocked and the shock is 1 percent.

Change the name of the Solution file to MOHOMOG but use the same Equations file and Environment file (MO). Rerun the simulation using SAGEM as in the previous example. Run GEMPIE to create the Print file MOHOMOG.PI5 and view the results in the editor. If the model MO is homogeneous, all nominal variables should have increased by 1 percent and all quantity variables should be zero.

Example 2.2.6 - Modifying the closure for MO

To modify the closure in the Command file MOTAR.CMF, first copy it to a new file name MOTAR2.CMF, then edit it to make the following changes:

(1) Replace the exogenous variable **p_phi** by the variable **p_cpi**

(2) Replace the second component of p_XEXP, **p_XEXP("c2")** in the exogenous list
by the second component of p_V, **p_V("c2")**

(3) Change the name of the Solution file from MOTAR to MOTAR2 and change the name of the updated data file “basedata” to **motar2.upd**

(4) Change the name of the Environment file from MO to MO2.

(5) Change the verbal description at the end to indicate these changes have been made.

Run a simulation using MO.EXE (or GEMSIM) and this new Command file MOTAR2.CMF. Look at the results produced by GEMPIE to see the effect of this closure swap.

2.3 Global Trade Analysis Project Model Examples

The following examples are for the Global Trade Analysis Project model, GTAP, which can be used to analyse trade issues. It is a multi-regional model and is described in Hertel (1997). Several different aggregations (of commodities and/or regions) are available from the Project.

Preparing a Directory for Model GTAP

To keep all examples files for this model together in one area, create a separate directory \GTAP and copy all G*.* files from your examples directory (usually C:\GP\EXAMPLES) to this subdirectory. You can use File Manager or DOS commands as in the examples for Stylized Johansen (see section 2.1.2 above). In DOS, use the commands (you will need to alter the third one if your examples directory is not C:\GP\EXAMPLES):

```
md \gtap
cd \gtap
copy c:\gp\examples\g*.*
dir
```

Set the working directory

First set the working directory to be this directory \GTAP by choosing

File | Change both default directories

and select the directory GTAP on the appropriate drive. [See section 2.1.3 above for more details.]

2.3.1 Examining the GTAP Data Directly

There are three data files associated with each GTAP data set. For the 3x3 aggregation, the files are

GDAT2-01.HAR	The Global data set (I/O for each region, trade data etc)
GSET2-01.HAR	Set information, giving region and commodity names in aggregation
GPAR2-01.DAT	Parameter values

There are also three data files for a 10x10 aggregation:
GDAT2-06.HAR, GSET2-06.HAR and GPAR2-06.DAT.

Example 2.3.1 - Using ViewHAR to view the global data for the 3x3 aggregation

The GTAP global data file contains large amounts of data including the input-output data for each region and trade data.

This file is given the (logical) name **GTAPDATA** in the TABLO Input file **GTAP3x3.TAB** which lays down the theory of GTAP. To see what information is on this global data file, select

File | Edit file...

The Open box should list several files associated with the GTAP model. Under the Edit File menu item, the type of files you can edit are all text (ASCII) files. (The editor you are using is called **GEMEDIT** which automatically saves files as text files.)

Select the TABLO Input file to edit:

`GTAP3x3.TAB`

Then search for GTAPDATA. [To search in GEMEDIT, select ***Search | Find...*** from GEMEDIT's menu, then type in the word(s) you wish to search for, and finally type a carriage return. Use this technique to search for GTAPDATA. To search again after you have found the first occurrence of "GTAPDATA", you can either select ***Search | Search again*** from GEMEDIT's main menu or you can touch the **F3** key (near the top of your keyboard).[6] Use this technique to see the first 3-4 occurrences of GTAPDATA.]

You will see that various pieces of data are read from this file.

One of these is the array **`VDPA(i,r)`** whose values are held at header "VDPA". To see this and to find out what data is stored at this header and associated with VDPA(i,r) in GTAP3X3.TAB, move to the start of GTAP3X3.TAB (use **Ctrl+Home**, that is, hold down the **Ctrl** key and touch the **Home** key). Then search for **`VDPA`**. You will see that VDPA(i,r) is declared as a **COEFFICIENT** and that it holds the data for "Value of Private household expenditure on Domestic commodity **i** in region **r**, valued at Agents' prices".

By searching again for VDPA you will see that this data is read from file GTAPDATA at header "VDPA".

Exit from GEMEDIT in the usual Windows way by ***File | Exit***. (There are usually alternatives in terms of keystrokes instead of the mouse action. For example you can use keystrokes **Alt** followed by **f** followed by **x** in order to exit.)

To see the VDPA data in the 3x3 aggregation, you can run the program **ViewHAR**. To do this, select ***HA files | View VIEWHAR*** from WinGEM's main menu.

A ViewHAR window will appear. Click on

File | Open

and open the file GDAT2-01.HAR in directory \GTAP.

This will open the file GDAT2-01.HAR and show its contents on the Contents screen.

[6] This **F3** "keyboard shortcut" is indicated on the right-hand side of ***Search again*** under GEMEDIT's ***Search*** menu. You will find many other keyboard shortcuts indicated similarly in WinGEM's and GEMEDIT's main menus.

Each of the rows corresponds to a different array of data on the file. Look at the column under the heading Name to see what these arrays are.

```
 Header Type Size         Name
1 EVFA  RE  ENDW_COMMxPRO Endowments - Firms' Purchases at Agents' Prices
2 EVOA  RE  ENDW_COMMxREG Endowments - Output at Agents Prices
      (etc)
9 VDPA  RE  TRAD_COMMxREG Intermediates - Household Domestic Purchases ...
      (etc)
```

You can see that array number 9 is the data at Header "VDPA". The data at this header is the value of households' domestic purchases at agents' prices. To see the actual data, double-click on the VDPA row. What is the value of EU households' domestic purchases of manufactures at agents' prices? What about purchases of food by households in ROW (that is, Rest of the World)?

Now click on ***Contents*** in the ViewHAR window showing the data and you will return to the list of contents of the arrays in this global data file. Look at the VDFM row (array number 6). You can see that the associated data is a 3-dimensional array of size
TRAD_COMM x PROD_COMM x REG and that this is described as "Intermediates - Firms' Domestic Purchases at Market Prices".

(Note that the sizes of the sets in this GTAP aggregation GTAP3x3 are
Set TRAD_COMM 3 elements, Set PROD_COMM 4 elements, Set REG 3 elements
so the array VDFM is of size 3 x 4 x 3.)

To see the actual data, double-click on this VDFM row. You see a 3x4 matrix of data (plus a totals row and a totals column) with the rows labelled "food", "mnfcs" and "svces" and the columns labelled "food", "mnfcs", "svces" and "CGDS". These must be the elements of the sets TRAD_COMM (tradeable commodities) and PROD_COMM (produced commodities) respectively. What about the 3rd dimension REG of this data? The clue is given by the 3 drop-down lists near the top right-hand corner of the screen which say

All TRAD_COMM **All PROD_COMM** **Sum REG**

respectively. Because your computer screen is 2-dimensional, what you are seeing are the VDFM values **summed across regions (REG)**. What is the total across all regions of the value at market prices of domestic purchases of services by the food firms? What about of manufactures by the capital-goods firms?

How can we see the value of firms' purchases in just one region, for example in EU? To see this, click on the **Sum REG** drop-down list box near the top right-hand side and select **EU** from the options. The data will change and now you are seeing how much is purchased just by firms in the EU. What is the value at market prices of purchases of services by manufacturing firms in the EU? What about by manufacturing firms in the USA?

There are lots of ways of viewing 2-dimensional slices of a 3-dimensional array. To see another, click on the **TRAD_COMM** drop-down list box (the first of the three) and select **Sum TRAD_COMM**. Now click on the **REG** list box and select **All REG.** What does the number in row "food" and column "ROW" indicate? What is the total value (at market prices) of all intermediate inputs into the services sector in the EU?

What is the value at market prices of intermediate inputs of manufactures to the capital goods sector in "ROW"? [There are various ways you can see this. One is to select "ROW" in the REG list box. Another is to select "CGDS" in the PROD_COMM list box.]

Recall that you are looking at the TRAD_COMMxPROD_COMMxREG data at header "VDFM" in the global data set. To check what data is read from this header according to the description of the model in GTAP3X3.TAB, find the WinGEM main menu on your screen, select ***File | Edit file...*** and open file GTAP3X3.TAB. Search in it for **`VDFM`** until you find the lines saying which data is read from this header (it is the values of Coefficient **`VDFM(i,j,r)`** where **`i`** is the tradeable commodity, **`j`** is the produced commodity (firm) and **`r`** is the region). Return to the top of the file (use **Ctrl+Home**) and then search again for **`VDFM`**. You will see indeed that VDFM(i,j,r) is described as "purchases of domestic i r for use in j in region r". Now close GTAP3X3.TAB via ***File | Exit***.

Also close the ViewHAR window by selecting ***File | Exit*** from ViewHAR's (not WinGEM's) menu.

Example 2.3.2 - Using ViewHAR to view the set information

The set information tells which regions and commodities are represented in the current aggregation of the data. This set information file is given the (logical) name **`GTAPSETS`** in the TABLO Input file **`GTAP3X3.TAB`** which lays down the theory of GTAP. To see what information is on this set information file, select ***File | Edit file...*** and open **`GTAP3X3.TAB`**.

Then search for **`GTAPSETS`**. You will see that

- the names of the regions (the SET of regions is called **REG**) are held at header "**H1**",
- the names of the tradeable commodities (the SET is called **`TRAD_COMM`**) are held at header "**H2**", and
- there are several other SETs defined.

Leave this file open in the editor GEMEDIT. (It will be convenient to return to it later.)

The GTAPSETS data file for the 3x3 aggregation is called GSET2-01.HAR. To see the actual data at these headers in this file, you need to return to WinGEM following the procedure described below.

(a) If you are running Windows 95, click on **GEMPACK for Windows** in the Windows 95 **Taskbar** (which you should find along the bottom, or perhaps the top, of your screen).[7]
(b) If you are running Windows, you can use **Alt+Tab** to switch back to WinGEM. This means that you hold down the **Alt** key and keep touching the **Tab** key. Each time you touch it, Windows focuses on a different application that is running. When you get to **GEMPACK for Windows**, let go of the **Alt** key.[8]

In either case, you should see WinGEM's main menu at the top of your screen (though **`GTAP3X3.TAB`** will still be visible below this) and WinGEM's main menu should be highlighted meaning that WinGEM is now the active application.

[7] The **Alt+Tab** method described under (b) below for Windows can also be used with Windows 95.
[8] Another way of doing this under Windows is to use **Ctrl+Esc** which gives you a Task List from which you can choose the task you wish to switch to.

[Being able to switch between applications as described above is an important skill when working under Windows or Windows 95. That this can be done so readily is one of the reasons why Windows is so useful. You will need to do this often when working through this document. When you need to switch, we will just say something like "switch to xxx (use the **Taskbar** or **Alt+Tab**)".]

Now that you have switched to WinGEM, click on ***HA files | View VIEWHAR*** in WinGEM's main menu and open GSET2-01.HAR. The Contents list begins

```
Header    Type  Size         Name
1  H1      1C   3 length 12
2  H2      1C   3 length 8
```

The data type "1C" means character data (i.e., lists of names). The "3 length 12" means that there are 3 names of (maximum) length 12 held at header "H1".

To look at the names at header "H1", double-click on this row in the Contents. What are the 3 regions called? Return to the Contents (click on ***Contents***) and look at the data at header "H2". As you know from GTAP3X3.TAB (look at it again if you are not sure - it is still open at the right place) these are the names of the 3 tradeable commodities.

Close this ViewHAR window by selecting ***File | Exit*** from ViewHAR's menu. [But leave GTAP3X3.TAB still open in GEMEDIT.]

Example 2.3.3 - Using SeeHAR to look at the global data

In the first GTAP example you used ViewHAR to look at different parts of the data in the global data set GDAT2-01.HAR. This is an excellent way of looking at individual items of data; indeed you can use ViewHAR's print features to print out selected 2-dimensional slices of some of the arrays. But sometimes you will want to print out the whole data base or at least several of the arrays. Then it may be best to use the program **SEEHAR**.

To see how SeeHAR works, select

HA files | See SEEHAR...

from WinGEM's main menu. [Use the **Taskbar** or **Alt+Tab** if necessary to switch to WinGEM.]

A SeeHAR task window appears in the middle of your screen.

Click on the **Select** button (WinGEM has marked this as the obvious thing to do by putting dots around the text on this button).

In the file open dialogue box which appears, select the global data file **GDAT2-01.HAR** (which you can do either by double-clicking on this name in the list of files or by single-clicking on it and then selecting ***Ok***).

Now the ***Run*** button is marked as the obvious thing to do so click on it. A DOS box appears and WinGEM has started the program SeeHAR running to examine the data on this file. When it finishes running (it will take less than a minute), take WinGEM's advice and click on ***View file***.

Search for **VDPA** which is the header whose data you looked at in Example 1 above. You will see that at header "VDPA" is 3x3 data described as "Intermediates - Household Domestic Pur" [the name is truncated] and denoted by VDPA(TRAD_COMM,REG) which means it is 2-dimensional data, the first argument being in TRAD_COMM and the second in REG. Repeat the search for **VDPA** until you see the actual data. It is shown as a 3x3 matrix whose rows are labelled with the names of the tradeable commodities and whose columns are labelled with the names of the regions. What is the value (at agents' prices) of household purchases of food in the EU? What about manufactures in ROW?

Recall that you looked at the 3-dimensional array of VDFM data in Example 1 above, via ViewHAR. What does this data look like in the SeeHAR output? To check this, return to the top of the SeeHAR output file via **Ctrl+Home**. Then search for **VDFM** until you get to the actual VDFM data. This array has 3 indices ranging over the sets TRAD_COMM, PROD_COMM and REG, which are of sizes 3, 4 and 3 respectively. You can see that this array of size 3x4x3 is shown as 3 TRAD_COMMxPROD_COMM matrices, the first of these giving the values in USA, the second giving the EU values and the third the ROW values. What is the value at market prices of purchases of domestic manufactures by firms in the EU? What about purchases of domestic food by ROW firms?

Now close this SeeHAR output file GDAT2-01.SEE by selecting ***File | Exit***. This will return you to the SeeHAR program window. Note that, if you have a printer attached to your computer, you can print this file by clicking on the ***Print file*** button in this window.

The global data file GDAT2-01.HAR is a Header Array file (each array of data is accessed via its header which is a string of up to 4 characters). Header Array files are binary files, which means that you cannot edit or access the data in them directly. This is why you had to use a program such as ViewHAR or SeeHAR to look at the data in this file. ViewHAR shows you the data on the screen while SeeHAR converts the data to a text file GDAT2-01.SEE which you can view in an editor, or print.

Leave this SeeHAR window open.

Example 2.3.4 - Using SeeHAR to look at the set information file

You can open another SeeHAR window by selecting ***HA files | See SEEHAR***... from WinGEM's main menu. ***Select*** the set information file GSET2-01.HAR and then click on the ***Run*** button.

Then look at the output file GSET2-01.SEE and check the names of the 3 regions, the 3 tradeable commodities and of the four produced commodities. If you aren't sure which headers these names are found at, check by looking in GTAP3X3.TAB (which should be still open in a GEMEDIT window). What are the names of the demanded commodities (see the set DEMD_COMM) in this aggregation?

Now close the two SeeHAR windows which are open by selecting ***File | Exit*** in them (not in WinGEM's main menu).

Example 2.3.5 - Viewing the parameter values

Although the global data and set information are held on Header Array files, the parameters data for any GTAP data set are held on a text file. (This is to facilitate editing by those wishing to conduct sensitivity analysis.) You can see the parameter values by editing the file directly (or

printing it). To see the actual parameter values used with the 3x3 data set, select ***File | Edit file...*** from WinGEM's main menu.

We want you to select the file **`GPAR2-01.DAT`**. Selecting this is a little complicated since the suffix ".DAT" of this file is not one of those included in the list of suffixes for "GEMPACK related files" shown by default in the File Open window GEMEDIT shows. If you click on **GEMPACK related files** in the drop-down list shown in the bottom left of this window under the heading "List files of type:", you will see other choices including (at the very bottom) **All files (*.*)**. If you click on this you will see all files in the File Open window. Then scroll down this list until you find **`GPAR2-01.DAT`**. [Another way of doing this is to immediately type ***.dat** in the box under "File name:" where the usual suffixes *.tab,*.cmf *etc* are shown. Then GEMEDIT just shows files with this suffix and it is easy to find GPAR2-01.DAT.]

For example, search in GPAR2-01.DAT for ESUBVA. You will see that there are 4 values (one for each commodity in PROD_COMM). Look at these values. To find the significance of these values, you need to look in **`GTAP3X3.TAB`** which should still be open in a GEMEDIT window which you should be able to get to via the **Taskbar** or **Alt+Tab**. [If not, open **`GTAP3X3.TAB`** again via ***File | Edit file...*** in WinGEM's main menu.] Search in GTAP3X3.TAB for ESUBVA and you will see that these four values are the elasticities of substitution between capital, labor and possibly land in the production of value added for each such commodity.

Close the file GPAR2-01.DAT by going back to the GEMEDIT window it is open in (use the **Taskbar** or **Alt+Tab**) and then selecting ***File | Exit***.

Text files can be edited directly. But binary files (such as the Header Array file GDAT2-01.HAR) cannot be looked at in an editor. To see this, select ***File | Edit file...*** from WinGEM's main menu and open GDAT2-01.HAR by typing this name "GDAT2-01.HAR" in the "File name:" provided. Although GEMEDIT is able to open this file (some other text editors wouldn't be able to do so), you don't obtain any useful information about this file when it is opened. Close this file and exit from this GEMEDIT window.

We suggest that you now exit from WinGEM by selecting ***File | Exit*** from WinGEM's main menu. This will close any SeeHAR windows open but will not close any GEMEDIT or ViewHAR windows, which you will need to close separately.

2.3.2 A GTAP3x3 Simulation Reducing One Distortion

In the following examples 2.3.6 and 2.3.7, you will carry out a simulation with the 3x3 data in which the import tariff on Food from the USA imported into the European Union (EU) is reduced by ten percent. (In the 3x3 data base, the power of this tariff is approximately 1.369.)

Example 2.3.6 - Implementation of GTAP3x3

When large models are implemented, it is usually necessary to **condense** the model. This means carrying out algebraic substitutions to reduce the size of the system of linear equations solved at each step of a multistep calculation. The concept of condensation is discussed in section 3.9 of GPD-1. You will use the Stored Input file or STI file GTAP33TG.STI (or GTAP33GS.STI for GEMSIM output) to provide the input to the program TABLO to condense the GTAP model in the TABLO Input file GTAP3x3.TAB.

First select in the main WinGEM menu,

File | Change both default directories

Check that the working directory is subdirectory \GTAP on the appropriate drive. Then from the main WinGEM menu choose

Simulation | TABLO Implement...

to open a TABLO Window. In doing a condensation, you need to say which variables are to be condensed out and which equations are to be used. This information has been prepared in Stored-input files called GTAP33TG.STI and GTAP33GS.STI.

To tell TABLO to use one of these files, choose **in the menu for the TABLO window**

Options | Run from STI file

and then ***Select*** the name of the Stored-input file (*i.e.*, STI file) as GTAP33TG.STI if you have a Source-code version of GEMPACK and wish to produce the TABLO-generated program, or GTAP33GS.STI (which produces output for GEMSIM) otherwise.

Run TABLO. When TABLO has finished, view the Log file and the Information file to see that TABLO has completed successfully. If you have the Source Code version of GEMPACK and produced the TABLO-generated program, compile and link the TABLO-generated program GTAP3x3.FOR to make the EXE file GTAP3x3.EXE.

Example 2.3.7 - Running a simulation for Condensed GTAP3x3

To run GTAP3x3.EXE or GEMSIM to carry out the above simulation, use the Command file GTMSEU33.CMF. First look at this Command file in the editor:

File | Edit file...

and select the file GTMSEU33.CMF.

Search for the shock applied in this simulation. The variable in question is **tms** (the percentage change in the power TMS_L of the import tariffs). This variable has three arguments. The notation

tms(i,r,s)

means the percentage change in the power of the import tariff levied in region **s** on imports of commodity **i** from region **r**. Thus to reduce the power of the import tariff on USA Food imported into the EU by 10 percent, you must specify a shock of -10 to **tms("food","usa","eu")** of -10 percent

```
shock tms("food","usa","eu") = -10 ;
```

Exit from the editor.

Run the TABLO-generated program GTAP3x3.EXE or GEMSIM by choosing from the main WinGEM menu

Simulation | TG program... or ***Simulation | GEMSIM Solve...***

and ***Select*** the Command file GTMSEU33.CMF and ***Run*** the program.

Either view the results by clicking on the ***View file*** button to start **ViewSOL** or make a Print file using GEMPIE. Choose ***Go to GEMPIE*** and ***Run*** GEMPIE with the new Solution file GTMSEU33.SL4 to make a Print file GTMSEU33.PI5. Then look at some of the results by clicking on ***View file*** in the GEMPIE window.

For example, check that the output of food in the USA **qo("food","USA")** increased by 0.886 percent, and that exports of food from the USA to EU **qxs("food","USA","EU")** increased by about 53 percent.

2.3.3 GTAP Simulation with a 10x10 Aggregation

In the following examples 2.3.8 and 2.3.9, you will carry out a simulation with a 10x10 aggregation. This simulation is to find the impact of Multi-Fibre Agreement (MFA) removal in the pre-Uruguay Round setting. Full details of this simulation are given in Experiment E1 in section IV of Chapter 10 of Hertel (1997).

The TABLO Input file used is GTAP94.TAB which is very similar to file GTAP3x3.TAB except that the set sizes in it allow up to 10 regions and 10 tradeable commodities (whereas those in GTAP3X3.TAB only allow 3 regions and 3 tradeable commodities).

Example 2.3.8 - Implementation of GTAP1010

You will use the Stored-input file GTAP10TG.STI (or GTAP10GS.STI for GEMSIM output) to provide the input to the program TABLO to condense the GTAP model in the TABLO Input file GTAP94.TAB.

First select in the main WinGEM menu,

File | Change both default directories

Check that the working directory is subdirectory \GTAP on the appropriate drive. Then from the main WinGEM menu choose

Simulation | TABLO Implement...

to open a TABLO Window. In doing a condensation, you need to say which variables are to be condensed out and which equations are to be used. This information has been prepared in a Stored-input file called GTAP10TG.STI or GTAP10GS.STI.

To tell TABLO to use this file, choose **in the menu for the TABLO window**

Options | Run from STI file

and then ***Select*** the name of the Stored-input file (*i.e.*, STI file) as GTAP10TG.STI if you have a Source-code version of GEMPACK or GTAP10GS.STI if you have the Executable-image version.

Run TABLO. When TABLO has finished, view the Log file and the Information file to see that TABLO has completed successfully. If you have the Source Code version of GEMPACK,

compile and link the TABLO-generated program GTAP1010.FOR to make the EXE file GTAP1010.EXE.

Example 2.3.9 - Running a simulation for Condensed GTAP1010

To run GTAP1010.EXE or GEMSIM to carry out the above simulation, use the Command file GC2-06E1.CMF. First look at this Command file in the editor:

File | Edit file...

and select the file GC2-06E1.CMF.

Search for the shocks applied in this simulation. The variable in question is **txs(i,r,s)** (the percentage change in the combined tax in region r on good i bound for region s).
The value of the shocks are selected from a shock file call GTX2-06.SHK and have been calculated to represent the MFA removal.

Exit from the editor.

Run the TABLO-generated program GTAP1010.EXE or GEMSIM by choosing from the main WinGEM menu

Simulation | TG program... or ***Simulation | GEMSIM Solve...***

and ***Select*** the Command file GC2-06E1.CMF and ***Run*** the program.

Before going on to ViewSOL to view the results or GEMPIE to print out the results of the simulation, ***View*** the log file to see how much Total CPU time has been used. This time is given nearly at the end of the Log file.

Choose ***Go to GEMPIE*** and ***Run*** GEMPIE with the new Solution file GC2-06E1.SL4 to make a Print file GC2-06E1.PI5.

Then look at some of the results by clicking on ***View file*** in the GEMPIE window.

Example 2.3.10 Running ViewSOL to look at the results

Click on the ***Go to ViewSOL*** button in the GEMSIM or TG program window to start ViewSOL running. (An alternative method is to select ***Other tasks | ViewSOL*** from the main WinGEM menu and open the file GC2-06E1.SL4.)

You will see the **Contents** page listing many of the variables of the model. ViewSOL has 3 slightly different formats for this Contents list. Select ***Format...*** from ViewSOL's main menu and there click on ***Arrange vectors by size and set*** (in the panel headed Vector options); then click ***Ok*** which will put you back to the Contents list.

To see the results of one of these variables listed by name, just **double-click** on the corresponding row in the Contents list. For example, double-click on **qo** to see its results. Then click on ***Contents*** to return to the Contents list.

The results for some variables (those with just one index) are grouped together in tables which appear at the top of the Contents list. For example, double-click on

Vectors size 10 TRAD_COMM

in the Contents list. You will see several variables with one index which ranges over the set TRAD_COMM of tradeable commodities. You might also like to look at the results for the **macros** (which are variables with no index).

Recall the other useful way of **arranging variables by name** under the ***Format…*** menu option of ViewSOL (see Example 2.1.5a above). You might like to experiment with this here.

When you have finished looking at the results, exit from ViewSOL.

Example 2.3.11 - Comparison of times for GEMSIM and TG program

If you have a Source-code version of GEMPACK, you may like to compare the time needed for a long simulation with many steps using the two methods. Repeat Example 2.3.8 but this time run TABLO by choosing the STI file GTAP10GS.STI to produce GEMSIM output. Repeat Example 2.3.9 this time using GEMSIM

Simulation | GEMSIM Solve...

and use the same Command file GC2-06E1.CMF.

View the log file to see how much Total CPU time has been used. Compare it with the time taken using the TG program GTAP1010.EXE.

2.4 Examples with the ORANIG Model

The following examples are with the ORANIG model, using 1986/87 data for the Australian economy. This model has 23 commodities and 22 industries. Documentation for this model is available on the GEMPACK Web site.

Preparing a Directory for Model ORANIG

To keep all examples files for this model together in one area, create a separate directory \ORANIG and copy all O*.* files from you examples directory (which is usually C:\GP\EXAMPLES) to this subdirectory. You can use File Manager or DOS commands as in the examples for Stylized Johansen (see section 2.1.2 above). In DOS, use the commands (you will need to modify the third if your examples directory is not C:\GP\EXAMPLES):

```
md \oranig
cd \oranig
copy c:\gp\examples\o*.*
dir
```

Set the working directory

First set the working directory to be this directory \ORANIG by choosing

File | Change both default directories

and select the directory ORANIG on the appropriate drive. [See section 2.1.3 above for more details.]

Example 2.4.1 - Examine the TAB file and the data

Examine the TABLO Input file ORANIG98.TAB in the editor. Select

File | Edit file... and select ORANIG98.TAB.

The data file is a Header Array file called ORANG867.HAR. Examine it using ViewHAR by selecting

HA files | View VIEWHAR and select ORANG867.HAR.

Exit from both of these windows by selecting ***File | Exit***

Example 2.4.2 - Implement the model using TABLO

The file ORANIG98.TAB makes a model which is too big to run on a PC unless it has been condensed.

From the main WinGEM menu choose

Simulation | TABLO Implement...

to open a TABLO Window. In doing a condensation, you need to say which variables are to be condensed out and which equations are to be used. This information has been prepared in a Stored-input file called ORANIGTG.STI or ORANIGGS.STI.

To tell TABLO to use this file, choose **in the menu for the TABLO window**

Options | Run from STI file

and then ***Select*** the name of the Stored-input file (*i.e.*, STI file). If you have a Source code version, select ORANIGTG.STI to create the TG program. If you have the Executable Image version, select ORANIGGS.STI to produce GEMSIM output.

Run TABLO. When TABLO has finished, view the Log file and the Information file to see that TABLO has completed successfully. If you have the Source Code version of GEMPACK, compile and link the TABLO-generated program ORANIG98.FOR to make the EXE file ORANIG98.EXE.

Example 2.4.3 - Running a Simulation for Condensed ORANIG

To run ORANIG98.EXE or GEMSIM to carry out the above simulation, use the Command file ORNG98SR.CMF. First look at this Command file in the editor:

File | Edit file...

and select the file ORNG98SR.CMF. Notice that this uses a short-run closure. What is the shock?

Run the TABLO-generated program ORANIG98.EXE or GEMSIM by choosing from the main WinGEM menu

Simulation | TG program... or ***Simulation | GEMSIM Solve...***

Select the Command file ORNG98SR.CMF and ***Run*** the program.

Before going on to ViewSOL or GEMPIE to look at the results of the simulation, ***View*** the log file to see how much Total CPU time has been used. This time is given nearly at the end of the Log file.

Either ***Go to ViewSOL*** or ***Go to GEMPIE*** as usual, to look at the results.

Example 2.4.4 - Comparison of times for GEMSIM and TG program

If you have a Source-code version of GEMPACK, you may like to compare the time needed for a long simulation with many steps using the two methods. Repeat Example 2.4.3 but this time run TABLO by choosing the STI file ORANIGGS.STI to produce GEMSIM output. Repeat Example 2.4.3 using GEMSIM

Simulation | GEMSIM Solve...

and use the same Command file ORNG98SR.CMF.

View the log file to see how much Total CPU time has been used. Compare it with the time taken using the TG program ORANIG98.EXE. [Some CPU times are reported in chapter 4.]

2.5 Examples with the ORANIF Model

The following examples are for the ORANIF model, using data for the Australian economy. This model has 23 commodities and 22 industries. The model is documented in Horridge *et al* (1993) [HPP].

Preparing a Directory for Model ORANIF

To keep all examples files for this model together in one area, create a separate directory \ORANIF and copy the file **oranif.zip** from your examples directory (which is usually C:\GP\EXAMPLES) to this subdirectory. Then unzip these files using PKUNZIP. You can use File Manager or DOS commands as in the examples for Stylized Johansen (see section 2.1.2 above). In DOS, use the commands (you will need to modify the third if your examples directory is not C:\GP\EXAMPLES):

```
md  \oranif
cd  \oranif
copy  c:\gp\examples\oranif.zip
pkunzip  oranif.zip
dir
```

Set the working directory

First set the working directory to be this directory \ORANIF by choosing

File | Change both default directories

and select the directory ORANIF on the appropriate drive. [See section 2.1.3 above for more details.]

Example 2.5.1 - Examine the TAB file and the data

Examine the TABLO Input file for the linearised model ORANIF.TAB in the editor. Select

File | Edit file... and select ORANIF.TAB.

The data file is a Header Array file called ORANIF.DAT. Examine it using ViewHAR by selecting

HA files | View VIEWHAR and select ORANIF.DAT

Exit from both of these windows by selecting ***File | Exit***

Example 2.5.2 - Implement the model using TABLO

The file ORANIF.TAB makes a model which is too big to run on a PC unless it has been condensed.

From the main WinGEM menu choose

Simulation | TABLO Implement...

to open a TABLO Window. In doing a condensation, you need to say which variables are to be condensed out and which equations are to be used. This information has been prepared in a Stored-input file called ORANITG.STI or ORANIGS.STI.

To tell TABLO to use this file, choose **in the menu for the TABLO window**

Options | Run from STI file

and then ***Select*** the name of the Stored-input file (*i.e.*, STI file). If you have a Source code version, select ORANIFTG.STI to create the TG program. If you have the Executable Image version, select ORANIFGS.STI to produce GEMSIM output.

Run TABLO. When TABLO has finished, view the Log file and the Information file to see that TABLO has completed successfully. If you have the Source Code version of GEMPACK, compile and link the TABLO-generated program ORANIF.FOR to make the EXE file ORANIF.EXE.

Example 2.5.3 - Running a Simulation for Condensed ORANIF

To run ORANIF.EXE or GEMSIM to carry out the above simulation, use the Command file ORFG8.CMF. First look at this Command file in the editor:

File | Edit file...

and select the file ORFG8.CMF.

As well as the information in this Command file, the ORANIF model needs user input from the terminal of the number of years T and the values of the coefficient ORD. To give this information from the terminal, it would be necessary to run ORANIF interactively. An alternative is to use a Stored-input file which gives the responses which would otherwise be input to the terminal. For this simulation use the STI file called ORFG8.STI. First examine it in the editor.

File | Edit file...

and select the file ORFG8.STI. You will see that it gives the name of the CMF file ORFG8.CMF and also the values for T and ORD.

Exit from the editor.

Run the TABLO-generated program ORANIF.EXE or GEMSIM by choosing from the main WinGEM menu

Simulation | TG program... or ***Simulation | GEMSIM Solve...***

In the menu for the TG program window or the GEMSIM window, select

Options | Run from STI file

and ***Select*** the Stored-input file ORFG8.STI and ***Run*** the program.

Before going on to GEMPIE to print out the results of the simulation, ***View*** the log file to see how much Total CPU time has been used. This time is given nearly at the end of the Log file.

Choose ***Go to GEMPIE*** and ***Run*** GEMPIE with the new Solution file ORFG8.SL4 to make a Print file ORFG8.PI5.

Then look at some of the results by clicking on ***View file*** in the GEMPIE window.

[Alternatively, use ViewSOL to look at the results.]

Example 2.5.4 - Comparison of times for GEMSIM and TG program

If you have a Source Code version of GEMPACK, you may like to compare the time needed for a long simulation with many steps using the two methods. Repeat Example 2.5.3 but this time run TABLO by choosing the STI file ORANIFGS.STI to produce GEMSIM output. Repeat Example 2.5.3 using GEMSIM

Simulation | GEMSIM Solve...

and use the same STI file ORFG8.STI.

View the log file to see how much Total CPU time has been used. Compare it with the time taken using the TG program ORANIF.EXE. [Some CPU times are reported in chapter 4.]

2.6 Other Example Models

The files for various other example models are supplied with GEMPACK and are located in the **Examples** subdirectory (usually C:\GP\EXAMPLES).

Examine in the editor (or print out) some of the TABLO Input files (with extension .TAB) from the Examples subdirectory. Brief descriptions for running each of the model examples are given in chapter 1, and comments in the TABLO Input files and Command files give further help. References are given for each of the models. Try running simulations with some of the models.

2.7 Building Your Own Models

You can use the GEMPACK software to build and solve your own models, and to carry out data-related tasks. We suggest you create a new subdirectory on the hard disk for each model.

A description of building models and an introduction to TABLO Input files are given in chapter 3 of GPD-1. The basic syntax is in chapter 3 of GEMPACK Document GPD-2, "User's Guide to TABLO, GEMSIM and TABLO-generated Programs".

2.8 Using RunGEM for Simulations

If you work mainly with one model (a model built by others or by yourself), you may like to use RunGEM (see chapter 5) to carry out simulations.

If you have built your own model and have a source-code version of GEMPACK, you can make it easy for others (including others who do not have a GEMPACK licence) to carry out simulations with your model via RunGEM. Simply send them the TABLO-generated executable image of your model (plus a few other files) together with RunGEM. More details are given in section 5.3.

Chapter 3

3. Unix / DOS Prompt: Hands-on Computing

In this section we give several examples for you to try using various GEMPACK programs and some of the models described in chapter 1.

This assumes that you have access to a machine on which an appropriate version of GEMPACK is installed. Source-code versions (on any machine), Executable Image versions and the Demonstration Version of GEMPACK are all suitable. We refer to the directory in which your GEMPACK programs and libraries are installed as the **GEMPACK directory.** Often this is directory **gp** or C:\GP or C:\GP60 but it depends on where you installed GEMPACK on your particular computer.

The examples below all rely on files which are in the appropriate **Examples subdirectory** of your GEMPACK directory. For example if your GEMPACK directory is C:\GP on a PC computer, the examples are in subdirectory C:\GP\EXAMPLES. If you are working on another type of machine, you may need to consult your machine-specific documentation to find the location of the Examples subdirectory on your machine. For the examples below, we will assume that the GEMPACK directory on the UNIX machine is **gp** and that the examples are in examples subdirectory **gp/examples**

Most of the input to the programs is independent of the type of machine being used. Where this is not the case below, we give the DOS command and indicate this using a comment "! DOS".

3.1 Examples using the Stylized Johansen Model SJ

Many of these examples using SJ have been discussed in greater detail in the document GPD-1. In these cases we give the appropriate section as reference.

Preparing a Directory for Model SJ

Create a **working directory** called **sj**. Locate the GEMPACK Examples subdirectory on your computer (perhaps gp/examples or similar) and copy all the **sj*.*** files in the Examples subdirectory to the new subdirectory **sj**.

Under DOS, you can use the command

```
md  \sj                                 ! DOS
```
or under UNIX
```
mkdir  sj                               !UNIX
```

Change to this directory and copy the **sj** files from the directory containing GEMPACK model examples. Under DOS, you can use the commands

```
cd  \sj                                 ! DOS
copy   \gp\examples\sj*.*               ! DOS
```
or under UNIX
```
cd  sj                                  ! UNIX
cp   gp/examples/sj*.*                  ! UNIX
```

This should list about several files associated with the Stylized Johansen model.

3.1.1 Looking at the Data Directly

The input-output data used in the Stylized Johansen model is contained in the data file SJ.DAT. This is a special GEMPACK *binary* file - called a **Header Array file** - so you cannot just look at it in a text editor. Instead you will look at SJ.DAT using one the GEMPACK programs SEEHAR for looking at data on Header Array files.

On most operating systems, to run this program, just type in its name, as in

seehar

Then give the following user input for running SEEHAR.
(The first and third are carriage returns or Enter. After each response, we have given a comment, which starts with an exclamation mark '!'. When running the program, you should not type in the exclamation mark or the following comment.)

User Input to SEEHAR

```
<carriage-return>    ! Use the default options
sj.dat               ! Name of data file
<carriage-return>    ! Use the default output file name SJ.SEE
<carriage-return>    ! (As instructed by SEEHAR)
r                    ! Output the remaining (ie, all) arrays
```

This should produce the file SJ.SEE containing all the data in SJ.DAT. You can look at this file in a text editor to see the actual data.

Find the data at header **CINP** in this file, which should look like the box shown below.

```
Page 1 of Display of (all of) 'DVCOMIN(SECT,SECT)'.
This coefficient is of size 2x2.
(This data is at header 'CINP' on the file. Long name is
 'Intermediate inputs of commodities to industries - dollar values'.)
  ---------------------------------------------------------------

Next submatrix contains numbers from DVCOMIN(SECT,SECT) part,which are
  positions (1-2, 1-2) of DVCOMIN(SECT,SECT).

  COLUMN                1           2         ROW
  ROW                                         TOTALS
 No. Name             s1          s2
   1 s1             4.000000    2.000000     6.000000
   2 s2             2.000000    6.000000     8.000000
   COLUMN
   TOTALS           6.000000    8.000000    14.000000
```

DVCOMIN is the name used for this data in the TABLO Input file for the Stylized Johansen model.

The actual data in the file at this header is just the 2x2 matrix. SeeHAR calculates and shows the row and column totals. [You may have noticed in Example 1.1 above that ViewHAR also shows row and columns totals.]

Use the Page Down key to find the DVFACIN data at Header FINP and find out how much Labor is used by Sector s2.

3.1.2 An Example Simulation with Stylized Johansen

This is the simulation in section 2.2.2 of GPD-2. We show you in sections 3.1.3 and 3.1.4 below how to carry out this simulation. If you do not have a source-code version of GEMPACK, please skip section 3.1.3 and go straight to section 3.1.4.

3.1.3 The Example Simulation using a TABLO-generated Program

In this section we are assuming that you have a Source-code version of GEMPACK on your computer (together with a suitable Fortran compiler). As indicated in section 2.1 of GPD-1, you have the choice of using a TABLO-generated program (usually preferred since it is usually faster) or of using the program GEMSIM. We explain the TABLO-generated program method in this section 3.1.3 and the GEMSIM alternative in section 3.1.4 below.

If you are using an Executable-image version or a Demonstration version of GEMPACK, please skip the rest of this section 3.1.1 and proceed directly to section 3.1.4.

Example 3.1.2 - Implementing the model SJ using TABLO

This is Step 1 described in section 2.1 of GPD-1.

Step 1(a) - Run TABLO

Make sure you are in the working directory **sj** for the Stylized Johansen model. The command to run a program varies from computer to computer. Under many operating systems, just type the name of the program:

```
tablo
```

(or whatever command is required on your machine to run TABLO. If this does not work, consult your machine-specific documentation.) Then give the following user input for running TABLO.
(The first and third are carriage returns or Enter. After each response, we have given a comment, which starts with an exclamation mark '!'. When running the program, you should not type in the exclamation mark or the following comment.)

User Input to TABLO

```
<carriage-return>    ! Use the default options
sj                   ! Name of the TABLO Input file
<carriage-return>    ! Use the default Information file name

          (TABLO will take a minute or two to check that the
          formulas, equations and updates contain no errors.
          When finished a menu will appear asking what to do next.)

a                    ! Begin automatic code generation

          (The code generation menu appears.)

wfp                  ! Write a Fortran (the TABLO-generated) program
<carriage-return>    ! Use the other default code generation options
sj                   ! Name of the program to be written

           (TABLO will take a minute or two to write the code
           for the TABLO-generated program.)
```

When this is finished, you can check that the following new files have been created.

- The TABLO-generated program (often called **sj.for**).
- The Information file (often called **sj.inf**),
- Auxiliary Statement and Table files (usually called **sj.axs** and **sj.axt** respectively) for the TABLO-generated program. These are binary files containing data for the program **sj.for**.(They should not be deleted, renamed or moved.)

Enter

```
dir sj.*                          ! DOS
```
or
```
ls -al  sj.*                      ! UNIX
```

You can also look at the Information file **sj.inf** in your text editor. Under DOS, you can use the command

```
edit  sj.inf                        ! DOS
```

Under UNIX, you can use a text editor such as **vi.**

This file **sj.inf** gives information about the TABLO Input file such as whether there are any syntax or semantic errors found by the program TABLO when it was checking the TABLO Input file.

Step 1(b) - Compile and Link the TABLO-generated Program

The exact command for doing this varies from machine to machine. On most machines you can simply type [9]

```
ltg sj
```

to do this. (Consult your machine-specific documentation if this does not work.) It should create an executable image (often called **sj.exe** or just **sj**).

[9] This is the only step that requires a suitable Fortran compiler and, normally, a source-code version of GEMPACK. (This step cannot be carried out with the Demonstration Version of GEMPACK.)

Example 3.1.3 - Running a Simulation using the TABLO-generated program

This is Step 2 described in section 2.1 of GPD-1.

Step 2 - Run the TABLO-generated Program

This is where the actual simulation is run. The exact command to start this running varies from machine to machine. On most machines you can simply enter

```
sj
```

At the first screen of options, choose **cmf** to use a GEMPACK Command file to run this simulation. Enter the 2 responses

```
cmf
sjlb.cmf
```

(These responses are the same on all machines.)
Then there will be a lot of screen output. First this does a 1-step Euler solution and updates the data. Then a 2-step solution and finally a 4-step one. Finally the extrapolated solution is calculated from these 3 solutions and the updated data based on this is calculated and written. This will take a minute or two.

To look at the GEMPACK Command file which contains the input for the program GEMSIM, look at file **sjlb.cmf** in your text editor. This file is discussed in section 2.8.1 of GPD-1.

When the program **sj** is finished, you can check that the Solution file **sjlb.sl4** has been created. This contains the numerical results of the simulation.

Example 3.1.4 - Print out the results using GEMPIE.

This is Step 3 described in section 2.1 of GPD-1.

Step 3 - Run GEMPIE

The Solution file produced in Step 2 is a binary file which cannot be viewed or printed directly. To convert it to a form suitable for viewing on your terminal or printing, you need to run the program GEMPIE, which can usually be done by entering:

```
gempie
```

Enter the following responses when prompted by the program. As before, don't type in the exclamation marks and parts of lines after them. (In particular, if a line below begins with an exclamation mark, it is just a comment, and does not need to be entered when you run the program.)

User Input to GEMPIE

```
<carriage-return>        ! Use the default program options
sjlb                     ! Name of Solution file (produced in Step 3)
L                        ! Use the "Lists" option to choose
!                            which endogenous variables to print
a p_y p_pc p_xh p_xf p_dvhous  ! Choose all components of these
f                        ! Finished giving list
<carriage-return>        ! Accept default name (usually SJLB.PI5)
!                            for the Print file
Test Results             ! Page heading
4                        ! Number of decimal places
```

Check that a GEMPIE Print file (usually called **sjlb.pi5**) has been created. To check your results, view this file in your editor (or print it). [The end of this file is shown in Table 2.7 in GPD-1] For example, what are the percentage changes in the prices of the two factors, labor and capital? [We show in detail how to read these results in section 2.7 of GPD-1.]

3.1.4 The Example Simulation using GEMSIM

Here we spell out the GEMSIM alternative. Of course the simulation results are the same whichever method you use.

Example 3.1.2G - Implementing the model SJ using TABLO

Step 1 - Run TABLO for GEMSIM output

If you wish to run TABLO to produce GEMSIM Auxiliary files instead of producing the TABLO-generated program, start TABLO running as before

```
tablo
```

then give the following User Input. (The one change from the User Input in Example 1 is the response **pgs** instead of **wfp**).

User Input to TABLO

```
<carriage-return>    ! Use the default options
sj                   ! Name of the TABLO Input file
<carriage-return>    ! Use the default Information file name

          (TABLO will take a minute or two to check that the
          formulas, equations and updates contain no errors.
          When finished a menu will appear asking what to do next.)

a                    ! Begin automatic code generation

          (The code generation menu appears.)

pgs                  ! Produce output for GEMSIM
<carriage-return>    ! Use the other default code generation options
sj                   ! Name of GEMSIM Auxiliary files to be output

           (TABLO will take a minute or two to write the
            output required by GEMSIM.)
```

When this is finished, you can check that the following new files have been created.

- The GEMSIM Auxiliary Statement and Table files (usually called **sj.gss** and **sj.gst** respectively). They are different from the Auxiliary files produced if, as in section 3.1.3 above, you select option WFP instead of PGS; the different suffixes (usually **.axs**, **.axt** in the TABLO-generated case and **.gss**, **.gst** in the GEMSIM case) indicate this.
- The Information file (often called **sj.inf**). This contains information about the run of TABLO. If the TABLO Input file contains errors, these will be clearly marked and explained in this Information file.

You can examine the Information file. It should indicate that there were no syntax or semantic errors during the CHECK stage and, at the end of the CODE stage, tell you the names of the GEMSIM Auxiliary Statement and Table files.

Example 3.1.3G - Running a Simulation using GEMSIM

Step 2 - Run GEMSIM

Enter the command to start the program GEMSIM running, (on most machines)

```
gemsim
```

When GEMSIM prompts you, enter the 2 responses

```
cmf
sjlb.cmf
```

Example 3.1.4G - Print out the results using GEMPIE.

Proceed exactly as in Example 3.1.4 above.

3.1.5 Source-code Version : Use GEMSIM or TABLO-generated Program?

As you have seen, you have the choice of using GEMSIM or the TABLO-generated program. For small models such as Stylized Johansen, Miniature ORANI or 3-region, 3-commodity GTAP, GEMSIM is quite fast. TABLO-generated programs only give their great advantage with large models and/or more disaggregated data sets (see chapter 4).

3.1.6 The Updated Data - Another Result of the Simulation

Example 3.1.5 - Looking at the Updated Data

The line

```
updated file iodata = sjlb.upd ;
```

in the Command file SJLB.CMF means that, when you ran the simulation (Step 2, Examples 3.1.2 and 3.1.2G above), the software produced the so-called **updated data file SJLB.UPD**. This file contains the data as it would be after the shocks (in this case, the increase in labor supply) have worked their way through the model. This data represents the state of the economy after the shocks, which is why the updated data is sometimes referred to as the **post-simulation data**.

Use SEEHAR (Example 3.1.2) to look at the updated data in file SJLB.UPD. You should see the values in the Table 2.1.11 (which are shown to 3 decimal places).

You can check that these post-simulation values are consistent with the results of the simulation as seen in Examples 3.1.4 or 3.1.4G above, and as discussed in section 2.7 of GPD-1. For example, the p_DVHOUS results show that the value of household expenditure on commodity s2 increased by 5.8853 percent from its pre-simulation value of 4 to its post-simulation value of 4.2354 (which agrees with the Commodity 2 Households value in the table above).

The most obvious results of a simulation are the percentage changes in the variables. The updated data (which is always obtained when you run a simulation) is another important "result" of the simulation,

one which is sometimes overlooked. You can look at this updated data to see how the data base has changed as a result of the simulation.

3.1.7 Several Simulations using SAGEM

The GEMPACK program SAGEM can be used to carry out a simulation, and indeed, as we shall see in this section, several simulations at once. However these simulations produce somewhat less accurate solutions than the multi-step calculations carried out earlier, since the linearized equations of the model are only solved once.
Nonetheless, carrying out these simulations, which are referred to as **Johansen simulations** [10], can be quite revealing.

In many cases, the results are sufficiently accurate to produce the right qualitative results. Being able to compute several such solutions as quickly as one multi-step solution has its advantages, especially for a new model whose behaviour you are just beginning to understand.
The starting point is always the Equations file for the model which is produced by running the TABLO-generated program SJ.EXE or GEMSIM. The **Equations file** contains the numerical linearized equations of the model.

Example 3.1.6 - Preparing an Equations file for use by SAGEM

An Equations file for Stylized Johansen can be created by running the TABLO-generated program SJ.EXE or GEMSIM and taking inputs from the Command file **sjeq.cmf**. You might like to look at this Command file in GEMEDIT. This file is discussed in section 2.10.1 of GPD-1.

To create the Equations file, proceed as in Step 2 of the example simulation above but use the Command file **sjeq.cmf** instead of **sjlb.cmf**. This will create the new Equations file **sj.eq4**.

Example 3.1.7 - Carrying out the Johansen simulations with SAGEM

You will use the Command file **sjlbj.cmf** for running SAGEM to carry out these simulations. This gives shocks of 1 percent to supplies of both labor and capital.

You might like to look at the file **sjlbj.cmf** before running SAGEM. [If so, look in Example 2.1.13b above to see a discussion of parts of it.]

Start SAGEM running by entering the command

```
sagem
```

(or whatever variation is required on your system). When SAGEM prompts you, give the two responses below.

```
cmf           ! Take inputs from a GEMPACK Command file
sjlbj.cmf     ! The name of the Command file
```

[10] The name pays tribute to Johansen who pioneered this way of obtaining useful, approximate solutions of general equilibrium models around 1960.

This should create the Solution file usually called **sjlbj.sl4**. (The last "J" in the name is a reminder that this contains Johansen solutions.)

Example 3.1.8 - Run GEMPIE to Look at the Individual Column Results

To see the results, you should run GEMPIE, for example by typing

```
gempie
```

and then giving the responses below.

User Input to GEMPIE

<carriage-return>	! Take the default program options
sjlbj	! Solution file (from SAGEM run)
i	! Print individual results from Solution file
a	! Print all available columns
a	! Print all available rows
<carriage-return>	! Default name (SJLBJ) for Print file
All shocks 1	! Heading for Print file
5	! Decimal places

This should create the GEMPIE Print file **sjlbj.pi5**, which you should print or look at in an editor. Page 1 of the results (these are on the second last page of the Print file) should be (approximately) as shown in Table 2.9.2. of GPD-1

3.1.8 Changing the Closure and Shocks

Example 3.1.9 - Changing the Closure and shocks

To modify the closure on the command file **sjlb.cmf**, copy the file **sjlb.cmf** to **sjlb2.cmf**

```
copy sjlb.cmf sjlb2.cmf            ! DOS
```
or
```
cp  sjlb.cmf  sjlb2.cmf            ! UNIX
```

Then use a text editor to modify this file, following the steps below.

1. In the original closure, both components of p_XFAC (supplies of labor and capital) are exogenous. Here we keep the supply of capital exogenous, but set the price (rather than the supply) of labor exogenous. Find the statement

   ```
   exogenous p_XFAC ;
   ```

   and change this to

   ```
   exogenous p_PF("labor") p_XFAC("capital") ;
   ```

   (Be careful not to leave a space between the variable name p_PF and the bracket in this type of command.)

2. Shock p_PF("labor"), the price of labor, by 3 per cent and shock p_XFAC("capital"), the supply of capital, by 10 per cent.

You will need two separate shock commands. The **first** is

```
shock p_PF("labor") = 3 ;
```

3. Change the name of the Solution file to **sjlb2.**

4. Change the verbal description appropriately.

Rerun program GEMSIM with command file **sjlb2.cmf** (similarly to Example 2) and view the Extrapolation Accuracy file **sjlb2.xac** using the text editor. Extrapolation Accuracy files, which estimate the accuracy of an extrapolated multi-step solution, are discussed in section 2.5.3 of GPD-1.

3.1.9 Making a Data File using MODHAR

This section shows you how you can make a Header Array file for a model.

Example 3.1.10 - Making a data file for Stylized Johansen using MODHAR

In the editor, view the text file **sjdat.txt**. Details of the syntax of text files are given in GPD-4.

Start the program MODHAR running.

```
modhar                  ! DOS or UNIX
```

Then type in the User Input as shown below (see also section 3.4.1 of GPD-1).

Input for MODHAR to Recreate Data File for Stylized Johansen

```
<carriage-return> ! Use default program options
n                 ! Not based on old file (we are creating a new one)
sj.dat            ! Name of file to be created
at                ! Add arrays from a text file
sjdat.txt         ! The name of the text file
a                 ! Add all arrays from this file
ex                ! Exit (There is no more data to add.)
<Your name>       ! Your name
<date>            ! Date (Will not be prompted for on most machines)
Standard input-output data for the Stylized Johansen model. ! History
**end             ! end the history
y                 ! Yes, this history is what I wanted
```

You may wish to check that the file **sj.dat** has been created. You can examine the data on it by running the GEMPACK program SEEHAR (as in Example 8 below). [For an example of modifying an existing Header Array file see example 2.1.16 in section 2.1.]

Example 3.1.11 - Adding Set and Element Labelling to this file

Ideally Header Array files include set and element labelling (see chapter 5 of GPD-4). Then, when the data on these files is examined (for example, via the programs SEEHAR or ViewHAR), this labelling makes it clearer which commodities (etc) the data correspond to. The file SJ2.DAT produced above does not yet have this labelling.

There are various ways of adding the labelling. Perhaps the simplest is to run a simulation in which zero shocks are given. The updated data will then be identical (in values) to the original data. However, the software adds set and element labelling to this updated data.

To do this for the Stylized Johansen data, you can use the Command file SJLABEL.CMF.

First look at this file to see that it gives a zero shock and to check the name of the updated data it will produce.

Then carry out a simulation (as in Step 2 Examples 3.1.3 or 3.1.3G), taking inputs from this Command file SJLABEL.CMF. You can then use the "updated" data file SJLABEL.DAT in place of SJ2.DAT since it has the same data and also set and element labelling.[11]

3.1.10 Working with a Condensed Version of Stylized Johansen

Example 3.1.12 - Condensation of Stylized Johansen using TABLO

The concept of condensation is discussed in section 3.9 of GPD-1. This is also an example of using some of the basic options at the start of all GEMPACK programs, creating a LOG file and taking input from a Stored-input file **sjcond.sti**.

Run TABLO.

```
tablo
```

Then enter the following responses:

User Input to TABLO

```
log           ! LOG file
sjcond.log    ! name of log file
sti           ! Stored-input file
B             ! output to both screen and log file
sjcond.sti    ! name of Stored-input file
```

When this finishes, examine (using your text editor) the Information file **sjcond.inf** and the LOG file **sjcond.log**.

[11] If you wish, you can use SEEHAR to see the difference between the unlabelled SJ2.DAT produced after Example 3.1.10 and the labelled SJLABEL.DAT produced after Example 3.1.11.

Example 3.1.13 - Running GEMSIM or the TABLO-generated program for Condensed SJ

Copy the file **sjlb.cmf** to file **sjcond.cmf**

```
copy sjlb.cmf  sjcond.cmf          ! DOS
or
cp  sjlb.cmf  sjcond.cmf           ! UNIX
```

Edit the file **sjcond.cmf** to change the names of the Auxiliary files, Equation file and Solution file to SJCOND.

Run the program **sj** or GEMSIM using the command file **sjcond.cmf** (as in Example 2 or 2G above).

Compare the .XAC files **sjlb.xac** (for the uncondensed system) and **sjcond.xac** (for the condensed system of equations). The results should be the same but not all variables are there in **sjcond.xac**

Example 3.1.14 - Backsolving using TABLO

Copy the file **sjcond.sti** to **sjback.sti**. Edit the file **sjback.sti**

(1) to change the "s" above p_XH to a "b" so that p_XH is backsolved for instead of being substituted out.

(2) Change the name of the Information file and the GEMSIM Auxiliary files to **sjcond**

Repeat the steps in Examples 3.1.12 and 3.1.13 above, replacing **sjcond** with **sjback** throughout.

Compare the .XAC files in the three simulations SJ, SJBACK and SJCOND to see whether p_XH is present.

3.1.11 Transferring Simulation Results to a Spreadsheet

Example 3.1.15 - Using SLTOHT to transfer Solution results to a Spreadsheet

The program SLTOHT is used to convert results on a Solution file to either a Header Array file or a text file (CSV file) suitable for importing the results into a spreadsheet program such as Excel. In this example we will convert the results from the file SJLBJ.SL4 created in Example 5 to a text file in CSV format (Comma Separated Values) where the numbers in the array are separated by commas. A spreadsheet program will usually place the values of an array separated by commas into separate cells in the spreadsheet.

Start SLTOHT running

```
sltoht
```

and enter the response below:

User Input to SLTOHT

```
ss                  ! Choose spreadsheet output
<carriage-return>       ! Comma as separator
<carriage-return> ! Finish option choice
sjlbj.sl4           ! the solution file
a                   ! all solutions
n                   ! don't use an existing mapping file
sjlbj.csv           ! file suitable for spreadsheet use
```

The file SJLBJ.CSV can be opened in a spreadsheet program such as Excel (as a text file with commas as separators). Each column is a different solution and each row is a component of a variable. More complicated variable selection can be carried out using a Spreadsheet mapping file; see section 8.3 of GPD-1 and chapter 6 of GPD-4 for details.

3.2 Miniature ORANI Model Examples

The following examples are based on files relating to the Miniature ORANI model MO.

Preparing a Directory for Model MO

To keep all examples files for this model together in one area, create a separate directory MO. Under DOS, you can use the command

```
md  \mo                              ! DOS
or
mkdir  mo                            ! UNIX
```

Change to this directory and copy the MO files from the directory containing GEMPACK model examples. Under DOS, you can use the commands

```
cd   \mo                             ! DOS
copy  \gp\examples\mo*.*             ! DOS
dir                                  ! DOS

  or
cd  mo
cp  gp/examples/mo*.*                ! UNIX
ls -al                               ! UNIX
```

Example 3.2.1 - Implementation of the model MO using TABLO

Run TABLO.

```
tablo                                ! DOS or UNIX
```

Then respond to prompts as in Example 3.1.2 but replace the file name **sj** with **mo**. If you have a source-code version of GEMPACK and you produced a TABLO-generated program, compile and link the program **mo.for** to create the executable image, program **mo.exe** or perhaps just **mo**.

Example 3.2.2 - Simulation using the TABLO-generated program mo (or GEMSIM)

Examine the command file **motar.cmf** in the editor to see the closure and shocks applied in the simulation.

Run the program **mo** (or GEMSIM is you produced output for GEMSIM in Example 3.2.1 above) using the Command file **motar.cmf** similarly to Example 3.1.3 above.

Look at the Extrapolation Accuracy file **motar.xac** to see the results or run GEMPIE as in Example 3.1.4 above to make a print file **motar.pi5**.

Example 3.2.3 - Several simulations at once with SAGEM

In the editor, look at the Command file **mosagem.cmf** (usually supplied with GEMPACK). Check that is contains the text below:

Command file MOSAGEM.CMF

```
 use equations file mo ;
solution file = mosagem ;
use environment file mo ;

individually-retained exogenous  %all  ;

shock P_T 2  =  1 ;
shock p_phi = 1 ;
shock p_fwage  =  -2.38 ;
shock p_cR = 2.76 ;

verbal description  = MO  standard closure ;
```

Then run SAGEM with the file **mosagem.cmf** by typing

sagem

to start the program running, and then responding

log
mosagem.log
cmf
B
mosagem.cmf

If there are any errors, look in the log file **mosagem.log**. If not, run GEMPIE as in Example 3.1.6 above for SAGEM runs to create the GEMPIE Print file **mosagem.pi5** from the Solution file called **mosagem.sl4**.

Examine the PI5 file to see the results.

Example 3.2.4 - Homogeneity Test using SAGEM

To test whether some models are homogeneous, you can shock certain price variables by 1 percent and leave all quantities unshocked. (See section 8.1.2 of GPD-1 and section 13.8 of GPD-4 for more information.) In this example, you will carry out one such homogeneity test for MO.

Copy the command file **mosagem.cmf** to a new file **mohomog.cmf** and edit **mohomog.cmf** so that only the exchange rate p_PHI is shocked and the shock is 1 percent.

Change the name of the Solution file to **mohomog** but use the same Equations file and Environment file (mo). Rerun the simulation using SAGEM as in the previous example. Run GEMPIE to create the Print file **mohomog.pi5** and view the results in the editor. If the model MO is homogeneous, all nominal variables should have increased by 1 percent and all quantity variables should be zero.

Similarly you can shock all quantity variables by 1 percent and leave all price variables unshocked to check a second kind of homogeneity.

Example 3.2.5 - Modifying a closure

To modify the closure in the command file **motar.cmf**, first copy it to a new file name **motar2.cmf**, then edit it using the editor to make the following changes:

(1) Replace the exogenous variable 'p_phi' by the variable 'p_cpi'.

(2) Replace the second component of p_XEXP, p_XEXP("c2"), by the second component of p_v, 'p_v("c2")'.

(3) Change the name of the solution file to "motar2" and the name of the environment file to "mo2".

(4) Change the verbal description at the end to indicate these changes have been made.

Rerun the program **mo** or GEMSIM using this command file **motar2.cmf**. The results are in the Extrapolation Accuracy file **motar2.xac**.

3.3 Other Models Supplied

Examine in the editor (or print out) some of the TABLO Input files (extension .TAB) from the Examples subdirectory on your computer. Brief directions for running each of the model examples are given in chapter 1, and comments in the TABLO Input files and Command files give further help. References are given for each of the models. Try running simulations with some of these models.

3.4 Working with TABLO Input Files

You can use the GEMPACK software to build and solve your own models, and to carry out data-related tasks. We suggest you create a new directory on the hard disk for each model.

A description of building models and an introduction to TABLO Input files are given in chapter 3 of GPD-1. The basic TABLO syntax is in Chapter 3 of the GEMPACK Document GPD-2, "User's Guide to TABLO, GEMSIM and TABLO-generated Programs".

Chapter 4

4. TABLO-Generated Programs and GEMSIM - Timing Comparison

In this chapter we show the CPU times for solving some typical simulations with some of the example models. We report the CPU times for the same simulations carried out using a TABLO-generated program and also GEMSIM. We provide this information to assist source-code licensees of GEMPACK make a choice between these two ways of carrying out simulations.

The times reported are on a 133MHz pentium PC running Windows 95, with a source-code version of GEMPACK Release 6.0 using LF90. You should not take much notice of the actual times (which will vary between machines depending on their clock speeds, and will also vary between simulations depending on the number of steps required), but rather on the ratio between the GEMSIM and TABLO-generated CPUs. All simulations are Gragg 2,4,6-step except the 10x10 GTAP one which is Gragg 4,6,8. A fairly standard condensation of the model has been used in each case.[12]

Comparison of Times for TG-programs and GEMSIM

Model	Data size	TG-program	GEMSIM	Approx Ratio
GTAP	10x10	165 sec	300 sec	1.8
GTAP	15-com,10-reg	330 sec	460 sec	1.4
MONASH	26-com,25-ind	130 sec	820 sec	6.3
ORANIG	122-com,119-ind	510 sec	3970 sec	7.8
ORANIG	37-com,35-ind	50 sec	240 sec	4.8
ORANIG	23-com,22-ind	35 sec	100 sec	2.9

Note that GEMSIM and TABLO-generated programs take the same time as each other for the actual simulation part (LU decomposition, MA28/MA48 calls) and for reads, writes, displays, sets and subsets. The differences come from formulas, submatrices (equations), backsolves and updates.

It is likely that the more condensation is carried out, the greater will be the ratio between GEMSIM and TABLO-generated program times.[13] In particular, when large numbers of substitutions and/or backsolves are done during condensation, there will be larger numbers of extra coefficients (the ones with names like C00456), with their associated formulas, created during the condensation stage of TABLO. The formulas for these are often quite complicated and these add to the CPU ratio.

[12] The times and ratios reported may be quite different if the condensation is changed.
[13] For example, there are more condensation actions with ORANIG and MONASH than with GTAP.

Chapter 5

5. Using RunGEM for Simulations on a Windows PC

If the model you work with is fairly stable (that is, if you are not modifying it by running TABLO very often), you may like to use RunGEM for simulations. RunGEM is a Windows interface which provides an environment specially tailored for carrying out simulations with a model. RunGEM is not used to develop models but is used to run many simulations on an existing model.

This chapter provides hands-on computing to enable you to learn how to use RunGEM. The first examples (section 5.1) are with the Stylized Johansen model and then we give examples with the ORANIG model (section 5.2). However you can run any established GEMPACK model in a similar way, as will be clear once you have worked through the examples in this chapter.

If you have built your own model and have a source-code version of GEMPACK, you can make it easy for others (including those without a GEMPACK licence) to carry out simulations with your model via RunGEM. Simply send them the TABLO-generated executable image of your model (plus a few other files) together with RunGEM. Details are given in section 5.3 below.

Note that RunGEM can only be used with models which have been implemented using Release 6.0 (not Release 5.2 or earlier) of GEMPACK. [That is, the TABLO-generated program or GEMSIM Auxiliary files must have been produced using Release 6.0 (or later).]

RunGEM is described in section 9.3 of GEMPACK document GPD-4. There is also On-line Help available within RunGEM.

5.1 Stylized Johansen

5.1.1 Preparing the Model files for RunGEM

Before you start using RunGEM with a particular model, you need to collect together various files for the model with which you wish plan to carry out simulations.

If you have worked through the WinGEM Stylized Johansen examples in section 2.1 above, the relevant files are already in the directory you created then (see section 2.1.2). In this case you can skip the rest of this section and go straight to section 5.1.2.

Otherwise, to prepare the files which RunGEM needs, follow the instructions in the rest of this section.

First create a directory for Stylized Johansen (for example C:\SJ) or use the existing SJ directory on your PC. Copy the model files for Stylized Johansen to the SJ directory as described in section 2.1.

Run **TABLO** with the TABLO-Input file SJ.TAB as described in section 2.1.3 to create the TABLO-generated program SJ.EXE or, as in section 2.1.6, to create the GEMSIM Auxiliary files SJ.GSS and SJ.GST.

This TABLO run will also create the Model Information file **`SJ.MIN`**. This is a new file which is only produced by GEMPACK Release 6.0, not by earlier versions of GEMPACK. The file SJ.MIN is a text file so you can edit it in the text editor. [You may look to see the sort of information it contains about

the SJ model, but you don't need to understand the structure of this file. Certainly you should not change it in any way as otherwise RunGEM may not function properly.]

You should also find the file **SJ.CLS** in this directory.[14] This file (needed by RunGEM) contains just the statements needed in a GEMPACK Command file to set up one (in this case, the standard) closure for Stylized Johansen. If you look at this file in your text editor you will see that it contains just the two lines

```
exogenous p_XFAC ;
rest endogenous ;
```

[In general if you have a Command file for your model, and if it sets up the closure by listing the exogenous variables and saying that the rest are endogenous, you can easily cut out the section of it which gives the closure and save this section as the Closure file for the model.]

Files needed for Stylized Johansen in RunGEM

SJ.GSS and SJ.GST	the Model files - the Auxiliary files for GEMSIM
or	
SJ.EXE, SJ.AXS, SJ.AXT	the Executable image for SJ and its Auxiliary files
SJ.MIN	the Model Information file
SJ.CLS	a Closure file
SJ.DAT	the usual Header Array data file for SJ
SJ.TAB	the TABLO Input file for SJ.

The TABLO-Input file SJ.TAB is not actually used by RunGEM but is included more as a reference for you to consult when in doubt about the model and its variables and equations.

5.1.2 Starting RunGEM

Double-click on the **RunGEM** icon to start the RunGEM program. Alternatively start the file RunGEM.EXE in your GEMPACK directory (usually C:\GP) in a typical Windows way, for example double-clicking on RunGEM.EXE in File Manager or Window Explorer.

This produces a screen with a menu bar at the top and underneath a set of Tabs labelling a "Tabbed Notebook" which looks something like a card index.

Title | Model/Data | Closure | Shocks | Output files | Solve | Results |

To change between the different "pages" of the RunGEM tabbed notebook, just click on these Tabs. The order is roughly the order you would work through in setting up a model but you can go back and alter details on any of the pages at any time.

Select the Model

Select ***Model/Data*** by clicking on it. Click the button ***Change Model*** to select your model. In the File choosing box which appears select either the file SJ.EXE or the file SJ.GSS in your Stylized Johansen directory.

[14] If this file is not there, you can easily create SJ.CLS using your text editor. It should contain the two lines:
exogenous p_XFAC ;
rest endogenous ;

Select the Data Files

In the white box headed *Input Data Files* a single line of text will appear

```
file iodata = ?? ; ! input-output data for the model
```

You need to complete this line to say which data file on your computer corresponds to the logical file in the TABLO Input file SJ.TAB called *iodata*. Select the line by **right clicking** on it.[15] You will see a small menu pop up near where you clicked. Select the option ***Select or change the file name*** . Then select the usual data file for the Stylized Johansen model, SJ.DAT in the directory SJ.

[In some other models which read from several data files, there would be several lines in the *Input Data Files* box. The first time you run a model there will be question marks ?? to fill in for each of these files.]

Click on the button ***Save As…*** and save the list of data files by the suggested name of SJ.MDF. This enables RunGEM to remember the names of your data files ready for the next time you use RunGEM to run the model SJ.

Load the Closure

Select the next Tab of the tabbed notebook ***Closure*** . Because you have a file called SJ.CLS in the same directory SJ as your model files, RunGEM will automatically open it to show the closure which it contains in the Closure box. [If this file SJ.CLS is not present the Closure box will be empty and you can type in the lines

```
exogenous p_XFAC ;
rest endogenous ;
```

and click on the ***Save Closure*** button to save them as the file SJ.CLS.]

Click the button ***Check closure*** and RunGEM will check to see if this is a valid closure for the Stylized Johansen model. This is really a check to see if you have the correct number of exogenous and endogenous variables.

Select the Shocks

Click on the ***Shocks*** tab, and in the box labelled *Variable to Shock*, click on the small arrow on the right hand side to get a drop-down list of exogenous variables. For the closure in the file SJ.CLS, there is only one exogenous variable, namely p_XFAC. Click on this line to select p_XFAC and then in the *Elements to Shock* box, click on the arrow and select the line "labor" so that in this simulation you are shocking just one component of p_XFAC, the labor supply. Type in the next box the value of the shock as **10 .** The red shock statement below the boxes gives the form of the shock statement you are adding. When you are happy with the shock statement, click on the button ***Add to Shock List.*** Save this list of shocks with the ***Save File of Shocks*** button and save it to the name SJLB.SHF in the SJ directory.

Output Files

Click on the Tab ***Output Files.*** RunGEM has supplied some default names for these files but we suggest below that you choose other names similar to those used in the standard Stylised Johansen

[15] That is, click on the **right** mouse button (not the left one which you may be more familiar with).

simulation. For details about the *Post Simulation files* see the RunGEM help. To get help relevant to this page of the tabbed notebook, press the function key **F1**. Exit from the Help to return to RunGEM.

To change the names of the output files, click (left click this time) on the first line in the lower box:

```
Solution file = SIM1 ;
```

Change the name of the Solution file to SJLB.SL4. [You will notice that, when you make this change, RunGEM also changes the name of the updated data file iodata to be SJLB.UPD - RunGEM tries to keep the output file names from one simulation similar to each other.]

Carry out the Simulation

Select the next page ***Solve*** and type in some verbal description to say

```
Stylized Johansen. Standard closure. 10 percent increase in labor supply.
```

Click on the ***Solve*** button and RunGEM will calculate the solution of this simulation. When finished, a box will appear which says how long the simulation took and asking you to look at the ***Results*** page.

Look at the Results

The results appear in a format similar to results in ViewSOL[16] but slightly simplified because the ViewSOL menu is not available. ViewSOL opens at the Contents page as usual. To see the Number page, click on the right-hand side of one of the lines of the Contents. Press **F1** to obtain help for this page and how to use ViewSOL.

To return to the Contents screen from the results, click twice on one of the numbers. [Clicking on the variable or component names has no effect.]

Look at the Updated Data

Click on RunGEM's ***View*** menu and select ***Updated data*** from the drop down menu, and then select ***updated iodata*** (the only option to the right of "Updated data"). You will see the updated input-output data in a ViewHAR window.

Now you have completed setting up RunGEM for the Stylized Johansen model and run one simulation.

5.1.3 Modifying the Closure and Shocks

To run other simulations with different closures and/or shocks is very simple. In the next example, the simulation is to increase the price of labor in the model by 3 percent and also to increase the supply of capital by 10 percent. This is the same simulation as in section 2.1.12 (Example 2.1.10 - Changing the closure and shocks).

Work through the pages of RunGEM again and see what needs changing to modify the closure and shocks.

Model/Data

[16] See Example 2.1.5a in section 2.1.8.

Same model, same data so no change is required.

Closure

New closure is needed with the variables we wish to shock on the exogenous list.
Edit the closure file to read

```
exogenous p_pf("labor")  p_xfac("capital") ;
rest endogenous ;
```

Save the closure as the closure file SJLB2.CLS
Check the closure (by clicking on the *Check Closure* button).
Load the new closure in SJLB2.CLS (by clicking on the *Load Closure* button).

Shocks

New shocks needed are: Price of labour = 3 Supply of capital = 10

Click on *Variable to shock* and select the variable for the price of factors, p_PF.
Click on *Elements to Shock* and select the component "labor", type in the *Value of shock* as 3.
Click on the button *Add to shock list.*

Click on *Variable to shock* and select the variable for the supply of factors, p_XFAC.
Click on *Elements to Shock* and select the component "capital", type in the *Value of shock* as 10.
Click on the button *Add to shock list.*

Click on the button *Save file of Shocks* and save to a new name SJLB2.SHF

Output Files

Change the name of the Solution file to SJLB2.SL4.
Change the name of the updated data file to SJLB2.UPD
Change the verbal description.

Solve

Click on the *Solve* button. [If you wish to use a different solution method or different numbers of steps, click on the *Change* button to the right of the currently shown solution method and change these before you click on the Solve button.]

Results

View the results (and perhaps look at the updated data).

5.2 ORANIG98 Model

This section describes how to use RunGEM with a more complicated model. ORANIG is one of the models supplied with GEMPACK - see section 1.4 for details of this model. The files for it are in the Examples subdirectory (usually C:\GP\EXAMPLES).

5.2.1 Prepare the Model Files for RunGEM

Before you start using RunGEM with a particular model, you need to collect together various files for the model with which you wish plan to use carry out simulations.

If you have worked through the WinGEM ORANIG examples in section 2.4 above, the relevant files are already in the directory you created then. In this case you can skip the rest of this section and go straight to section 5.2.2.

Otherwise, to prepare the files which RunGEM, follow the instructions in the rest of this section.

Create a directory for ORANIG98 (for example C:\ORANIG). Copy the model files for ORANIG98 from the Examples subdirectory to the ORANIG directory (see section 2.4 above for details).

Run **TABLO** with the TABLO-Input file ORANIG98.TAB to create the TABLO-generated program ORANIG98.EXE or to create the GEMSIM Auxiliary files ORANIG98.GSS and ORANIG98.GST. Note that you must condense the ORANIG98 model so use the appropriate STI file to run TABLO, either ORANIGTG.STI (for the TG program) or ORANIGGS.STI (for GEMSIM). This will also create the Model Information file **ORANIG98.MIN**. This is a new file which is only produced by GEMPACK Release 6.0, not by earlier versions of GEMPACK.

You should also find the file **ORANIG98.CLS** in this directory.[17] This file (needed by RunGEM) contains just the statements needed in a GEMPACK Command file to set up one closure (in this case, the standard shortrun closure) for ORANIG. You might like to look at this file in you text editor. If so you will see that it contains the closure statements (that is the "exogenous …" and "rest endogenous ;" statements) from the Command file ORNG98SR.CMF.

Files needed for ORANIG98 in RunGEM

ORANIG98.GSS and ORANIG98.GST	the Auxiliary files for GEMSIM
or	
ORANIG98.EXE, ORANIG98.AXS, ORANIG98.AXT	the Executable image and its Auxiliary files
ORANIG98.MIN	the Model Information file
ORANIG98.CLS	a Closure file
ORANG867.HAR	the usual Header Array data file for ORANIG
ORANIG98.TAB	the TABLO Input file for ORANIG

[17] If this file is not there, you can create it using your text editor. Copy the section of ORNG98SR.CMF relating to closure (that is, the statements beginning with "exogenous" and the "rest endogenous ;" statement) and save it as a new text file ORANIG98.CLS.

5.2.2 Starting RunGEM

Double-click on the **RunGEM** icon to start the RunGEM program.

Select the Model

Select ***Model/Data*** tab of RunGEM's tabbed notebook by clicking on it.
Click the button ***Change Model*** to select your model. In the File-choosing box which appears, select either the file ORANIG98.EXE or the file ORANIG98.GSS in your ORANIG directory.

Select the Data Files

In the white box headed *Input Data Files* a single line of text will appear

```
File MDATA = ?? ; ! Data file
```

You need to complete this line to say which data file on your computer corresponds to the logical file in the TABLO Input file ORANIG98.TAB called *MDATA*. Select the line by **right clicking** on it.[18] You will see a small menu pop up near where you clicked. Select the option ***Select or change the file name*** . Then select the data file for the ORANIG98, ORANG867.HAR in the directory ORANIG.

Click on the button ***Save As…***and save the list of data files by the suggested name of ORANIG98.MDF. This enables RunGEM to remember the names of your data files ready for the next time you use RunGEM to run the model ORANIG98.[19]

Load the Closure

Select the next Tab of the tabbed notebook ***Closure*** Because you have a file called ORANIG98.CLS in the same directory as your model files, RunGEM will automatically open it to show the closure which it contains.

Click the button ***Check closure*** and RunGEM will check to see if this is a valid closure for the ORANIG98 model. This is really a check to see if you have the correct number of exogenous and endogenous variables.

Select the Shocks

Click on the ***Shocks*** tab, and in the box labelled *Variable to Shock*, click on the small arrow on the right hand side to get a drop-down list of exogenous variables. There are many exogenous variables to choose from. To run a price homogeneity simulation, select the exchange rate variable **phi**. Click on the line to select phi. Since phi has only one component, no *Elements to Shock* box appears.

Type in the value of the shock as **1** . The red shock statement below the boxes gives the form of the shock statement you are adding. When you are happy with the shock statement, click on the button ***Add to Shock List.***

Save the list of shocks with the ***Save File of Shocks*** button and save it to the name ORNGHOMO.SHF in the ORANIG directory.

---

[18] That is, click on the **right** mouse button (not the left one which you may be more familiar with).
[19] If you don't save this file, RunGEM will save it for you after you have successfully carried out a simulation with ORANIG.

Output Files

Click on the Tab ***Output Files.*** RunGEM has supplied some default names for these files but we suggest that you choose other names. Click (left-click this time) on the first line in the lower box:

```
Solution file = SIM1 ;
```

Change the name of the Solution file to ORNGHOMO.SL4. Change the name of the file SUMMARY from ORNGHOMO.OU1 to SUMMARY.HAR.

Carry out the Simulation

Select the next page ***Solve*** and type in the following verbal description.

```
Oranig98 Homogeneity test. Short run closure.
```

Change the Solution method to run a Johansen one-step simulation.
Click on the ***Solve*** button and RunGEM will calculate the solution of this simulation. When finished, a box will appear which says how long the simulation took and asking you to look at the ***Results*** page.

Look at the Results

The results appear in a format similar to results in ViewSOL but slightly simplified because the ViewSOL menu is not available. ViewSOL opens at the Contents page as usual. To see the Number page, click on the right-hand side of one of the lines of the Contents.

To return to the Contents screen from the results, click twice on one of the numbers. [Clicking on the variable or component names has no effect.]

Viewing other Output Files

Several other output files were produced when you solved the model. In the RunGEM menu bar, select ***View*** and a dropdown menu will appear. You can select any you want to View.

`Input Data files`	This is the original MDATA file ORANG867.HAR
`Updated Data files`	This is the updated version of the MDATA file ORNGHOMO.UPD.
`Outputs (PreSim)`	This is the file SUMMARY.HAR written via TABLO Write statements. The values reflect the pre-simulation data in the Input MDATA file.
`Outputs (PostSim)`	If there are any Outputs(PreSim), RunGEM automatically runs the simulation starting from the updated data. The values in these files reflect the post-simulation data in the updated data file ORNGHOMO.UPD.
`Log file`	This is the Log file of the main simulation.
`XAC file`	This is the Extrapolation Accuracy file from the simulation. It is **not** produced for a 1 step sim (only if the simulation extrapolates from 3 separate solutions).

5.2.3 Wage Cut Simulation

Now you have completed setting up RunGEM for the ORANIG98 model and run one simulation. This was a (not very interesting) homogeneity test. In the next example you can modify the choice of shocks to run a Wage Cut Simulation.

Select the Shocks

Since the model, base data and closure are unaltered, the only changes are to the Shocks and Output files pages.
Click on the ***Shocks*** tab. ***Clear the Shocks List*** and in the box labelled *Variable to Shock,* click on the small arrow on the right hand side to get a drop-down list of exogenous variables. Select the variable **f1lab_io,** which is an overall wage shifter.

Type in the value of the shock as **-5.0** The red shock statement below the boxes gives the form of the shock statement you are adding. When you are happy with the shock statement, click on the button ***Add to Shock List.***

Output Files

Click on the Tab ***Output Files.*** You must select other names for the output files if you wish to avoid overwriting the results of previous simulations. Select the first line in the lower box for the Solution file:

```
Solution file = …. ;
```

Change the name of the Solution file from ORNGHOMO.SL4 to ORNG98SR.SL4.

Carry out the Simulation

Select the next page ***Solve*** and type in the verbal description:

```
Oranig98 Short run closure. Wage Cut 5 percent
```

Change the Solution method to Gragg and the number of steps to 2 4 6.

Click on the ***Solve*** button and RunGEM will calculate the solution of this simulation. When finished, a box will appear which says how long the simulation took and asking you to look at the ***Results*** page.

Look at the Results

The results appear in a format similar to results in ViewSOL but slightly simplified because the ViewSOL menu is not available. ViewSOL opens at the Contents page as usual. To see the Number page, click on the right-hand side of one of the lines of the Contents.

To return to the Contents screen from the results, click twice on one of the numbers.

Viewing other Output Files

New output files were produced when you solved the model. In the RunGEM menu bar, select ***View*** and a dropdown menu will appear. Select the ones you want to look at.

`Input Data files`	This is the original MDATA file ORANG867.HAR
`Updated Data files`	This is the updated version of the MDATA file ORNG98SR.UPD.
`Outputs (PreSim)`	This is the file SUMMARY.HAR written via TABLO Write statements. The values reflect the pre-simulation data in the Input MDATA file.
`Outputs (PostSim)`	If there are any Outputs(PreSim), RunGEM automatically runs the simulation starting from the updated data. The values in these files reflect the post-simulation data in the updated data file ORNG98SR.UPD.
`Log file`	This is the Log file of the main simulation.
`XAC file`	This is the Extrapolation Accuracy file from the simulation.

5.2.4 Long Run Simulation

Since the model and data files are unchanged, you need to change only the closure, shocks and output files. The simulation is to find the effect of a 1 percent increase in the labour force (while all other exogenous variables are held fixed.

Load the Closure

Select the Tab of the tabbed notebook ***Closure***…Load the file ORNG98LR.CMF, which is a GEMPACK Command file which contains the Long Run Closure. Select and delete all parts of the file which do not relate to the closure till all that remains in the "exogenous…" and "rest endogenous" statements. Save this closure as ORNG98LR.CLS.

Click the button ***Check closure*** and RunGEM will check to see if this is a valid closure.

Select the Shocks

Click on the ***Shocks*** tab, and in the box labelled *Variable to Shock,* click on the small arrow on the right hand side to get a drop-down list of exogenous variables. There are many exogenous variables to choose from. Select the variable **employ_i.**

Type in the value of the shock as **1.0** . ***Clear the Shock list*** and then click on the button ***Add to Shock List.***

Output Files

Click on the Tab ***Output Files.*** RunGEM has supplied some default names for these files but we will choose other names. Select the first line in the lower box:

```
Solution file = … ;
```

Change the name of the Solution file to ORNG98LR.SL4.

Carry out the Simulation

Select the next page ***Solve*** and type in some verbal description to say

```
Oranig98 Long run closure. 1 percent increase in labour force
```

Click on the ***Solve*** button and RunGEM will calculate the solution of this simulation. When finished, a box will appear which says how long the simulation took and asking you to look at the ***Results*** page. Look at the Results and View the Output files as in the previous simulation.

5.3 Preparing Models for Use by Others with RunGEM

In this section we tell you how you can prepare the relevant files for your own model (or a model built by someone else) so that others (including those without a GEMPACK licence) can carry out simulations using RunGEM.

You need to run TABLO (from Release 6.0 of GEMPACK, not earlier) to produce the TABLO-generated program for the model. If you are sending this to someone without source-code GEMPACK installed, make sure that you make a stand-alone executable image (for example, using WinGEM's Compile & Link option *Create stand-alone .EXE*).

You also need one Closure file. This should consist of a sequence of "exogenous … " statements (listing the exogenous variables for one standard closure of the model) followed by the statement "rest endogenous ;". Save this file with suffix **`.CLS`** (required by RunGEM) and make the first part of its name the same as the name of the TABLO-generated program (without the .EXE).

Then collect

- the TABLO-generated .EXE and .AXS and .AXT files,
- the Model Information **`.MIN`** file produced when TABLO ran,
- the **`.CLS`** file,
- the TABLO Input file, and
- the base data file(s) for your model.

These model files are what someone else needs to put into a new model directory in order to run simulations with your model.

More details can be found in the section *Preparing a Model for Use with RunGEM* in RunGEM's help file (which you can open by clicking on ***Help*** from RunGEM's main menu). In particular, you will need to read this carefully if your model reads data from the terminal.

Note that RunGEM restricts the statements allowed in a .CLS file (or on its Closure page). Basically RunGEM insists that you specify the closure by listing the exogenous variables and then saying that the rest are endogenous. More details can be found under the heading "Closure" in RunGEM's Help file.

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[20] The numbering of GEMPACK Documents has been re-started with Release 5 of GEMPACK, when the abbreviation "GPD" was first used. Previous editions of these documents did not have the same numbers as the current editions. Pre-Release-5 documents are numbered "GED-xx".

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