GEMPACK USER DOCUMENTATION

Release 8.0

GPD-8 Getting Started with GEMPACK : Hands-on Examples

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 3800, 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 introductions to

- RunGEM which is a Windows interface for carrying out simulations with models.
- AnalyseGE, software for assisting modellers in the analysis of their simulation results.

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

Authors and Earlier Editions

Date	*Author(s)*	*Comment*
October 98	J.Harrison & K.Pearson	First edition (Release 6.0) [In Release 5.2, this material was in Appendix B of GPD-4 and Appendices B and E of GPD-1.]
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Chapter 1

1. Models Usually Supplied With GEMPACK

The models usually supplied with GEMPACK are listed in section 1.8 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 (see section 2.3 of GPD-1) 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 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 Windows interface for carrying out simulations with models implemented via GEMPACK[1]. Both new and experienced GEMPACK users may find that RunGEM helps them to carry out simulations easily and efficiently. RunGEM used in conjunction with TABmate can provide an excellent model development environment for experienced users (an alternative to WinGEM, for example) – see section 5.4. RunGEM provides an excellent environment for students to carry out simulations in a computer laboratory – see section 5.5.

Chapter 6 contains an introduction to AnalyseGE[2].

For Release 7.0 of GEMPACK, some of the examples files were changed slightly.

- There were some changes to avoid input from the terminal during simulations since this is awkward when using WinGEM.
- Some other changes have been name changes so that all files for a particular model start with the same letter. For example, all GTAP files start with "G".

---

[1] RunGEM was introduced in Release 6.0 of GEMPACK.

[2] AnalyseGE was introduced in Release 7.0 of GEMPACK.

- There have been some changes in Command files to use a more modern style of syntax, for example using <cmf>, and not saving an Equations or BCV files unnecessarily.

For Release 8.0,

- we have added examples involving complementarities (for example, quotas) have been added (see section 1.11).
- we have added examples based on the current (as at October 2002) version ORANIG01 of ORANI-G (see section 1.4.1).
- we have added examples based on the current (as at October 2002) version GTAP61 of GTAP (see section 1.6.1).
- a full-sized intertemporal, rational expectations version of ORANI is now available (see section 1.12).

The example files from earlier Releases should all still run successfully in Release 8.0.

If you have the Demonstration Version of GEMPACK, you can only run some of the models supplied.

- You cannot use GEMSIM to carry out the ORANI-G and ORANI-F simulations (see sections 1.4 and 1.5 below).
- You cannot use GEMSIM to carry out simulations with any aggregation of the GTAP model (see section 1.6) larger than 3 commodities and 3 regions.
- You cannot carry out the GTAP complementarity examples (see section 1.11).
- You can carry out simulations with the other models supplied.

1.1 Stylized Johansen SJ

Stylized Johansen 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 3.4 and
- the levels version in section 3.5.

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***
		or SJLNA.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 4.2 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***
		or SJLNALB.CMF	
GEMSIM or TABLO-generated	***SJEQ.CMF***	-	-
SAGEM	***SJLBJ.CMF***	-	-
GEMSIM or TABLO-generated	***SJLABEL.CMF***	-	-
GEMSIM or TABLO-generated	***SJENV.CMF***	-	-
GEMSIM or TABLO-generated	***SJSUB.CMF***	-	-

The Command files SJLB.CMF, SJLNLB.CMF, SJLNALB.CMF and SJLVLB.CMF all carry out the example simulation from section 2.1.2 of GPD-1. The files SJEQ.CMF and SJLBJ.CMF are those used in section 2.12 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 4.2 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 Command file SJSUB.CMF produces subtotals results (see section 11.3 of GPD-3 and section 8.2.4 of GPD-4).

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 3.8.2 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.

When running Stylized Johansen using the Windows program RunGEM, you need a text file containing the closure. An example is the file SJ.CLS. More details are given in section 5.1 and in the on-line Help file for RunGEM.

There are some additional files for the AnalyseGE example in section 6.1. The TABLO Input file SJLNA.TAB is the same as SJLN.TAB except for some additional statements to calculate real GDP. To run a simulation with SJLNA, the Command file is SJLNALB.CMF.

The TABLO Input file ***SJERROR.TAB*** is used in section 3.9.1 of GPD-1 to illustrate the procedure for identifying and removing errors in TABLO Input files. The Command files ***SJLBERR1.CMF*** and ***SJLBERR2.CMF*** are used in section 3.9.2 of GPD-1 to illustrate how to identify and remove errors in Command files.

1.2 Miniature ORANI MO

Miniature ORANI 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	Levels
TABLO Input file	***MO.TAB***	***MOLN.TAB***	***MOLV.TAB***
Header Array data file	***MO.DAT***	(same)	(same)
Command file	***MOTAR.CMF***	***MOLNTAR.CMF***	***MOLVTAR.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 levels TABLO file is *MOLV.TAB* and the corresponding Command file is *MOLVTAR.CMF*.

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.

When running MO using the Windows program RunGEM, you need a text file containing the closure. An example is the file MO.CLS.

There are complementarity and quota examples using MO – see section 1.11.

As an example of Newton's method, the levels TABLO Input file *MOLV.TAB* can be used. Run TABLO using the Stored-Input file *MOLV-NWT.STI*. Compile and link to make the EXE file called *MOLV-NWT .EXE*. *MOLV-NWT.EXE* can be run using the Stored-input file *MOLVNWT1.STI*. This runs a simulation from the Command file *MOLV-NWT.CMF* using Newton's method. See section 7.5 of GPD-3 for details of Newton's method.

1.3 Trade Model TRADMOD

The Trade Model TRADMOD 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

There are two versions in the GEMPACK examples:
ORANIG01 - the model used in the 2001 Practical GE Modelling Training Course, and
ORANIG98 – the model used in the 1998 Practical GE Modelling Training Course.

1.4.1 ORANIG01 Model

The relevant files are

`TABLO Input files`	***ORANIG01.TAB, OG01.TAB***
`Condensation files`	***OG01GS.STI, OG01TG.STI***
`Header Array data file`	***OGOZD867.HAR***
`Command files`	***OG01HOMO.CMF, OG01RHOM.CMF*** ***OG01WAGE.CMF, OG01EMPL.CMF*** ***OG01SUM.CMF***

The TABLO Input file ORANIG01.TAB is as used in the Practical GE Modelling course held at Monash University in June 2001. Run TABLO with either of the Stored-input files OG01GS.STI (produces output for GEMSIM) or OG01TG.STI (produces a TABLO-generated program) to condense the model.

The data supplied in OGOZD867.HAR is 23-commodity, 22-industry 1986/87 data for Australia.

Command files OG01HOMO.CMF and OG01RHOM.CMF are simulations to test price and real homogeneity of the model (see section 13.2 of GPD-4).

The Command file OG01WAGE.CMF is for a simulation with a Short Run closure, simulating a wage-cut and OG01EMPL.CMF is a simulation with a Long Run closure which simulates a 1 percent growth in employment.

The Command file OG01SUM.CMF is used to check the balance of on ORANI-G data set (see section 6.8.2 of GPD-3).

The TABLO Input file OG01.TAB is an example of adding the condensation actions to the TABLO Input file (see section 2.4 of GPD-2). If you run TABLO and select the TABLO Input file OG01.TAB, then the same condensation actions are carried out, just as if you had selected to run TABLO using one of the STI files OG01GS.STI or OG01TG.STI.

1.4.2 ORANIG98 Model

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 ORNGAPP1.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.

The Command file *ORNGAPP1.CMF* carries out a simulation with subtotals – see section 2.8.7 for details.

When running ORANIG using the Windows program RunGEM, you need a text file containing the closure. An example is the file ORANIG98.CLS. More details are given in section 5.2 and in the on-line Help file for RunGEM.

1.5 Single Country Model of Australia ORANI-F

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*** ***ORFJ8.STI*** ***ORFG8.STI***	***ORANIFM.STI*** ***ORFJ8MIX.STI*** ***ORFG8MIX.STI***
GEMPACK Command files	***ORFJ8.CMF*** ***ORFG8.CMF***	***ORFJ8MIX.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)).

There are two version of the GTAP model in the GEMPACK examples:
GTAP94.TAB and GTAP61.TAB.

There are also complementarity and quota examples using GTAP – see section 1.11.

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.

1.6.1 GTAP61 Model

The file GTAP61.TAB contains Version 6.1 (August 2001) of GTAP (the Global Trade Analysis Project's model). This is the version used in the August 2002 GTAP Short Course.

The relevant files are

TABLO Input files	***GTAP61.TAB GTPVEW61.TAB***
Condensation files	***GTAP61.STI GTAP61GS.STI GTAP61TG.STI***
Header Array files	***GDATC3X3.HAR GPARC3X3.HAR GSETC3X3.HAR*** ***GDATA7X5.HAR GPARA7X5.HAR GSETA7X5.HAR*** ***GDATCH10.HAR GPARCH10.HAR GSETCH10.HAR***
Command files	***GEX15.CMF GEX15E.CMF GEX15I.CMF*** ***GEX15A1.CMF GEX15A2.CMF GEX15A3.CMF*** ***GSEFTA1.CMF*** ***GC10E1.CMF GC10E1AA.CMF GC10E1RT.CMF*** ***GTPV3X3.CMF***
Shock files	***GTXS2-06.SHK GTMSA7X5.SHK***

The TAB file GTAP61.TAB and the condensation Stored-input files GTAP61TG.STI and GTAP61GS.STI are used in various simulation examples, including those in section 7.1.1 of GPD-3.

The Header Array files above are three different aggregations of the GTAP data, namely C3X3, A7X5 and CH10.[3]

The Command files GEX15*.CMF are used in the simulations in section 7.1.1 of GPD-3, as are the C3X3 data files.

The Command files GC10E1*.CMF are used in the simulations in section 6.4.3 of GPD-3, as are the CH10 data files and the two Shock files above.

The Command file GSEFTA1.CMF is used in the simulation in section 5.5.1 of GPD-3, as are the A7X5 data files.

The TABLO Input file GTPVEW61.TAB is used for checking and reporting various features of the data base (see section 6.8.1 of GPD-3). The Command file GTPV3X3.CMF is used with this TABLO Input file.

[3] These correspond to the Versions ACORS3X3, ASA7X5 and CHP10 under RunGTAP (see section 2.5 of GPD-4). Each aggregation has 3 files, the GDAT file (input-output and trade data), the GPAR file (parameter values) and the GSET file (set and element names).

1.6.2 GTAP94 Model

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***
	GDAT2-05.NAF	
Header Array set data files	***GSET2-01.HAR***	***GSET2-06.HAR***
	GSET2-05.HAR	
Text Parameter files	***GPAR2-01.DAT***	***GPAR2-06.DAT***
	GPAR2-05.DAT	
Command files	***GNUM2-01.CMF***	***GC2-06E1.CMF***
	GTMSEU33.CMF	***GCAPMRGE.CMF***
	GIP73A.CMF	
Shock files	***GTXS2-06.SHK***	***GTMS25E3.SHK***

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

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).

It is possible to decompose simulation results from a multi-step solution with respect to exogenous shocks[4] as discussed in the paper by Harrison, Horridge and Pearson (2000). The Command file *GIP73.CMF* carries out the example in this paper -a multi-step GTAP simulation which decomposes the simulation results using subtotals. See section 2.6.10 below and chapter 11 in GPD-3 for details about subtotals for GEMSIM or TABLO-generated programs.

[4] This was introduced in Release 7.0.

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 chapter 10 in GPD-3) 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	***TREEGRID.DAT***[5]
GEMPACK Command file	***TREESP.CMF***

The TABLO Input file is as in Appendix of Codsi *et al* (1992) but it has been rewritten so no terminal data is necessary[6].

The base data file *TREES20.DAT* contains the steady state data described in section 6 of Codsi *et al* (1992). 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.

[5] The file TREEGRID.DAT used to be called EVEN2080.DAT (Release 6.0 or earlier).

[6] Prior to Release 7.0 of GEMPACK, this model required input from the terminal and was run using the Stored-input file TREESP.STI. The files TREES.TAB, TREESP.CMF and TREES20.DAT have been changed.

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	***CRTSGRID.DAT***[7]
GEMPACK Command file	***CRTSDIV.CMF***

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.) You can experiment with other grids.

This model has been rewritten so that it no longer needs terminal input[8]. To run the simulation, use the CMF file CRTSDIV.CMF.

1.9.1 Using Levels Equations and ADD_HOMOTOPY in CRTS

How would you create an intertemporal data set for the CRTS model if one of the values in the first year of this data were changed from its steady state value? See section 7.6 of GPD-2 for a description of how to use levels equations for the inter-period equations and to add the Homotopy terms to these equations. This is what we have done in TAB file **CRTSV3.TAB** (version 3, February 2002 of that TAB file) and starting data file **CRTS20I.DAT** (which differs from the standard, steady-state data CRTS20.DAT only in the investment values). You need Release 8.0 (or later) of GEMPACK for this example.

The relevant files are

TABLO Input file	***CRTSV3.TAB***
Text base data file	***CRTS20I.DAT***
Time data file	***CRTSGRID.DAT***[9]
GEMPACK Command file	***CRTSV3BS.CMF***

The Command file **CRTSV3BS.CMF** carries out a simulation starting from the non-steady state data in CRTS20I.DAT and shocks just c_HOMOTOPY (the linear variable associated with the levels variable HOMOTOPY) by one. The updated data is a solution to all the levels equations of the model. See section 7.6 of GPD-2 for more details about the closure in this Command file.

Wendner (1999) considers this topic in considerable detail. The ADD_HOMOTOPY idea above automates what he refers to as Step 3 in Part two [see Figure 3 in Wendner (1999)]. When the model has intertemporal parameters, further steps may be needed to complete the intertemporal data set – see Wendner (1999) for more details.

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[7] The file CRTSGRID.DAT used to be called EVEN2080.DAT (Release 6.0 or earlier).

[8] Prior to Release 7.0 of GEMPACK, this model required input from the terminal and was usually run using a Stored-input file called CRTSDIV.STI. The files CRTS.TAB, CTRS20.DAT and CRTSDIV.CMF have been changed.

[9] The file CRTSGRID.DAT used to be called EVEN2080.DAT (Release 6.0 or earlier).

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***
Text expectation data files	***5SECT_PF.DAT or 5SECT_FE.DAT***
Time data file	***5SGRID80.DAT***[10]
GEMPACK Command file	***5SSIM.CMF***

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 the TABLO Input file 5SECT.TAB has been rewritten so that it no longer uses terminal data[11]. If you wish to carry out the simulation using perfect foresight, use the expectation data file called 5SECT_PF.DAT in the Command file 5SSIM.CMF. For fixed expectations, edit the Command file to use the expectation data file 5SECT_FE.DAT.

1.11 Complementarity Examples

In Chapter 16 of GPD-3, there are several detailed examples relating to Complementarities and quotas which you can work through.

Miniature ORANI with various sorts of quotas

The file MOQ.ZIP contains the files needed for examples using the Miniature ORANI model.

See sections 16.4 and sections 16.8.1 to 16.8.3 of GPD-3 for details.

GTAP with various sorts of quotas

The file G5TRQ.ZIP contains files need for examples using the GTAP model.

See sections 16.8.4 to 16.8.6 of GPD-3 for details.

1994 version of GTAP with export and import volume quotas

The file G94-QUO.ZIP contains files need for examples using the GTAP94 model.

See sections 16.8.7 and 16.8.8 of GPD-3 for details.

[10] The file 5SGRID80.DAT use to be called GRIDH80.DAT (Release 6.0 or earlier).

[11] Prior to Release 7.0 of GEMPACK, this model required input from the terminal and was usually run using a Stored-input file 5SSIM.STI. The files 5SECT.TAB, 5SECT.DAT and 5SSIM.CMF have been changed, and the expectation data files are new.

1.12 ORANI-INT : An Intertemporal Rational Expectations Version of ORANI

Michael Malakellis has developed ORANI-INT, a 13-sector intertemporal elaboration of ORANI, and used it for policy analysis. His model, which is fully documented in Malakellis (2000) and Malakellis (1994), is available from the GEMPACK web site at address

http://www.monash.edu.au/policy/gp-orint.htm

You can download the files and follow the instructions to replicate the policy simulations reported in Malakellis (2000).

Some details about this model and the policy simulations in Malakellis (2000) are given in section 7.7 of GPD-2.

1.13 ORANIG-RD : A Recursive Dynamic Version of ORANI-G

ORANIG-RD, which is developed by Mark Horridge, shows how a few equations may be added to ORANIG to produce a Recursive Dynamic (forecasting) model much like a simplified version of the MONASH model [see Dixon and Rimmer (2001) and (2002)]. Modellers could perhaps use this as a starting point for constructing their own, more complex, dynamic model.

Supplied with the GEMPACK Example files is zip file **ORANIGRD.ZIP** which includes TAB, HAR and DOC files sufficient to rebuild the ORANIG-RD model.

In recursive dynamic models, investment is often depends on the rate of return, and care must be taken to ensure that investment in any industry in any year does not become negative. Simulations, using a Complementarity statement to ensure that investment stays non-negative in ORANIG-RD, are described in section 16.10 of GPD-3.

Running dynamic simulations with recursive dynamic models is immensely simplified by using the Windows interface RunDynam (see section 2.7 of GPD-4). A free demonstration version of RunDynam, which uses ORANIG-RD as an example, can be downloaded from the GEMPACK web site at address

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

You can find more details about ORANIG-RD at

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

Chapter 2

2. Getting Started with GEMPACK via WinGEM

WinGEM is the Windows version of GEMPACK. WinGEM runs on Windows PCs running Windows 95, 98, ME, NT, 2000 or XP.

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 at the Command (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.

2.1 GEMPACK Examples For New Users

If you are a new user of GEMPACK, we recommend you work through the Stylized Johansen examples in chapters 2 to 4 of GPD-1 rather than using the brief notes on Stylized Johansen in section 2.4 in this document. After the examples in GPD-1, there are some extra examples on Stylized Johansen in sections 2.4.16 to 2.4.18 of this document that you can try. Then go on to the Miniature ORANI examples (section 2.5), or the GTAP examples (section 2.6) or the ORANIG examples (section 2.7) depending on your modelling interests.

You may also like to try using RunGEM for carrying out simulations with one of these models[12]. A hands-on introduction to RunGEM is given in chapter 5.

2.2 Installing GEMPACK Software

You can carry out the examples in this chapter with a Source-code version, an Executable-image version, or the Demonstration Version of GEMPACK.[13]

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. See section 1.9 of GPD-1 for details of different versions of GEMPACK (Source-code or Executable-image) and associated licences.

You should also have installed all of the GEMPACK Windows programs, including WinGEM, ViewHAR, ViewSOL, TABmate and AnalyseGE.

The examples below rely on files which are in the **Examples subdirectory** of your GEMPACK directory (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.

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[12] You need Release 6.0 (or later) of GEMPACK in order to run RunGEM.

[13] The version of GEMPACK used in conjunction with the WinGEM examples in chapter 2 below must be Release 6.0 or later.

2.2.1 Editing Text Files in WinGEM

We suggest you use TABmate as your text editor, as described in section 3.3.1 of GPD-1.

There are two text editors supplied with the Windows version of GEMPACK called TABmate and GEMEdit. If TABmate is not the default editor in WinGEM, select, in the WinGEM main menu,

Options | Change editor...

then select your editor ***Use TABmate.*** You should only have to do this once, since WinGEM should remember which editor you have chosen.

We suggest you use TABmate since it has coloured highlighting of TABLO syntax, and a powerful Gloss feature which displays all parts of the TABLO code where a chosen variable or coefficient is used. See section 3.3.2 of GPD-1 for an example of using the Gloss feature.

2.3 GEMPACK Document GPD-1

As an abbreviation, GEMPACK documents are referred to by their GPD numbers. The first GEMPACK document *An Introduction to GEMPACK* is referred to as GPD-1. See section 8 for a full list of GEMPACK documents.

The first GEMPACK document **GPD-1** is referred to frequently in the following examples on the Stylized Johansen model. When a topic has been covered in GPD-1, we simply refer you to the corresponding section in GPD-1 for details.

2.4 Examples using the Stylized Johansen Model SJ

Stylized Johansen is a 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 section 2.1 of the GEMPACK Document GPD-1.

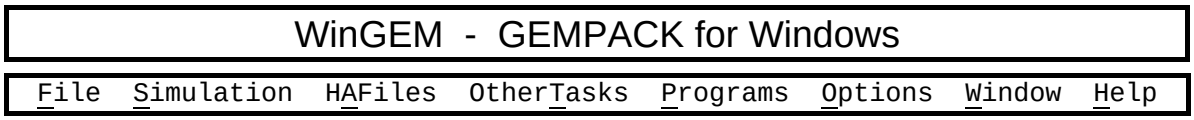
The Stylized Johansen examples here are in two groups. The first group (sections 2.4.1 to 2.4.15) are compressed versions of examples covered in detail in chapters 2 to 4 of GPD-1. The second group (sections 2.4.16 to 2.4.18) are not covered in detail elsewhere in the GEMPACK documentation.

If you are a new user of GEMPACK, we encourage you to work through the versions in chapters 2 to 4 of GPD-1 (rather than the compressed versions in sections 2.4.1 to 2.4.15 here). Then go on to sections 2.4.16 to 2.4.18 here.

2.4.1 Starting WinGEM

See section 2.4.1 of GPD-1 for full details.

In Windows, double click on the ***WinGEM*** icon to start the program WinGEM (GEMPACK for Windows).[14] This should give the main WinGEM menu, as shown below, across the top of the screen.



2.4.2 Preparing a Directory for Model SJ

See section 2.4.2 of GPD-1 for full details about how to keep all example files for the Stylized Johansen model together in a separate directory **C:\SJ** and how to copy the relevant files into this directory.

All Stylized Johansen files start with the letters **SJ** to distinguish them from other files in the Examples directory.

Copy all the files SJ*.* in the Examples subdirectory of GEMPACK (usually C:\GP\EXAMPLES) to a working directory C:\SJ. There are about 20 files associated with the Stylized Johansen model.

2.4.3 Setting the Working Directory

WinGEM uses the idea of a working directory to simplify choosing files and running programs. It is important that you set the working directory before starting work on a model.

See section 2.4.3 of GPD-1 for details about setting the working directory.

For the Stylized Johansen model examples here, the working directory needs to be the directory **C:\SJ** that you have just created and copied the files for Stylized Johansen into.

File | Change both default directories...

---

[14] If you are using Windows and your Windows 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.

and select the directory C:\SJ.

2.4.4 Looking at the Data Directly using ViewHAR

The input-output data used in the Stylized Johansen model is contained in the data file SJ.DAT. 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. See section 2.4.4 of GPD-1 for details about what to look at in this file.

You can also look at the data in a Header Array file using the GEMPACK program SEEHAR as described in section 2.4.17 below.

2.4.5 TABLO-generated Program or GEMSIM?

As described in section 2.4.5 of GPD-1, there are two ways of running a simulation using either the TABLO-generated program or the GEMPACK program GEMSIM. The steps using a TABLO-generated program are in section 2.4.6 below. In section 2.4.6 we assume that you have a Source-code version of GEMPACK and also have access to a Lahey Fortran compiler (either LF90 or LF95) which should be on your DOS PATH.

Alternatively, you could also use the GEMSIM method (as in section 2.4.7 below).

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 in section 2.4.7 below.

The simulation results are the same whether you use GEMSIM or the TABLO-generated program for the model.

If you don't have the Source-code version, please skip section 2.4.6 and go straight to section 2.4.7.

2.4.6 The Example Simulation using a TABLO-generated Program

See section 2.4.6 of GPD-1 for full details of running a simulation using a TABLO-generated program.

The three steps involved in carrying out a simulation using GEMPACK are:

Step 1 - Implement the model

Step 2 - Solve the equations of the model

Step 3 - View the results

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[15]

Simulation | TABLO Implement...

Click on the ***Select*** button to select the name of the TABLO Input file **SJ.TAB**. Click on the Edit button to view this file in your editor.

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

TABLO Options...

In the TABLO Options window, select the option **WFP** from the pair of options:

```
PGS  Generate GEMSIM auxiliary files
```

- **`WFP  Generate Fortran code`**

In the TABLO window, click on the ***Run*** button to run TABLO.

Click on the ***Go to Compile and Link*** button at the bottom of the TABLO window to run the Fortran compiler.

Click on the button ***Compile and Link*** and wait 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'***

Step 2 - Solve the equations of the model

As an example of a simulation, the Command file SJLB.CMF contains a closure with supplies of the two factors, labor and capital, as exogenous variables. The shock increases the supply of labor by 10 percent and holds the supply of capital fixed.

Select the Command file called SJLB.CMF.

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

Step 3 - Look at the results with ViewSOL

Click on the button ***Go to ViewSOL*** to open the Solution file SJLB.SL4 created on the previous example.

In the Contents list, to see the results of one of these variables, just **double-click** on the corresponding row in the Contents list. To check results of the simulation, double-click on the **p_XCOM** row. Then you should see something like the following:[16]

---

[15] Another alternative is to use TABmate to implement your model by selecting instead ***Simulation | TABmate Implement***

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

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

Step 3 (alternative) - View the results using GEMPIE

Click on the *Go to GEMPIE* button in the TABLO-generated program window in Step 2 above.

The Solution file SJLB.SL4 is already selected. 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***.

2.4.7 The Example Simulation using GEMSIM

See section 2.4.7 of GPD-1 for full details of running a simulation using GEMSIM.

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

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[17]

Simulation | TABLO Implement...

Click on the ***Select*** button to select the name of the TABLO Input file **SJ.TAB**. Click on the Edit button to view this file in your editor.

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

TABLO Options...

In the TABLO Options window, select the option **PGS** from the pair of options:

- **`PGS  Generate GEMSIM auxiliary files`**

  `WFP  Generate Fortran code`

In the TABLO window, click on the ***Run*** button to run TABLO.

Click on the ***Go to GEMSIM*** button at the bottom of the TABLO window.

Step 2 - Solve the equations of the model

As an example of a simulation, the Command file SJLB.CMF contains a closure with supplies of the two factors, labor and capital, as exogenous variables. The shock increases the supply of labor by 10 percent and holds the supply of capital fixed.

Select the Command file called SJLB.CMF.

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

Step 3 - Look at the results with ViewSOL

Click on the button ***Go to ViewSOL*** to open the Solution file SJLB.SL4 created on the previous example.

In the Contents list, to see the results of one of these variables, just **double-click** on the corresponding row in the Contents list. To check results of the simulation, double-click on the **p_XCOM** row. Then you should see something like the following:[18]

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

[17] Another alternative is to use TABmate to implement your model by selecting instead ***Simulation | TABmate Implement***

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

Step 3 (alternative) - View the results using GEMPIE

Click on the ***Go to GEMPIE*** button in the TABLO-generated program window in Step 2 above.

The Solution file SJLB.SL4 is already selected. 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***.

2.4.8 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 2.4 here), Miniature ORANI (see section 2.5 below) or 3-region, 3-commodity GTAP (see section 2.6), GEMSIM is quite fast. TABLO-generated programs only give their great advantage with large models and/or more disaggregated data sets (see chapter 4).

2.4.9 The Updated Data - Another Result of the Simulation

See section 2.9 of GPD-1 for full details about looking at the updated data in file SJLB.UPD.

Select from the main WinGEM menu,

HA Files | View VIEWHAR

Click on ***File | Open*** and open the file SJLB.UPD.

2.4.10 Several Johansen Simulations

See section 2.12 in GPD-1 for full details about using SAGEM to carry out Johansen simulations.

The starting point is always the Equations file for the model which is produced by running the TABLO-generated program SJ.EXE or GEMSIM.

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.** This file is discussed in section 2.12.1 of GPD-1.

In the main WinGEM 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.

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.

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

Select the file SJLBJ.CMF.

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

Click on ***Go to GEMPIE*** (not *Go to ViewSOL* this time since ViewSOL cannot show individual column results – see section 10.2.5 of GPD-3) 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.

2.4.11 Changing the Closure and Shocks

Several simulations can be carried out on the same model by changing the closure and/or the shocks in the Command file. The example in section 2.11 of GPD-1 shows you how to make a new Command file in the text editor and then run another simulation using SJ.EXE (or alternatively GEMSIM). The simulation is to increase the price of labor by 3 per cent and to increase the supply of capital, by 10 per cent. In order to increase the price of labor, the variable p_PF("labor") needs to be exogenous so you need to change the closure, and also, apply different shocks.

You should work through the hands-on example in section 2.11 of GPD-1.

2.4.12 Correcting Errors in TABLO Input Files

When you build your own model, you will need to correct errors in your TABLO Input file. In the examples below, 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.

A detailed example is given in section 3.9.1 of GPD-1.

To begin, use ***File | Edit file...*** to open the file SJERROR.TAB.

Now please check how your WinGEM is configured by selecting

Options | Editor for TABLO Check Errors | Use TABmate[19]

Now open a TABLO window via ***Simulation | TABLO Implement...*** and then, in this window, ***Select*** this TABLO Input file SJERROR.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 the windows program **TABmate** which will open with this TABLO Input file SJERROR.TAB. Further details are given in the corresponding example in section 3.9.1 of GPD-1.

The procedure for removing errors from TABLO Input files is: Run TABLO, use TABmate (and its TABLO Check button) to remove all errors, then close TABmate, click on Rerun to rerun TABLO under WinGEM to produce a TABLO-generated program or output for GEMSIM.

As we indicated above, WinGEM provides different ways of proceeding when a syntax or semantic error is discovered in the Check stage of TABLO. The example above shows the usual way of proceeding using TABmate, which is the way we recommend for new users. Below we show you a different way of proceeding. If this is the first time you have read this document, we strongly suggest that you **skip this alternative** and come back to it when you are more familiar with WinGEM and GEMPACK. We only include it here for completeness.

[19] This assumes that you are running version 2.1 (February 2000) or later of WinGEM. [You can see this information by selecting ***Help | About..*** from WinGEM's main menu.] WinGEM provides different ways of proceeding if a syntax or semantic error is found by TABLO during the Check stage. The default (which we describe in this section) is to use TABmate.

Correcting errors in SJERROR.TAB via WinGEM and Split Window Editing

Begin by using ***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 please configure your WinGEM to use split-screen editing after a TABLO Check error by selecting

Options | Editor for TABLO Check Errors

and then slide your mouse across to click on ***Use GemEdit (Split Window)*** .

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***.

Now you see the difference between this example and the one above. This time you are put into a GemEdit 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 using Split Window editing with GemEdit. Run TABLO, use split window editing to remove some errors and then rerun TABLO until all errors are eliminated. As indicated above, we think that most users will find the TABmate alternative the most efficient way of eliminating errors.

2.4.13 Creating the Base Data Header Array File

Making a data file for Stylized Johansen using MODHAR is discussed in section 4.2 of GPD-1. You should work through the hands-on examples there.

[Full details on using the program MODHAR to create or modify data files are given in chapter 3 of GEMPACK document GPD-4.]

2.4.14 Modifying Data on a Header Array File

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

See section 4.3 of GPD-1 for hands-on examples you can work through.

2.4.15 Condensing the Model

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 3.8 of GPD-1.

See section 3.8.2 and 3.8.4 of GPD-1 for hands-on examples showing you

- how to make a condensation Stored-input file for Stylized Johansen, and
- how to run TABLO using a condensation Stored-input file.

2.4.16 Transferring Simulation Results to a Spreadsheet using SLTOHT

The program SLTOHT is used to convert results on a Solution file to either a Header Array file or a text file in CSV format (Comma Separated Values) suitable for importing the results into a spreadsheet program such as Excel. A spreadsheet program will usually place the values of an array separated by commas into separate cells in the spreadsheet.

See the examples in section 2.10 of GPD-1 for details about running SLTOHT with the option SSS and SSE. Both examples use Spreadsheet Mapping files.

In the example below (which is not in GPD-1), you will convert the results from the file SJLBJ.SL4 created in section 2.4.10 to a text file in CSV format where the numbers in the array are separated by commas. This example does not use a Spreadsheet Mapping file.

Note that SJLBJ.SL4 is produced by running SAGEM. This Solution file contains the totals (cumulative) column of results and two individual column results (see section 2.12 of GPD-1 and section 10.1 of GPD-3). You will see these all three solutions on the spreadsheet file produced in the example below.

Example - Running SLTOHT without using a Spreadsheet Mapping file

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.

Look first at the p_XCOM results which are shown as follows:

```
 ! Variable p_XCOM # Total demand for (or supply of) commodity i #
 ! Showing this as an array of size 2x3
 ! Solutions in columns - each row is a different component

 2,3, real spreadsheet;

  0.60000002    , 0.40000001    ,  1.0000000    ,
  0.69999999    , 0.30000001    ,  1.0000000    ,
```

What do all these numbers represent? This is explained near the top of the file SJLBJ.CSV where you see

```
 ! For each variable below columns represent the following solutions:

 ! 2 INDIVIDUAL column(s) each one giving the solution
 !  for an individual shock.
 ! 1 TOTALS column giving cumulative solutions across ALL shocks.

 ! For details about the shocks relevant to each column run GEMPIE.
```

This reminds you of the solutions you see on the file SJLBJ.CSV and tells you how they are set out on the file. Each column is a different solution and each row is a component of a variable.

Look again at the p_XCOM results. The first row of numbers is for the first component p_XCOM("s1"). The first number 0.60000002 in that row is the first individual column result (the effect of just a 1 percent increase in the supply of labor). The second number 0.4000001 is the second individual column result (the effect of just a 1 percent increase in the supply of capital). The third number (1.0) is the totals solution (which shows the combined effect of 1 percent increases in the supplies of both labor and capital).[20] The "2 3 spreadsheet ;" line is the "how much data" information (see chapter 6 of GPD-4) for this array of data on the GEMPACK text data file SJLBJ.CSV.

Now look at results for the other variables.

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).

[20] Recall that the shock in this simulation is "shock p_XFAC = uniform 1 ;".

There are various other ways of running the program SLTOHT, for example by using a **Spreadsheet Mapping file** as described in chapters 8 and 9 of GPD-4.

2.4.17 Using SEEHAR to Look at Data

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.[21]

In the WinGEM main menu, select

HA files | See SEEHAR...

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.

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.

[21] This example via WinGEM is not included in GPD-1.

2.4.18 Analysing Simulation Results using AnalyseGE

You can find a hands-on introduction to analysing simulation results using AnalyseGE in section 6.1 of GPD-8. This example analyses the results of the 10 percent labor increase in Stylized Johansen.

We encourage you to work through this example.

2.4.19 What Next ?

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 chapter 1.

Alternatively, if you have Release 6.0 of GEMPACK (or later), 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.

2.5 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)).

2.5.1 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 Windows Explorer or DOS commands as in the examples for Stylized Johansen (see section 2.4.2 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
```

2.5.2 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 2.4.3 above for more details.]

Examine the TABLO Input file MO.TAB in your text editor (preferably TABmate – see section 2.2.1) 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.

2.5.3 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 2.4.4).

2.5.4 Implementing the Model MO using TABLO

As in Step 1 in section 2.4.6 or 2.4.7, 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).*

2.5.5 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.

Then proceed as in Step 3 in section 2.4.6 or 2.4.7 above to look at the results. That is, click on ***Go to ViewSOL*** to look at the results via ViewSOL, or, alternatively, click on ***Go to GEMPIE*** to prepare a Print file MOTAR.PI5 which you can look at to see the results.

The simulation is a multi-step 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. [Extrapolation Accuracy files are discussed in section 2.13.3 of GPD-1 and in section 7.2.3 of GPD-3.]. Choose

File | Edit file...

in the main WinGEM menu and examine MOTAR.XAC in the text editor. This shows the results for each endogenous component of each endogenous variable. 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. See section 7.2.3 of GPD-3 for information about the component numbers and the codes (for example, "CX") shown on the file.

Also look at the Extrapolation Accuracy Summaries for the variables and data (see sections 7.2.1 and 7.2.2 respectively of GPD-3). You can find these near the end of the Log file MOTAR.LOG.

2.5.6 Several Johansen Simulations using SAGEM

In the editor (use ***File | Edit 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 ;
use environment file mo ;

! Name of Solution file is inferred from name of Command file.
! (See section 2.5 of GPD-3.)

! Choosing sets of variables
individually-retained exogenous  %all  ;
individually-retained endogenous p_Z p_YCOMIND(COM,"i2")
                                 p_XINTFAC 1-3 %macro ;
cumulatively-retained endogenous p_Z p_YCOMIND (COM) (FAC,IND) ;

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

! Subtotals results
subtotal p_T = tariff shock ;
subtotal p_PHI = exchange rate shock ;
subtotal p_FWAGE p_CR = wage and real consumption shocks ;

verbal description  = MO  standard closure ;
```

Then run SAGEM with the file MOSAGEM.CMF by selecting

Simulation | SAGEM Solve...

This should produce a Solution file MOSAGEM.SL4.[22] [The name is derived from the name of the Command file as explained in section 2.5 of GPD-3.]

The Solution file MOSAGEM.SL4 produced by this run of SAGEM contains

- the cumulative solution (the effect of all shocks),
- four individual column results (one for each component shocked), and
- three subtotals results (one for each "subtotal" statement in the Command file).

[See sections 10.1 and 10.2 of GPD-3 for information about these different types of solutions, and see section 5.4.2 of GPD-3 for information about the "choosing sets" statements in the Command file.]

Individual Column Results

First we show you how you can look at the individual column results.

To do this, click on ***Go to GEMPIE*** (not *Go to ViewSOL* this time since ViewSOL cannot show individual column results – see section 10.2.5 of GPD-3). You will be asked which solutions you wish to view. Click on

Individual column solutions

and then click **OK**. Then click on the **Run** button to run GEMPIE.

Examine the results in the Print file MOSAGEM.PI5. Each column corresponds to a different shock. First come the results for all individually-retained endogenous variables for two of the shocks (those to p_T("c2") and p_FWAGE). Then come the results for the other two shocks (those to p_CR and p_PHI) The last column of results (headed "TOTALS") shows the total of the results of the individual column results.

Note that the results are only shown for the individually-retained endogenous variables, not all endogenous variables. For example, no results for endogenous variable p_HOUSE are shown. This shows the effect of the "individually-retained endogenous" statement in the Command file.

Subtotals Results

Although ViewSOL cannot show the individual column results (see above), it can show subtotals results.

Go back to the SAGEM window which should still be open.

Click on ***Go to ViewSOL*** and look at the results. For example, click on **Macros** in the ViewSOL Contents page. You should see the cumulative solution (under the heading "mosagem") and the three subtotals results for these variables (which are all exogenous in this simulation). If you do not see the subtotals results, click on menu item ***File | Options*** and click on **Show subtotal results (if present)** and then click **OK**. Then close ViewSOL and run it again.

Alternatively, go back to the SAGEM window and click on ***Go to GEMPIE*** to use GEMPIE to look at the subtotals results. This time click on **Total and subtotals solutions** when asked which solutions you wish to print. Then **Run** GEMPIE and look at the results. Note that GEMPIE shows the subtotals results first and the cumulative column (headed "ALL SHOCKS") last.

Close ViewSOL and the SAGEM and GEMPIE windows.

---

[22] If there are errors, see section 3.9.2 of GPD-1 for advice about identifying and fixing them.

2.5.7 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 13.2 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. Remove the subtotals statements.

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. [If there is an error, see section 3.9.2 of GPD-1 for advice about identifying and fixing the error.]

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.

2.5.8 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 Environment file from MO to MO2.

(4) 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. [If you encounter an error running the simulation, see section 3.9.2 of GPD-1 for advice about identifying and fixing the errors in your Command file.]

Look at the results via ViewSOL or GEMPIE to see the effect of this closure swap.

2.6 Examples for Global Trade Analysis Project Model GTAP94

The following examples are for the Global Trade Analysis Project model, GTAP94, 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.

See also section 2.7 for examples using the more recent version GTAP61.TAB of this model.

Preparing a Directory for Model GTAP94

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 2.4.2 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 2.4.3 above for more details.]

2.6.1 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:[23]

GDAT2-06.HAR, GSET2-06.HAR and GPAR2-06.DAT.

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.)

[23] These two data sets are from Version 2 of the GTAP data.

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).[24] 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.

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**

[24] 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.

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.

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).[25]

(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.[26]

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.

[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.]

---

[25] The **Alt+Tab** method described under (b) below for Windows can also be used with Windows 95.

[26] 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.

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 via ViewHAR earlier. 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 earlier, 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.

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).

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.

2.6.2 A GTAP3x3 Simulation Reducing One Distortion

In the following examples in sections 2.6.3 and 2.6.4, 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.)

2.6.3 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 multi-step calculation. The concept of condensation is discussed in section 3.8 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.

2.6.4 Running a Simulation with 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.

2.6.5 GTAP Multi-Fibre Agreement Simulation with a 10x10 Aggregation

The examples in this section cannot be run with the Demonstration Version of GEMPACK.

In the following sections 2.6.6 to 2.6.8, 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).

2.6.6 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.

2.6.7 Running a Simulation with 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 values of the shocks are selected from a shock file called GTX2-06.SHK, The shocks on this file 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 | Run 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.

2.6.8 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).

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

2.6.9 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 the example in section 2.6.6 but this time run TABLO by choosing the STI file GTAP10GS.STI to produce GEMSIM output. Repeat the example in section 2.6.7 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.

2.6.10 GTAP APEC Liberalization Simulation (including Decomposition of Results)

The examples in this section cannot be run with the Demonstration Version of GEMPACK.

In the following examples you will carry out a simulation with a 3-commodity, 10-region aggregation. This simulation concerns APEC liberalization of import tariffs between APEC regions and also between these regions and the rest of the world. Full details of the original application (carried out by Linda Young and Karen Huff) can be found in Chapter 9 of Hertel (1997).

In the examples below, you will use the subtotal feature (new for Release 7.0 of GEMPACK) to decompose the simulation results to see the separate effects of

(i) within-APEC liberalization,

(ii) APEC liberalizing with respect to Rest of World (no reciprocation),

(iii) Rest of World reciprocating.

The decomposition of the results from this application is discussed in detail in Harrison *et al* (2000) to which we refer you for a fuller discussion of decomposition of these results, and also of the motivation behind the decomposition of results as implemented in GEMPACK.

The TABLO Input file used in these examples is GTAP94.TAB. Before starting these examples, make sure that you have set up a working directory and copied the relevant files following the instructions at the start of section 2.6.

If you have not carried out the example in section 2.6.6 above, please do so now before proceeding.

2.6.11 Carrying Out the APEC Liberalization Simulation (with Subtotals)

Run WinGEM and check that your working directory is \GTAP on the appropriate drive.

Now run either GTAP1010.EXE or GEMSIM to carry out a simulation (select either **Run TG program** or **GEMSIM Solve** from WinGEM's Simulation menu), and **Select** the Command file GIP73A.CMF. First look at this Command file by clicking on the **Edit** button. Note that

- the shocks are selected from file GTMS25E3.SHK which have been calculated to remove all import tariffs (within APEC and between APEC regions and the Rest of the World).
- the starting data base is the file GDAT2-05.NAF which represents the effects of NAFTA (North-American Free Trade Agreement).
- the first 3 subtotals which can be used to decompose the effects of this liberalization into the three categories (i), (ii) and (iii) indicated earlier. The remaining subtotals can be used to give estimates of the effects of single regions liberalizing. You will look at these decompositions and subtotals results in the examples below.

Now ***File | Exit*** from this Command file and **Run** the simulation.

When the simulation finishes, continue on to the next example to look at some of the results.

2.6.12 Looking at the Results via ViewSOL

When the simulation above finishes, choose ***Go to ViewSOL*** to look at the results.

When ViewSOL shows the results, first select ***File | Options*** to check whether **Show subtotals results (if present)** is checked. If not, check it, close ViewSOL and repeat (selecting ***Go to ViewSOL*** again); this time you should have the subtotals results available.

Click on ***Format..*** in ViewSOL's main menu and click on option **Arrange vectors by name** and then click **Ok** to close the format window.

Then find variable **EV** (Equivalent Variation $US million) in the **Contents** page and click to look at the EV results. You will see 14 columns of results. The first one (headed GIP73A) contains the simulation results. The other 13 contain the different subtotals results.

The first 3 subtotals results are the decomposition of the overall result into the three effects (i), (ii) and (iii) indicated at the start of this section. For example, note that the overall EV result for North America (NAM) is (approximately) –2252. The first 3 subtotals results show that

(i) –973 is due to within-APEC liberalization,

(ii) –14887 is due to APEC liberalizing with respect to ROW (no reciprocation), and

(iii) +13608 is due to ROW reciprocating.

Note also that these 3 numbers (-973, -14887 and +13608) add to the overall simulation result –2252.[27] This is the decomposition of the simulation results shown in the "new way" row of Table 2 of Harrison *et al* (2000).

Note that the results in subtotals numbered 4 to 13 are the decompositions shown in columns (1) to (10) of Table 4 of Harrison *et al* (2000).

Now that you have carried out this application and decomposition for yourself, we encourage you to read sections 1-3 of Harrison *et al* (2000) in some detail to find out more about the motivation and ideas underlying this sort of decomposition of results.

[27] The addition works very accurately if you carry out the calculations to one or two decimal places.

2.7 Examples for Global Trade Analysis Project Model GTAP61

The following examples are for the current (as at October, 2002) version of the Global Trade Analysis Project model GTAP.TAB. When distributed with GEMPACK, we call this TAB file GTAP61.TAB to distinguish it from the 1994 version GTAP94.TAB. GTAP is a multi-regional model and is described in Hertel (1997). Several different aggregations (of commodities and/or regions) are available from the Project.

See also section 2.6 for examples using the older version GTAP94.TAB of this model.

The following examples are with the GTAP61 model.

2.7.1 Preparing a Directory for Model GTAP61

To keep all examples files for this model together in one area, create a separate directory \GTAP61 and copy the Zip file G61-GP.ZIP from you examples directory (which is usually C:\GP\EXAMPLES) to this subdirectory. Use WinZIP or pkunzip.exe to unzip the files from the Zip archive G61-GP.ZIP into the directory \GTAP61.

In DOS, use the commands (you will need to modify the third if your examples directory is not C:\GP\EXAMPLES):

```
md  \gtap61
cd  \gtap61
copy  c:\gp\examples\g61-gp.zip
pkunzip g61-gp.zip
dir
```

2.7.2 Set the Working Directory

First set the working directory to be this directory \GTAP61 by choosing

File | Change both default directories

and select the directory GTAP61 on the appropriate drive. [See section 2.4.3 above for more details.]

2.7.3 Examine the TAB File

Examine the TABLO Input file GTAP61.TAB in the editor. Select

File | Edit file... and select GTAP61.TAB.

2.7.4 View the Data Files for GTAP61

There are three different data sets available for this model in the GEMPACK examples: C3X3, A7X5 and CH10.[28]

There are three data files (DATA, SETs and PARAMETERs) for each data set for GTAP61. [For GTAP61, each of these is a Header Array file.]

[28] These correspond to the Versions ACORS3X3, ASA7X5 and CHP10 under RunGTAP (see section 2.5 of GPD-4).

C3X3 data	***GDATC3X3.HAR***	***GPARC3X3.HAR***	***GSETC3X3.HAR***
A7X5 data	***GDATA7X5.HAR***	***GPARA7X5.HAR***	***GSETA7X5.HAR***
CH10 data	***GDATCH10.HAR***	***GPARCH10.HAR***	***GSETCH10.HAR***

Examine them using ViewHAR by selecting

HA files | View VIEWHAR and select the name of the file.

2.7.5 Implement the Model using TABLO

The file GTAP61.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 GTAP61TG.STI or GTAP61GS.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 GTAP61TG.STI to create the TABLO-generated program. If you have the Executable Image version, select GTAP61GS.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 GTAP61.FOR to make the EXE file GTAP61.EXE.

2.7.6 Running a Simulation with Condensed GTAP61

To run GTAP61.EXE or GEMSIM to carry out a simulation, choose the Command file and look at this Command file in the editor:

File | Edit file...

There are many different Command files you can try.

Command files	***GEX15.CMF GEX15E.CMF GEX15I.CMF***
	GEX15A1.CMF GEX15A2.CMF GEX15A3.CMF
	GSEFTA1.CMF
	GC10E1.CMF GC10E1AA.CMF GC10E1RT.CMF

See section 7.1.1 of GPD-3 for a discussion of GEX15.CMF and related GEX15*.CMF Command files using the data C3X3. See section 6.4.3 of GPD-3 for Command file GC10E1.CMF and related Command files GC10E1*.CMF.

Run the TABLO-generated program GTAP61.EXE or GEMSIM by choosing from the main WinGEM menu

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

Select the Command file 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.

2.8 Examples with the ORANIG98 Model

The following examples are with the ORANIG98 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 at address

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

This version of ORANI-G was used in the Practical GE Modelling Course in 1998.

See also section 2.9 for examples with the more recent ORANIG01 version of the ORANI-G model.

2.8.1 Preparing a Directory for Model ORANIG98

To keep all examples files for this model together in one area, create a separate directory \ORANIG98 and copy all O*.* files from you examples directory (which is usually C:\GP\EXAMPLES) to this subdirectory.

In DOS, use the commands (you will need to modify the third if your examples directory is not C:\GP\EXAMPLES):

```
md  \oranig98
cd  \oranig98
copy  c:\gp\examples\o*.*
dir
```

2.8.2 Set the Working Directory

First set the working directory to be this directory \ORANIG98 by choosing

File | Change both default directories

and select the directory ORANIG98 on the appropriate drive. [See section 2.4.3 for more details.]

2.8.3 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.

2.8.4 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.

2.8.5 Running a Simulation with Condensed ORANIG98

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.

2.8.6 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 the example in section 2.8.4 but this time run TABLO by choosing the STI file ORANIGGS.STI to produce GEMSIM output. Repeat the example in section 2.8.5 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.]

2.8.7 Decomposition of Simulation Results

The Command file ORNGAPP1.CMF is for a simulation with many different shocks[29]. With Release 7.0 (or later) of GEMPACK you can now carry out a decomposition of simulation results using subtotals as described in Harrison *et al* (2000) and chapter 11 of GPD-3. Subtotals are used in a multi-step simulation (8, 10, 12 step Gragg) to calculate the contributions to the cumulative solution of 7 groups of shocks (7 subtotals).

Run the simulation using either the TABLO-generated program ORANIG.EXE or GEMSIM with the Command file ORNGAPP1.CMF. Use GEMPIE or ViewSOL to view the subtotal results and check that the subtotals results add up to the cumulative totals results.

2.9 Examples with the ORANIG01 Model

The following examples are with the ORANIG01 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 at address

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

This version of ORANI-G was used in the Practical GE Modelling Course in 2001.

See also section 2.8 for examples with the earlier ORANIG98 version of the ORANI-G model.

2.9.1 Preparing a Directory for Model ORANIG01

To keep all examples files for this model together in one area, create a separate directory \ORANIG01 and copy the Zip file GP-OG01.ZIP from you examples directory (which is usually C:\GP\EXAMPLES) to this subdirectory. Unzip the Zip file using WinZIP or pkunzip.exe.

In DOS, use the commands (you will need to modify the third if your examples directory is not C:\GP\EXAMPLES):

```
md  \oranig01
cd  \oranig01
copy  c:\gp\examples\gp-og01.zip
pkunzip gp-og01.zip
dir
```

2.9.2 Set the Working Directory

First set the working directory to be this directory \ORANIG01 by choosing

File | Change both default directories

and select the directory ORANIG01 on the appropriate drive. [See section 2.4.3 above for more details.]

2.9.3 Examine the TAB File and Data

Examine the TABLO Input file ORANIG01.TAB in the editor. Select

File | Edit file... and select ORANIG01.TAB.

---

[29] This simulation is similar to the simulation using the ORANIF model in section 7 of the "black magazine" Horridge, Parmenter and Pearson (1993).

The data file is a Header Array file called OGOZD867.HAR. Examine it using ViewHAR by selecting

HA files | View VIEWHAR and select OGOZD867.HAR.

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

2.9.4 Implement the Model using TABLO

The file ORANIG01.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 OG01TG.STI or OG01GS.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 OG01TG.STI to create the TG program. If you have the Executable Image version, select OG01GS.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 ORANIG01.FOR to make the EXE file ORANIG01.EXE.

2.9.5 Running Simulations with ORANIG01

There are various Command files for ORANIG01:

```
Homogeneity simulations: OG01HOMO.CMF, OG01RHOM.CMF
Wage cut and employment simulations: OG01WAGE.CMF, OG01EMPL.CMF
```

Run the TABLO-generated program ORANIG01.EXE or GEMSIM by choosing from the main WinGEM menu

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

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

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

2.10 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].

2.10.1 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 2.4.2 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
```

2.10.2 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 2.4.3 above for more details.]

2.10.3 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***

2.10.4 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.

2.10.5 Running a Simulation with 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.]

2.10.6 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 the example in section 2.10.4 but this time run TABLO by choosing the STI file ORANIFGS.STI to produce GEMSIM output. Repeat the example in section 2.10.5 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.]

2.11 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.

2.12 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.

2.13 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/Command 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. We assume that you are working under Unix or at the command line (as described in more detail in section 2.3 of GPD-1). We refer to this as the Unix/Command prompt way of running GEMPACK.

In particular, this chapter 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 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

Stylized Johansen is a small example general equilibrium model which is 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 section 2.1 of the GEMPACK document GPD-1.

The Stylized Johansen examples here are compressed versions of examples covered in detail in chapters 2 to 4 of GPD-1.

If you are a new user of GEMPACK, we encourage you to work through the versions in chapters 2 to 4 of GPD-1 (rather than the compressed versions in 2.4.1 to 2.4.15 here).

3.1.1 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 several files associated with the Stylized Johansen model.

3.1.2 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.

See section 2.6.1 of GPD-1 for full details of using SEEHAR to look at the SJ.DAT data file.

3.1.3 An Example Simulation with Stylized Johansen

This is the simulation in section 2.1 of GPD-1. We show you in sections 3.1.4 and 3.1.5 below how to carry out this simulation. If you do not have a source-code version of GEMPACK, please skip section 3.1.4 and go straight to section 3.1.5.

3.1.4 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 sections 2.5 and 2.6.4 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 3.1.4 and the GEMSIM alternative in section 3.1.5 below.

If you are using an Executable-image version or a Demonstration version of GEMPACK, please skip the rest of this section and proceed directly to section 3.1.5.

Step 1 - Implementing the model SJ using TABLO

This is Step 1 described in section 2.5.1 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 user input for running TABLO shown in Step 1(a) of section 2.6.2 of GPD-1.

When TABLO has finished running, you can check that the following new files have been created.

- The TABLO-generated program (called **sj.f** on Unix machines and often called **sj.for** on other machines).
- The Information file (often called **sj.inf**).[30]

[30] On Unix machines, file names are case sensitive. Usually the names of the files in this section will all be in lower case if you are working on a Unix machine.

- 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 [31]

```
ltg sj
```

The first letter in this command is "L" not one. (Consult your machine-specific documentation if this does not work.)

It should create an executable image (often called **sj.exe** or just **sj**).

Step 2 - Running a Simulation using the TABLO-generated program

This is Step 2 described in section 2.5.1 of GPD-1. 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.)

Alternatively, on most machines (including Unix machines), you can enter all this information in one line, namely

```
sj  -cmf  sjlb.cmf
```

as explained in section 5.5 of GPD-1.

Then there will be a lot of screen output. First this does a 1-step Euler solution and updates the data. Then it does 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.

[31] This is the only step that requires a suitable Fortran compiler. It also requires the source-code version of GEMPACK. (This step cannot be carried out with the Demonstration or Executable-image Version of GEMPACK.)

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.

Step 3 - Print out the results using GEMPIE.

This is Step 3 described in section 2.5.1 of GPD-1.

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.

See section Step 3 in section 2.6.2 of GPD-1 for full details of running GEMPIE to look at the simulation results.

3.1.5 The Example Simulation using GEMSIM

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

Step 1 - Implementing the model SJ using 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 user input as shown in Step 1 of section 2.6.3 of GPD-1.

The one change from the User Input for producing a TABLO-generated program in section 3.1.4 above is the response **pgs** ("Prepare output for GEMSIM") instead of **wfp** ("Write a TABLO-generated program").

When TABLO has finished running, you can check that the following new files have been created.[32]

- 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 3.1.4 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.

[32] On Unix machines, file names are case sensitive. Usually the names of the files in this section will all be in lower case if you are working on a Unix machine.

Step 2 - Running a Simulation using 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
```

Alternatively on most machines (including Unix machines), you can enter all this information in one line by typing

```
gemsim   -cmf   sjlb.cmf
```

as explained in section 5.5 of GPD-1.

Step 3 - Print out the results using GEMPIE.

Proceed exactly as in Step 3 in section 3.1.4 above.

3.1.6 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).

3.1.7 The Updated Data - Another Result of the Simulation

You will need to use the program SEEHAR, as in section 3.1.2, to look at the updated data in file **sjlb.upd**.

See the Command prompt hands-on instructions in section 2.9 of GPD-1 for full details about looking at this updated data. Also see section 2.9 in GPD-1 for details about what to look for in the file **sjlb.see** produced by SEEHAR..

3.1.8 Preparing Tables and Graphs for a Report

When you have run some simulations and analysed the simulation results, the next step is usually to write a report containing a selection of the results in tables or graphs.

Section 2.10 of GPD-1 describes how you can prepare some different tables of results from the Stylized Johansen simulation above. You should read the discussion there and carry out the Unix/Command prompt hands-on parts there to produce these tables.

3.1.9 Changing the Closure and Shocks

You can carry out several simulations on the same model by changing the closure and/or the shocks in the Command file.

Note that, if you change the closure and/or shocks, but do not change the model (that is, do not change the TABLO Input file), you do not need to repeat Step 1 (running TABLO) in section 2.5 of GPD-1. You only need to do Steps 2 and 3 there.

Section 2.11 of GPD-1 shows you how you can run a different simulation with Stylized Johansen by modifying the closure and shocks in sjlb.cmf.

You should read the discussion there and carry out the Unix/Command prompt hands-on parts there to carry out this simulation and look at the results.

3.1.10 Several Simulations using SAGEM

See section 2.12 of GPD-1 for details about using SAGEM to carry out Johansen simulations.

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.

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**. This file is discussed in section 2.12.1 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**. Alternatively type in

`sj -cmf sjeq.cmf` in you are using the TABLO-generated program **sj**, or

`gemsim -cmf sjeq.cmf` in you are using GEMSIM.

This will create the Equations file **sj.eq4.**

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.

Start SAGEM running by entering the command

`sagem`

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

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

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

Alternatively type in the one line:

```
sagem  -cmf  sjlbj.cmf
```

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 2.12.3. of GPD-1.

You might also like to

- read the discussion of these results in section 2.12.3 of GPD-1,
- look at the different statements in the Command file sjlbj.cmf as discussed in section 2.12.4 of GPD-1, and
- read the advantages and disadvantages of using SAGEM, as summarised in section 2.12.5 of GPD-1.

3.1.11 Making a Data File using MODHAR

Making a data file for Stylized Johansen using MODHAR is discussed in section 4.2 of GPD-1.

Start the program MODHAR running.

```
modhar                    ! DOS or UNIX
```

Then type in the User Input as shown in section 4.2 of GPD-1.

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.

[Full details on using the program MODHAR to create or modify data files are given in the GEMPACK document GPD-4 chapter 3.]

3.1.12 Modifying Data on a Header Array File

The program MODHAR can be used to modify data on a existing Header Array file.

You can work through the examples in section 4.3 of GPD-1 to learn about this.

3.1.13 Condensing the Model

The concept of condensation is discussed in section 3.8 of GPD-1.

You should work through Example 1 in section 3.8.2 of GPD-1 to create the Stored-input file **sjcond.sti** which can be used to run TABLO to condense the Stylized Johansen model.

You can then reuse this Stored-input file to repeat the process (as described in Example 2 in section 3.8.2 of GPD-1). To do this, run TABLO via

```
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
```

Alternatively you can type in the one line:

```
tablo  -sti  sjcond.sti  -log  sjcond.log
```

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

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 section 3.1.4 or 3.1.5 above).

This carries out the usual SJ simulations (a 10 percent increase in the supply of labor, holding the supply of capital fixed), but with the condensed version of the model.

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**.

See section 3.8.5 of GPD-1 for a discussion of the results from sjlb.cmf and sjcond.cmf.

Backsolving using TABLO

If you backsolve for, instead of substituting out, a variable, the results for this variable are still available.

To see a concrete example of this, work through the hands-on example in section 3.8.4 of GPD-1. You will carry out the same simulation with a condensed version of SJ but this time the variables will be backsolved for rather than substituted out.

See section 3.8.5 of GPD-1 for a discussion of the results from sjlb.cmf, sjback.cmf and sjcond.cmf.

Also compare the Extrapolation Accuracy (.xac) files in the three simulations SJ, SJBACK and SJCOND to see whether p_XH is present.

3.2 Miniature ORANI Model Examples

The following examples are based on files relating to the Miniature ORANI model MO (see section 1.2).

3.2.1 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
```

3.2.2 Implementation of the Model MO using TABLO

Run TABLO.

```
tablo                                ! DOS or UNIX
```

Then respond to prompts as in section 2.4.6 or 2.4.7, 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 TABLO-generated program to create the executable image, program **mo** (on Unix machines) or perhaps **mo.exe** (on DOS and other machines).

3.2.3 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 section 3.2.2 above) using the Command file **motar.cmf**.

```
mo  -cmf  motar.cmf
or
gemsim  -cmf  motar.cmf
```

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

3.2.4 Several Simulations at Once with SAGEM

In the editor, look at the Command file **mosagem.cmf** (usually supplied with GEMPACK). The contents of this file are shown in section 2.5.6 above.

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
```

or alternatively

```
sagem  -cmf  mosagem.cmf  -log  mosagem.log
```

If there are any errors, look in the log file **mosagem.log**.

The Solution file **mosagem.sl4** produced here contains

- the cumulative solution (the effect of all shocks),
- four individual column results (one for each component shocked), and
- three subtotals results (one for each "subtotal" statement in the Command file).

[See sections 10.1 and 10.2 of GPD-3 for information about these different types of solutions, and see section 5.4.2 of GPD-3 for information about the "choosing sets" statements in the Command file.]

You can run GEMPIE to see either the individual column results in one run, or the subtotals and totals result in one run. We describe these alternatives below.

Individual Column Results

First we show you how you can look at the individual column results.

Start GEMPIE running in the usual way. Then give the responses shown below.

User Input to GEMPIE for Individual Column results

```
<carriage-return>       ! Use the default options
mosagem                 ! Name of Solution file
i                       ! individual column results
a                       ! all individually-retained exogenous
a                       ! all individually-retained endogenous
mosag-ic                ! Print file name
Individual column results from MOSAGEM.CMF   ! heading
6                       ! Number of decimal places
```

Look at the results in the Print file **mosag-ic.pi5** produced by GEMPIE.

Each column corresponds to a different shock. First come the results for all individually-retained endogenous variables for two of the shocks (those to p_T("c2") and p_FWAGE). Then come the results for the other two shocks (those to p_CR and p_PHI) The last column of results (headed "TOTALS") shows the total of the results of the individual column results.

Note that the results are only shown for the individually-retained endogenous variables, not all endogenous variables. For example, no results for endogenous variable p_HOUSE are shown. This shows the effect of the "individually-retained endogenous" statement in the Command file. You should see the four individual column results. See the discussion in

Subtotals Results

Now we show you how you can look at the subtotals and totals results.

Start GEMPIE running in the usual way. Then give the responses shown below.

User Input to GEMPIE for Individual Column results

```
<carriage-return>       ! Use the default options
mosagem                 ! Name of Solution file
t                       ! print subtotals and totals results
a                       ! all cumulatively-retained endogenous
a                       ! all subtotals
mosag-st                ! Print file name
Subtotals and totals results from MOSAGEM.CMF  ! heading
6                       ! Number of decimal places
```

Look at the results in the Print file **mosag-st.pi5** produced by GEMPIE.

You should see the subtotals results first and the cumulative column (headed "ALL SHOCKS") last.

3.2.5 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 13.2 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. Remove the subtotals statements.

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. [If there is an error, see section 3.9.2 of GPD-1 for advice about identifying and fixing the error.]

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.

3.2.6 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**. [If there is an error, see section 3.9.2 of GPD-1 for advice about identifying and fixing the error.]

Use GEMPIE to look at the results.

The results are also 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.

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.[33]

Comparison of Times for TG-programs and GEMSIM

Model	Data size	TG-program	GEMSIM	Approx Ratio
GTAP94	10x10	165 sec	300 sec	1.8
GTAP94	15-com,10-reg	330 sec	460 sec	1.4
MONASH	26-com,25-ind	130 sec	820 sec	6.3
ORANIG98	122-com,119-ind	510 sec	3970 sec	7.8
ORANIG98	37-com,35-ind	50 sec	240 sec	4.8
ORANIG98	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.[34] 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.

[33] The times and ratios reported may be quite different if the condensation is changed.

[34] 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 which is 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.[35]

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 or later (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 2.5 of GEMPACK document GPD-4. There is also On-line Help available within RunGEM.

Which Text Editor to Use?

RunGEM comes with its own (very simple and rather limited) text editor. Via the **Options** menu, you can change to any other text editor (for example, TABmate or GemEdit). The choice is yours. [If you are in doubt, we recommend TABmate.]

If you are an experienced user of GEMPACK (for example, you may be using TABmate and RunGEM to develop models – see section 5.4 below), you will want to use your own editor (probably TABmate) under RunGEM.

We have provided the simple RunGEM editor, which is accessed via

Options | Change Text Editor.. | Use RunGEM's editor

because, in some lab settings in which the instructor is demonstrating and all students are following along on their own machines, this provides the most predictable environment.

[35] Even if you are making frequent changes to a model, you may find that TABmate plus RunGEM provide a good modelling environment – see section 5.4.

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 2.4 above, the relevant files are already in the directory you created then (see section 2.4.2). 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 2.4.2.

Run **TABLO** with the TABLO Input file SJ.TAB as described in section 2.4.6 to create the TABLO-generated program SJ.EXE or, as in section 2.4.7, 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 file which is only produced by GEMPACK Release 6.0 or later, 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.[36] 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, 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.

---

[36] 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 ;

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

Go to the ***Model/Data*** page by clicking on its tab. 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.

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.[37] 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

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

and endogenous variables (see sections 5.2.7 and 5.9 of GPD-3).

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 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

```
SJ. Standard closure. 10 percent increase in labor supply.
```

You need to select the solution method and steps. Click on the **Change** button to the right of the text "Solution method:" and select Gragg's method with 2,4,6-step calculations. [One subinterval, not automatic accuracy.]

Click on the ***Solve*** button and RunGEM will calculate the solution of this simulation.

When all the calculations are finished, a form will appear showing you the accuracy of the simulation.[38] The faces on this smile if the results are accurate and frown if they are not. For this simple simulation, you should see smiling faces.

When you click **OK**, 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[39] but slightly simplified because the

[38] This Accuracy Summary form will not be shown by versions of RunGEM before Version 1.1 (March 1999).

[39] See Step 3 in section 2.4.6.

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 2.4.11.

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

Model/Data

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. ORANIG98 is one of the models supplied with GEMPACK - see section 1.4.2 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 ORANIG98 examples in section 2.7 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 2.7 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 or 7.0, not by earlier versions of GEMPACK.

You should also find the file **ORANIG98.CLS** in this directory.[40] 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

[40] 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.[41] 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.[42]

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.

---

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

[42] 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). The XAC file is only produced if you have selected option "Create XAC file (if relevant)" under the Options menu of RunGEM.

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, the Accuracy Summary form will appear. After you click **OK**, 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. RunGEM makes a suitable platform for students to run various simulations on an established model.

You need to run TABLO (from Release 6.0 or later of GEMPACK, not earlier) to produce the executable image of the TABLO-generated program (see section 1.2 of GPD-2) for the model.

If you are working with Release 6.0 or 7.0 of GEMPACK and 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*). See section 6.5.4 in GPD-6 for further details about how to make a stand-alone executable image. [If you are working with Release 8.0 or later of GEMPACK, this is not an issue since all executable images are stand-alone.]

You also need one Closure file. For example, this could consist of a sequence of "exogenous … " statements (listing the exogenous variables for one standard closure of the model) followed by the statement "rest endogenous ;". Current versions of RunGEM allow any legal GEMPACK statements relating to closure (but early versions of RunGEM required that a sequence of "exogenous …" statements followed by "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.

5.4 TABmate + RunGEM

Some GEMPACK users prefer to use TABmate to implement their model. TABmate can also be used to **condense** a model and to **compile and link** a TABLO-generated program. You can use TABmate and RunGEM to develop a model (or models) and carry out simulations.

Some experienced GEMPACK users find this way of developing models more productive than, say, working via WinGEM. [Of course, then you should set your RunGEM text editor to be TABmate via the Options menu in RunGEM.]

5.5 RunGEM for Students

If you have a Source-code licence for GEMPACK, you can prepare an executable image (.EXE file) for the TABLO-generated program and associated files (Auxiliary files (.AXS,.AXT), the MIN file and a closure file (.CLS)) so that your students can carry out some simulations on an economic model studied in your lecture course.

Since the GEMPACK Windows programs can be downloaded from the GEMPACK Web site (free of charge), students can install RunGEM on their own computer or can use RunGEM in a computer laboratory.[43] If you used the F77L3 compiler, make sure that the Executable-image of the TABLO-generated program which you provide to the students is "stand-alone" (see GEMPACK document GPD-6 section 6.5.4 for details).[44]

[43] For medium sized models, students do not need a GEMPACK licence to run the TABLO-generated program, though an Introductory GEMPACK licence is required for larger models (see section 1.9.5 of GPD-1). You can not use GEMSIM for general distribution to students because GEMSIM needs a GEMPACK licence in order to run.

[44] For the F77L3 compiler, students should be warned not to use either long filenames or directory names, or filenames or directory names containing spaces.

Chapter 6

6. Using AnalyseGE to Analyse Simulation Results

AnalyseGE is a Windows program designed to assist modellers in the analysis of their simulation results.[45] The AnalyseGE software is introduced in section 2.6 of GPD-4.

AnalyseGE can be downloaded from the GEMPACK web site.

Note that AnalyseGE has its own on-line Help file which documents its features and gives examples of its use.

Note that AnalyseGE can only be used in conjunction with Solution files produced using Release 7.0 or later of GEMPACK.

In section 6.1 below, we include a detailed hands-on introduction to using AnalyseGE to analyse the results of the standard Stylized Johansen simulation (10 percent increase in the availability of labor, holding capital fixed) from chapter 2 of GPD-1. We encourage you to work through this in detail.

Then perhaps work through Pearson *et al* (2002) which lets you work in detail to analyse two simulations with GTAP.

You will find that you can use the same techniques you learn from these to analyse results from simulations with your own model.

AnalyseGE can be used in conjunction with data-manipulation TAB files – see section 8.6 of GPD-3. You can find a detailed hands-on example of this in section 6.8.2 of GPD-3.

Since AnalyseGE only runs on Windows PCs, this chapter is not relevant for users working on other machines.

6.1 Analysing a Stylized Johansen Simulation

In this section we lead you through an analysis of the simulation with Stylized Johansen in which the supply of labor is increased by 10 percent (while the supply of capital is held fixed). This is the simulation used in GEMPACK document GPD-1 to introduce simulations in GEMPACK. The analysis below is based on an extension of the TABLO Input file SJLN.TAB. SJLN.TAB is shown in full in section 3.4.1 of GPD-1 and is described in detail in section 3.4 of GPD-1.

We are grateful to Peter Dixon who outlined the strategy followed below for this analysis.

[45] AnalyseGE is new for Release 7.0 of GEMPACK.

6.1.1 Starting AnalyseGE

To get started, run TABLO in your usual way with the TABLO Input file SJLNA.TAB, (compile and link if you have a Source-code licence to make SJLNA.EXE). Run the TABLO-generated program SJLNA.EXE or GEMSIM, with the Command file SJLNALB.CMF.

SJLNA is an extension of the standard linearized TABLO Input file SJLN.TAB (see section 3.4 of GPD-1). SJLNA.TAB contains extra variables and equations which assist the analysis, especially equations defining Real GDP.

In this section, we assume that you have run TABLO with the TABLO Input file SJLNA.TAB and used it with Command file SJLNALB.CMF to carry out the simulation.

Once you have carried out this simulation, you should start AnalyseGE running and open the Solution file SJLNALB.SL4 produced.

- If you are using WinGEM to run the SJLNALB.CMF simulation, you will see a button **Go to AnalyseGE** appears when the simulation has run. Click on this button to have the Solution file loaded into AnalyseGE.
- If you are not using WinGEM, run the program ANALYSGE.EXE in the GEMPACK directory, or from the icon on your desktop. Click on the Select/Change button and select the Solution file SJLNALB.SL4 to load it into AnalyseGE.

When the Solution file is loaded, you will see that AnalyseGE puts you into a window which looks very like (and is very like) TABmate (see section 2.4 of GPD-4). In fact AnalyseGE has **three windows**.

- You will work mainly in the **TABmate window**. There you will select expressions to evaluate.
- Whenever you ask AnalyseGE to evaluate something, it transfers you to a window which looks very much like **ViewHAR** (see section 2.2 of GPD-4), and shows you the relevant numbers there.
- There is also the **AnalyseGE window**. Usually you only see this from when you start AnalyseGE.

Each of the three windows has a **Front** menu. You can use this menu item to move between the three windows. This probably sounds a bit complicated. However, it all happens fairly naturally as you will see when you work through the detailed example below.

Now you are ready to start analysing the results of the simulation.

The first place to start is usually with the shocks, to check if they have been correctly applied. Usually a good place to start analysing the simulation is to see how the shocks affect the model.

Next we ask you to work out what has happened to Real GDP and why. This will be done in sections 6.1.3 to 6.1.7 below. Then you will analyse the results for other variables in the remaining sections.

6.1.2 Looking at the Shocks for the Simulation

Make sure that you are in the TABmate window of AnalyseGE. [If you are not, select **Front** in the menu of the Window you are in and select **Bring TABmate to Front**.] Go to the top of the TABmate form in the usual Windows way and click somewhere near the top of the TAB file.

Variable p_XFAC

The name of the variable shocked in the simulation is **p_XFAC**. Search for p_XFAC using the **Search** menu. The first place p_XFAC occurs is in the declaration of the Variable. Now click anywhere inside the word **p_XFAC** (for example between the "X" and the "F"). Then **right-click** (that is, click on the right-hand mouse button). A menu will appear. Click (more precisely, **left-click**) on the menu item **Evaluate this variable**. You will be put into the ViewHAR window of AnalyseGE and be shown the values, which are

p_XFAC("labor") = 10.0000
p_XFAC("capital") = 0

[In this section, we show results to 4 decimal places – we suggest that you select this number of decimal places in the ViewHAR window.]

These are the correct shocks for this simulation.

Now you need to get back to the TABmate form. To do that, select menu item **Bring TABmate to Front** from the **Front** menu on the ViewHAR window.

Before you go on to further analysis, it is worth noting out another feature of AnalyseGE. You have probably noticed that the variable **p_XFAC** is coloured **red** in the TABmate window[46]. AnalyseGE uses red to indicate exogenous variables and green to indicate endogenous variables (for example, p_XCOM). Note also that p_XFAC is in a bold font. This indicates that at least one component of it (labor in this case) has been given a nonzero shock. [If you do not see the red colour on your screen, read the attached footnote[47] to remedy the problem.]

The variable p_XFAC, the supply of factors, is important in determining the real GDP from the income side and the real Value Added.

6.1.3 Real GDP in Stylized Johansen

Normally GDP from the expenditure side is equal to C + I + G + X - M (see footnote[48]).

In Stylized Johansen, I, G, X, M are not present and household consumption C is called "Y" in the TABLO Input file SJLNA.TAB.

Normally GDP from the income side is equal to total factor income plus taxes and other costs. In Stylized Johansen there are no taxes or other costs, so that GDP from the income side is equal to total factor income (from "labor" and "capital"), that is, to

```
SUM(f,FAC, DVFAC(f))
```

in the usual notation for Stylized Johansen.

If you look towards the bottom of SJLNAN.TAB you will see the variables and equations introduced to report the percentage changes in real GDP from the expenditure and income sides, also the variables and equations used to report price indices for GDP from these two sides. These variables are

realGDPEXP and **realGDPINC** (percent changes in real GDP from the 2 sides),

piGDPEXP and **piGDPINC** (percent changes in the price index for GDP from the 2 sides).

Make sure that you are in the TABmate window of AnalyseGE. [If you are not, select **Front** in the menu of the Window you are in and select **Bring TABmate to Front**.] Go to the top of the TABmate form in the usual Windows way and click somewhere near the top of the TAB file.

To see the values of realGPDINC, search for "realGDPINC" using the **Search** menu. The first occurrence is in a comment, so search again to find the second occurrence. This is in the declaration of the Variable. Now click anywhere inside the word **realGDPINC** (for example between the "G" and the "D"). Then **right-click** (that is, click on the right-hand mouse button). A menu will appear. Click

---

[46] In the ViewHAR window, red is used for negative values.

[47] To get the exogenous variables coloured red, you need to being the AnalyseGE form to the front. To do this, select item **Bring AnalyseGE to Front** from the **Front** menu on the TABmate form. When on the AnalyseGE form, click on menu item **Distinguish Exog/Endog in TABmate** . You will then need to close down AnalyseGE (which you can do via ***File | Exit***) and start again. The next time the exogenous variables should be shown in red.

[48] C Consumption (household), I Investment, G Government, X Exports, M Imports.

(more precisely, **left-click**) on the menu item **Evaluate this variable**. You will be put into the ViewHAR window of AnalyseGE and be shown the result, which is

realGDPINC = 6.5602.

Repeat this procedure to find the values of piGDPINC, realGDPEXP and piGDPEXP.

realGDPEXP should be equal to realGDPINC, and piGDPEXP should be equal to piGDPINC. You can find a proof of this for Stylized Johansen in the appendix to this analysis in section 6.1.17 below.

6.1.4 What Happens to Real GDP from the Income Side?

Now you need to get back to the TABmate form. To do that, select menu item **Bring TABmate to Front** from the **Front** menu on the ViewHAR window. Place your cursor on the word **realGDPINC** again. Then click on the **Glossary** button near the top of the TABmate form. A Glossary window will appear showing all occurrences of the variable realGDPINC in the TAB file. Indeed there are only two statements shown, the Variable statement declaring the variable and the equation called **E_realGDPINC**. To go to that equation, click on the red number (it probably says **~277**) beside it. The Glossary window will be closed and your cursor will be positioned at the start of the equation E_realGDPINC.

This equation says simply that

```
realGDPINC = realVA ;
```

Variables realVA and realVA2

Look just above the equation E_realGDPINC and you will see that there are two versions of "real Value Added", namely variables called realVA and realVA2. We have included both of these for pedagogical reasons – normally only one would be included.

The equations defining them are very similar. The difference is that the equation E_realVA2 determining realVA2 is the share form of the equation E_realVA which determines realVA.

```
Equation (Linear) E_realVA # Real value added #
  SUM(f,FAC, DVFAC(f))*realVA = SUM(f,FAC, DVFAC(f)*p_XFAC(f)) ;

Equation (Linear) E_realVA2 # Share version of Real value added #
  realVA2 = SUM(f,FAC, SHARE_VA(f)*p_XFAC(f)) ;
```

First you will want to check that the simulation results for realVA and realVA2 are the same. To see this, left-click on the word **realVA** (for example, left-click between the "l" and the "V" in this variable on the left-hand side of the equation E_realVA). Then **right-click** (that is, click on the right-hand mouse button). A menu will appear. Click (more precisely, **left-click**) on the menu item **Evaluate (selection of coeff/var at cursor)**. You will be put into the ViewHAR window of AnalyseGE and be shown the result, which is

realVA = 6.5602.

Now we want you to repeat the process above to see the simulation result for variable **realVA2**. First you need to get back to the TABmate form. To do that, select menu item **Bring TABmate to Front** from the **Front** menu on the ViewHAR window. When you are back in the TABmate window, repeat the process above to find the result for variable **realVA2**. [First **left-click** inside realVA2 on the left-hand side of equation **E_realVA2**, then **right-click** and select menu item **Evaluate (selection of coeff/var at cursor)** by **left-clicking** on it**.** Again you will be put into the ViewHAR window and shown the result. Is the result the same as for realVA?

You will be doing these sorts of mouse manoeuvres a lot as you work inside AnalyseGE. We will begin to abbreviate the instructions. One convention we follow is that "click" by itself means "left-

click". We will always say right-click in full when we want you to do that. We will say something like "**click on XX, then right-click and evaluate**" as an abbreviation for the left-click, then right-click, then select menu item "**Evaluate (selection of coeff/var at cursor)**". We will say something like "**Gloss on YYY**" as an abbreviation for "left-click inside YYY, then left-click on the Glossary button near the top of the TABmate window". Now back to the analysis.

Next find equation **E_realVA2** (the share form). This says that the percentage change in real Value added is a share-weighted sum of the percentage changes in the supplies of the two factors, labor and capital. Formally, the equation reads

```
realVA2 = SUM(f,FAC, SHARE_VA(f)*p_XFAC(f)) ;
```

How can you see the values of the shares? Click on SHARE_VA, right-click and evaluate. You can see that the shares are

SHARE_VA(labor) = 0.6667
SHARE_VA(capital) = 0.3333 .

What about the terms SHARE_VA(f)*p_XFAC(f) on the RHS?

To see the values of these terms, **select** the expression

SHARE_VA(f)*p_XFAC(f)

with your mouse. [To do this, click with your mouse just to the left of the "S" in SHARE_VA. Hold the left mouse button down and drag the mouse until it is positioned just after the last ")" in p_XFAC(f).][49] Then right-click and Evaluate. You can see that the values of these terms are

SHARE_VA(labor)*p_XFAC(labor) = 6.6667 (labor)

SHARE_VA(capital)*p_XFAC(capital) = 0

So, looking at the equation above, what result do you expect for the variable realVA2? It looks as if the result should be 6.6667 (that is, 6.6667 for labor plus 0 for capital). To confirm this, click inside the word SUM on the RHS (for example, click between the "S" and the "U"), then right-click and Evaluate. The result is

```
SUM(f,FAC, SHARE_VA(f)*p_XFAC(f)) = 6.6667.
```

But, as you have seen before, the result for realVA2 = 6.5602.

These values are close but not exactly the same. This illustrates an important feature of AnalyseGE. When you solve a model accurately (here the solution is calculated by extrapolating from Euler 1, 2 and 4 step results), the linear equations of the model (such as equation E_realVA2 above) **are only satisfied approximately**. See section 6.2.3 of GPD-3 for a further discussion of why the accurate results satisfy the non-linear levels equations of the model but not the linearized equations.

If you had used Johansen's method (that is, a single Euler step), the result for realVA2 would be 6.6667 (as AnalyseGE suggests). But the Johansen results are not accurate solutions of the underlying nonlinear levels equations of the model. When you have solved the model accurately, the values given by AnalyseGE only satisfy the linear equations in the TAB file approximately. Fortunately, the agreement between the two sides of a linear equation is sufficiently close that the sort of analysis you have done above via AnalyseGE gives good approximations. In the case above, knowing the shares (0.6667 and 0.3333) and the exogenous values for p_XFAC(f) for the two factors, you can conclude that the simulation result for realVA2 should be approximately 6.6667.

[49] In fact AnalyseGE is a little more flexible than this suggests. You can click anywhere inside SHARE_VA(f) – for example, between the R and E, then drag until you are anywhere inside p_XFAC(f) – for example, between the X and the F – and then right-click and Evaluate. AnalyseGE knows where the symbols [such as SHARE_VA(f)] start and end and completes your selection accordingly.

6.1.5 Summary of Real GDP Analysis from Income Side

Let's summarise the analysis of what happens to real GDP from the income side.

In Stylized Johansen, the realGDP result is the same as the result for realVA2, which is the share-weighted sum of the percentage changes in the supplies of the two factors. In this simulation, the percentage changes in the supplies of the two factors are exogenous. Knowing the shocks are 10 (labor) and 0 (capital) and knowing the shares (0.6667 for labor and 0.3333 for capital) you can conclude immediately that the result for realGDP is approximately 6.6667. AnalyseGE makes it easy for us to

- recognise that p_XFAC(f) is exogenous (it is red)
- see the values of the shares,
- evaluate the SUM on the RHS of equation E_realVA2.

So, for this simulation, understanding the realGDP result is simple.

It is very important to note that you began your analysis **from the shocks**. Clearly this is the right place to start since the shocks are what drive the simulation.

6.1.6 Real GPD from the Income Side via Equation E_realVA

In the TAB file, there are two equations determining realGDP from the income side, namely equations E_realVA and E_realVA2. They are the same equation written in two different ways. The share form E_realVA2 is obtained from the original form E_realVA by dividing both sides by `TOTAL_VA=SUM(f,FAC,DVFAC(f))`.

Here we show you how you can obtain similar conclusions about realVA by looking at equation E_realVA. Go to this equation in the TAB file. It reads

```
SUM(f,FAC, DVFAC(f))*realVA = SUM(f,FAC, DVFAC(f)*p_XFAC(f)) ;
```

First look at the RHS. First click inside DVFAC(f), right-click and evaluate. The values are 4 (labor) and 2 (capital). Now click on the word SUM (for example, between the "U" and the "M") on the LHS, right-click and evaluate. The result is, of course, 6.

There are various ways in AnalyseGE of evaluating the terms DVFAC(f)*p_XFAC(f) on the RHS. One way is to select this term (as you did in section 6.1.4 above). A simpler way is to click somewhere in the "f,FAC" part after the SUM on the RHS. Then right-click and evaluate. You can see that the terms DVFAC(f)*p_XFAC(f) have values 40 (labor) and 0 (capital). Thus this equation says that

$$6 * \text{realVA} = 40$$

which suggests that realVA = 40/6 = 6.6667 .

As before this is approximately the simulation result of 6.5602 for variable realVA.

6.1.7 Real GDP from the Expenditure Side

Above you saw that realGDPEXP, the percentage change in real GDP from the expenditure side equals realGDPINC, real GDP from the income side, which you have explained above. But, in Stylized Johansen, the percentage change in real GDP from the expenditure side is just the percentage change in real consumption (variable cR). Hence the analysis above also explains the result for real consumption. Evaluate the variable cR to check that cR = realGPDEXP.

6.1.8 Demand for Factors in Each Sector – A First Look

The shock increases the total supply of (and hence the demand for) labor by 10 percent, and leaves the total supply of (and demand for) capital unchanged.

What can you say about the demands for the factors in each sector?

For each factor, the weighted sum of the percentage changes in demands in the two sectors must equal the percentage change in the overall demand for the factor. Formally, this is equation **Factor_use**. [You might like to look at that equation in the TABmate window.]

1. For labor, this says that the weighted sum of the percentage changes in demands in the two sectors must be 10. For example, if the demand for labor in sector s1 goes up by say 8 percent, then the demand for labor in sector s2 would need to go up by more than 10 percent (perhaps 12 or 13) to ensure that the weighted sum equals 10. [Exactly how much depends on the actual weights.]
2. Similarly for the sectoral demands for capital.

To find out what has happened to these demands, go to the TABmate window. Search for **Factor_use** to find the equation we were talking about above. Then click on p_XF (say between the "X" and the "F"), then right-click and select menu item **Evaluate (selection of coeff/var at cursor)** by **left-clicking** on it. You will be put into the ViewHAR window and will see the table below.

p_XF results

	s1	s2	Total
labor	**10.0000**	**10.0000**	20.0000
capital	**-0.0000**	**0.0000**	0
Total	10.0000	10.0000	20.0000

So, in this model and simulation, the demand for labor p_XF("labor",j) has increased by exactly 10 percent in each sector j, while the demand for capital has remained the same in each sector.

Certainly that is one (rather special) way of ensuring that the weighted sums are 10 for labor and zero for capital.

Why these have increased by exactly 10 and zero will be explained in section 6.1.10 below. It turns out to depend on special properties of the Stylized Johansen model.

In the meantime, we ask you to believe these results and to use them in the section below to begin to figure out what happens to the prices of the factors.

6.1.9 What Happens to the Prices of Labor and Capital?

The shock increases the total supply of (and hence the demand for) labor by 10 percent, and leaves the total supply of (and demand for) capital unchanged.

Scarcity

So what do you think should happen to the relative prices of labor and capital? Since capital is now relatively more scarce than before, you would expect its price to become relatively higher (compared to the price of labor) than it was.

First, check to see if that has happened.

> Go to the top of the TABmate window and search for **p_PF** which gives the percentage changes in the prices of the factors. You should find the declaration of this variable. Click anywhere in this declaration and then right-click. Select **Evaluate this Variable** from the menu shown. You will be put into the ViewHAR window, where you can see that the price of labor falls by 3.74 percent while the price of capital rises by 5.88 percent.

p_PF("labor") = -3.74
p_PF("capital") = 5.88

So the scarcity idea told you correctly about the relative movements.

Questions about these prices

1. Why has one price fallen and the other risen?
2. What explains the size of the difference between these prices?

You will analyse the second of these questions in detail in the rest of this section. You will answer the first question in section 6.1.15 below.

Difference between the prices

It turns out that you can obtain information about the difference between the prices of labor and capital by looking at the equation **Factor_inputs**.

Go back to the TABmate window via ***Front | Bring TABmate to front*** .

Then go to the top of the TAB file and search for **Factor_inputs**. You can see this equation which says

```
(all,f,FAC)(all,j,SECT) p_XF(f,j) = p_XCOM(j) - (p_PF(f) - p_PC(j)) ;
```

On the left-hand side of these equations are the demands for the factors f (labor and capital) in each sector j. As you saw in section 6.1.8 above, demand for labor increases by 10 percent in each sector while demand for capital is fixed in each sector.

What do the numbers tell us?

Click anywhere in the **Factor_inputs** equation (for example on the variable p_XF on the LHS, or anywhere inside the labelling information), then right-click. Select **Decompose part of this equation** from the menu shown. A **Type of Decomposition** form appears. The options **RHS**, **Intelligent** and **First** should be selected. Change from Intelligent to **Complete** by clicking on the circle next to it. Then click **OK** . You will be put into the ViewHAR window. The drop-down combo boxes in the top right-hand corner will probably read **All DecEq1**, **All FAC** and **Sum SECT**.

The first sector s1

Change the last drop-down combo box (the one which now says "Sum SECT") to be **s1** so that you are now seeing information about the first sector. We want you to compare the columns for labor and capital.

RHS of Equation Factor_inputs (for "s1")

	labor	capital	Total
p_XCOM	5.8853	5.885311.7705	
p_PF	3.7407	-5.8853	-2.1445
p_PC	0	0	0
Total	9.6260	0	9.6260

The column Totals [9.626 for the labor column and 0 for the capital column] are (roughly) equal to the LHS of these equations, the p_XF(f,"s1") results. As you saw in section 6.1.8 above, these results are

p_XF("labor","s1") = 10, p_XF("capital","s1") = 0.

Notice that the only difference between the columns is in the p_PF row.

The reason for this is clear when you look again at the equation

```
(all,f,FAC)(all,j,SECT) p_XF(f,j) = p_XCOM(j) - (p_PF(f) - p_PC(j)) ;
```

This separates into the following two equations, the first for labor (in each sector) and the second for capital (in each sector):

```
(all,j,SECT) p_XF("labor",j) =   p_XCOM(j) - (p_PF("labor")   - p_PC(j)) ;
(all,j,SECT) p_XF("capital",j) = p_XCOM(j) - (p_PF("capital") - p_PC(j)) ;
```

The columns in the table of values above show the values of the terms on the right-hand side when j=s1 (the first sector).

The first numbers in each column (5.8853) are the p_XCOM("s1") numbers from the equations. The third numbers (zero) in each column are the p_PC("s1") results from the equations. These two parts of the two equations are indeed the same. This explains why the only difference between the two columns in the table above is in the p_PF rows. These numbers are the **negative** of the p_PF values, which are the prices of the factors. Since the column totals must differ by about 10 [since they add to the p_XF values which differ by 10], the p_PF numbers must also differ by approximately 10.

Since the numbers in the p_PF rows of the table are the negative of the p_PF("labor") and p_PF("capital") simulation results, you can see that

p_PF("capital") – p_PF("labor") must be approximately 10.

The second sector s2

This conclusion is reinforced if you change the third combo box in the ViewHAR window from **s1** to **s2** to look at this equation Factor_inputs for the second sector.

RHS of Equation Factor_inputs (for "s2")

	labor	capital	Total
p_XCOM	6.8993	6.8993	13.7986
p_PF	3.7407	-5.8853	-2.1445
p_PC	-0.9486	-0.9486	-1.8972
Total	9.6914	0.0654	9.7569

Again the column totals are roughly 10 and zero [as expected from section 6.1.8 above – these are the p_XF("labor","s1" and p_XF("capital","s2") results] and the only difference in the columns is in the p_PF row. The numbers there must differ by approximately 10. As in the s1 case, since the p_PF numbers in the columns are the negative of the p_PF("labor") and p_PF("capital") simulation results, you can see again that

p_PF("capital") – p_PF("labor") must be approximately 10.

You can also deduce this via algebra

Go back to the TABmate window by clicking on **Bring TABmate to Front** in the **Front** menu of the ViewHAR window.

Look again at the **Factor_inputs** equation which says

```
(all,f,FAC)(all,j,SECT) p_XF(f,j) = p_XCOM(j) - (p_PF(f) - p_PC(j)) ;
```

As indicated above, this separates into the following two equations, the first for labor (in each sector) and the second for capital (in each sector):

```
(all,j,SECT) p_XF("labor",j) =   p_XCOM(j) - (p_PF("labor")   - p_PC(j)) ;
(all,j,SECT) p_XF("capital",j) = p_XCOM(j) - (p_PF("capital") - p_PC(j)) ;
```

Subtract the second from the first. This gives

```
p_XF("labor",j) – p_XF("capital",j) = p_PF("capital") – p_PF("labor")
```

since the other terms cancel out. From section 6.1.8 above, we know that the left-hand side is equal to 10. Hence, again we conclude (this time via algebra) that

p_PF("capital") – p_PF("labor") must be approximately 10.

Summary about factor prices

At the start of this section you noted that the results for the prices of the factors are

p_PF("labor") = -3.74 p_PF("capital") = 5.88.

As always in this kind of analysis, you should seek to explain these on the basis of the shocks and what you have already deduced.

Under the scarcity heading above you saw a good reason to expect the price of labor to fall relative to the price of capital.

Under the "What do the numbers tell us" and the "What can we deduce from algebra" headings above, you saw different forms of the same argument leading to the conclusion that

p_PF("capital") – p_PF("labor") must be approximately 10

which is indeed true for the numbers –3.74 and 5.88 above.

Questions about these prices revisited

This answers the second of the questions about these prices we asked above (under the heading "Questions about these prices").

Recall that the explanations above of the price difference relies on the fact that the demand for labor increases by 10 percent in each sector and the demand for capital remains fixed in each sector. We have not explained these facts yet, but will do so in section 6.1.10 below.

The answer to the first question [why p_PF("labor") is negative and why p_PF("capital") is positive] will have to wait until section 6.1.15 below.

6.1.10 Demand for Factors in Each Sector – A Final Look

As you saw from the results in section 6.1.8 above,

- the demand for labor increases by 10 percent in each sector [pXF("labor",i) = 10 for each j],
- the demand for capital remains fixed in each sector [p_XF("capital",j) = 0 for each j].

Why do these follow from the shocks?

The changes in factor demands are the same in the two sectors only because of the special functional forms used in the Stylized Johansen model. Indeed, as you can see from part (g) of the Answer to Exercise 3.6 in DPPW, this depends on the Cobb-Douglas nature of both the production function and the household utility function (see Exercise 3.1 in DPPW). In other models (for example, ORANI or MONASH), you would not expect the demands by the sectors to be the same.

This result from Exercise 3.6 of DPPW is not obvious from a cursory look at the equations. Nor can it be seen from AnalyseGE. As far as your analysis of this simulation goes, we will ask you to accept the fact that percentage changes in factor demand are the same in the two sectors, and to go on to other parts of the story.

6.1.11 Prices of the Factors Again

Note that the analysis of factor prices in section 6.1.9 above was based on the simulation results that the percentage changes in demand for any factor are the same in the two sectors. So that analysis is certainly valid, given what you now know from section 6.1.10 about factor demands.

6.1.12 What Happens to the Prices of the Commodities?

What is the name of the variable which indicates changes in the prices of the commodities? Go to the top of the TAB file and search for this variable **p_PC**. When you find it, click anywhere within the name (say, between the "P" and the "C") and then click on the **Gloss** button shown at the top of the TABmate window. This brings up a new Glossary window which shows all occurrences of p_PC in the TAB file. Which equation do you think explains this variable? Well, p_PC occurs in several equations and is on the left-hand side of just two equations, namely the equations **Price_formation** and **NUMERAIRE**. The first of these is the one you want since the second of these merely fixes the price of the first commodity to be the numeraire. Variables are often (though not always) explained by an equation which has them on the LHS. The Glossary window indicates in red next to the **Price_formation** equation the line number 190 in the TAB file where this equation occurs. To go to this equation, click on the **~190** beside the equation. The Glossary window closes and you are taken to the **Price_formation** equation which says

```
(all,j,SECT) p_PC(j) = SUM(i,SECT,ALPHACOM(i,j)*p_PC(i)) +
                       SUM(f,FAC,ALPHAFAC(f,j)*p_PF(f)) ;
```

This says that the percentage change in the price of each commodity is a weighted average of the percentage changes in the prices of the inputs to making this commodity. The first SUM on the RHS is an appropriately weighted sum of the prices of the intermediate commodity inputs while the second SUM is an appropriately weighted sum of the factor inputs.

Unfortunately the RHS involves the variable p_PC you are trying to understand. But you can make progress by looking first at the factor term on the RHS since you already understand what happens to the prices of the factors.

The weights ALPHAFAC(f,j) relate to the factor intensity of the use of each factor f in the production in each sector j. First look at the ALPHAFAC values by clicking inside the word ALPHAFAC, then right-clicking and then selecting **Evaluate**.

ALPHAFAC values

	s1	s2	Total
labor	0.1250	0.25000.3750	
capital	0.1250	0.08330.2083	
Total	0.2500	0.33330.5833	

Which sector is more labor intensive? Which sector is more capital intensive? What happens to the prices of the factors? Hence, what are the effects of the factor prices only on the relative prices of commodities s1 and s2?

You can see that the changes in both factor prices are moving the commodity prices in the same direction. Sector s2 is more labor intensive than sector s1 (which drives the output price in sector s2 down relative to that in sector s1) and s2 is less capital intensive than sector s1 (which drives the output price in sector s1 up relative to that in sector s2). To confirm this, bring TABmate back to the front (via the **Front** menu on the ViewHAR window), then click anywhere inside **SUM(** [for example, between the "U" and the "M" in SUM], right-click and select **Evaluate**. AnalyseGE will evaluate the relevant SUM.[50] Sure enough, the numbers shown in the ViewHAR window confirm that the factor prices are driving up the price of the first commodity relative to that of the second one.

```
SUM(f,FAC,ALPHAFAC(f,"s1")*p_PF(f)) =     0.2681
SUM(f,FAC,ALPHAFAC(f,"s2")*p_PF(f)) =     -0.4447
```

[50] If you click anywhere inside "f,FAC," just after "SUM(", AnalyseGE will evaluate the expression [here this expression is ALPHAFAC(f,j)*p_PF(f)"] inside the SUM. You can find out about this and much more about AnalyseGE from the extensive on-line Help file provided with AnalyseGE.

Specifically, the factor price changes contribute about 0.2681 towards the price of s1 and about –0.4447 towards the price of s2. [Note that, in this case, the row Total shown in the ViewHAR window is not of any real interest.]

Now the RHS of this equation also involves the ALPHACOM*p_PC terms. With any sort of luck the values of these terms will be dominated by the values of the ALPHAFAC*p_PF terms. To check this, go back to the TABmate window, and click again anywhere within the Price_formation equation. Then right-click and select item **Decompose Part of this equation**. The options shown (RHS, Intelligent, First) are fine so click **OK**. The ViewHAR windows shows the values of the two SUMs in each column.

Decomposing RHS of Equation Price_formation

	s1	**s2**	Total
ALPHACOM	–0.2371	–0.4743	–0.7114
ALPHAFAC	0.2681	–0.4447	–0.1767
Total	0.0309	–0.9190	–0.8881

The first column shows these two SUMs for the first equation (the one for sector s1), while the second column shows these two SUMs for the second equation (the one for sector s2). In fact, for each sector, the sum of the ALPHACOM*p_PC terms is negative. The values of these terms are not dominated by the value of the sum of the ALPHAFAC*p_PF terms, but they are moving the prices in the same relative directions as the factor prices.

- In sector s1, the p_PC contributions (in the row labelled ALPHACOM) are about –0.23 which pretty well exactly offsets the p_PF contributions (equal to about 0.26 – see the ALPHAFAC row above). This is not surprising when you remember that commodity s1 is the numeraire in this simulation, in the sense that its price is held fixed via equation **NUMERAIRE**. That forces the row Total in the s1 sector in the ViewHAR window to be very close to zero. Hence, once you knew that the p_PF terms contribute about 0.26 towards p_PC("s1"), you could have inferred that the p_PC terms must contribute about –0.26.
- In sector s2, the p_PC contributions are about –0.47. So, compared to the corresponding contribution of –0.23 in the price of s1, this pushes the price of s2 down further relative to the price of s1.

The conclusion is that the price of s2 is lower than the price of s1. You can see this by looking at the p_PC results (which you can do by clicking on p_PC, then right-clicking and then selecting **Evaluate**). The results are

p_PC("s1") = 0
p_PC("s2") = -0.9486

About two-thirds of this difference (the difference between the sum of the ALPHAFAC*p_PF terms, namely 0.44+0.26=0.70 – see a couple of paragraphs above) is because of factor price changes and the rest must be because of relative changes in the factor prices. As far as the latter goes, look at the ALPHACOM(i,j) values and note which sector uses relatively more of commodity s1. Note also, from the p_PC results just above, that commodity s1 has become relatively more expensive than commodity s2. [The shares of the commodities used in sector s1 are in the first column below, and the shares used in sector s2 are in the second column.]

ALPHACOM values

	s1	**s2**	Total
s1	0.5000	0.1667	0.6667
s2	0.2500	0.5000	0.7500

Total	0.7500	0.6667	1.4167

You can see that sector s1 uses a bigger share (0.5) of the more expensive commodity than does sector s2 (where the share is 0.1667), and a smaller share (0.25) of the less expensive commodity than does sector s2 (where the share is 0.5). Hence these base data shares ALPHACOM are causing the relative prices of the commodities to move in the same way as the effect of changing factor prices.

6.1.13 What Happens to Household Demand for the Commodities?

What equation determines household use of commodities? **Gloss** and go to this equation **Consumer_demands** which says

```
(all,i,SECT) p_XH(i) = p_Y - p_PC(i) ;
```

You know (from section 6.1.12) what happens to the relative prices of the commodities. The term p_Y occurs in both equations, namely the one for p_XH("s1") and that for p_XH("s2"). What do you conclude about the relative household demands for the two commodities? Look at the p_XH results to confirm this. Sure enough household demand for s2 (the relatively less expensive commodity) increases by about 1 percent more than household demand for s1. Notice that the difference is determined by the difference between the p_PC results (which you have understood in section 6.1.12 above).

6.1.14 What Happens to Total Demand for the Commodities?

What equation determines demands for the commodities? **Gloss** and go to this equation **Com_clear** which says

```
(all,i,SECT) p_XCOM(i) =
  BHOUS(i)*p_XH(i) +  SUM(j,SECT,BCOM(i,j)*p_XC(i,j)) ;
```

This says that the percentage change in total demand for commodity i is a weighted sum of the percentage change in household demand and the percentage changes in intermediate demand. You have already analysed these terms on the RHS (in sections 6.1.13 and 6.1.10 respectively).

As you have seen in section 6.1.13, the p_XH result for s2 is about 1 more than for s1. The BHOUS(i) values are the household share in total demand. Look at their values (which are 0.25 for s1 and 0.33 for s2). Thus the household contribution to p_XCOM(i) will be about 0.3 more for s2 than for s1.

To see the contributions, click anywhere in the equation, right-click and then select **Decompose part of this Equation**. Take the default choices offered in the **Type of Decomposition** form and click **OK**. You will see that the p_XC contributions (shown in the BCOM row in the ViewHAR window) are about the same (roughly 4.4 to 4.5) for the two commodities while, as expected, the p_XH contribution (shown in the BHOUS row in the ViewHAR window) is about 0.8 higher for s2 than for s1.

Thus, as expected from the p_XH results, the percentage increase in the total demand for s2 is a little less than 1 percent more than the percentage increase in the total demand for s1.

6.1.15 Results for Factor Prices – Why is One Positive and the Other Negative?

You have seen that the p_PF results are –3.74 for labor and 5.88 for capital. Why is one positive and the other negative?

Firstly you can understand why they are not both negative. To do this, look at equation **Price_formation** again.

```
(all,j,SECT) p_PC(j) = SUM(i,SECT,ALPHACOM(i,j)*p_PC(i)) +
                       SUM(f,FAC,ALPHAFAC(f,j)*p_PF(f)) ;
```

Recall that p_PC("s1") must be zero from the NUMERAIRE equation. Recall also that commodity s2 must become relatively less expensive than commodity s1 (since it is less labor intensive and more capital intensive – see section 6.1.12 above). Thus the ALPHACOM*p_PC sum above must be negative. If the p_PF results were both negative, then the ALPHAFAC*p_PF sum would also be negative. This is impossible since p_PC("s1") must be zero. Hence the p_PF results cannot both be negative.

You have seen in section 6.1.9 above that the p_PF("capital") result must be about 10 less than the p_PF("labor") result. With this in mind, look at the Price_formation equation for s1, which says

```
p_PC("s1") = SUM(i,SECT,ALPHACOM(i,"s1")*p_PC(i)) +
                        SUM(f,FAC,ALPHAFAC(f,"s1")*p_PF(f)) ;
```

You know that the LHS must be zero. You have seen just above that the sum of the ALPHACOM*p_PC terms must be negative. Indeed you have understood in section 6.1.12 that the p_PC("s2") result must be about –1. And you can look up the ALPHACOM and ALPHAFAC values. Thus this equation says

0 = 0.5*0 + 0.25*(-1) + 0.125*p_PF("labor") + 0.125*p_PF("capital").

Since p_PF("capital") must be about 10 more than p_PF("labor") you can see that these cannot both be positive. Indeed if you replace p_PF("capital") by [10+p_PF("labor")] in the above equation you can solve it for p_PF("labor") and will see that p_PF("labor" must be about –4.[51]

Hence the p_PF("capital") result must be about 10 more, namely about 6. [The exact result is 5.88.]

The key fact here is that the model really only determines relative prices, and the simulation results for all price variables must be interpreted accordingly. For example, it is not strictly correct to say that the price of capital increases in this simulation. Rather you must say that it increases **relative to the price of the numeraire** (that is, relative to the price of the first commodity). It is only the NUMERAIRE equation which allows numerical results for price variables to be determined. [This is true of all general equilibrium models.]

6.1.16 Conclusion

This concludes a fairly complete analysis of the results of this simulation. You have analysed

- the Real GDP results (directly from the shocks),
- the changes in commodity prices (also directly from the shocks),
- the changes in demands for the factors in each sector,
- the changes in the prices of the commodities,
- the changes in household demand for the commodities,
- the changes in total demand for the commodities, and
- why the simulation result for the price of capital is positive and that for the price of labor is negative.

Note that the analysis **started from the shocks**.

Note also that, as the analysis above shows, the results depend critically on the base data (as well as the equations). For example, the fact that the price of commodity s2 falls relative to the price of commodity s1 is because commodity s2 is more capital intensive and less labor intensive.

[51] Then the equation becomes 0 = –0.25 + 0.125*10 + 0.125*2*p_PF("labor") which means that p_PF("labor") must be equal to about –4. [The exact result is –3.74.]

Perhaps the only results you have not analysed above are those for the changes in intermediate demands for the commodities. You might like to try these using the techniques you have learnt above.

If you want to test your understanding of the analysis above, we suggest that you try to analyse a different simulation with Stylized Johansen. Perhaps try a simulation in which the closure is as above but the shocks are different – say a 10 percent increase in the supply of labor (as above) and a 3 percent increase in the supply of capital. The analysis above should work in the same order as above (though you will be looking at different numbers).

You will be able to apply similar techniques to analyse the results for other simulations with your own model.

One word of caution is appropriate here. The analysis you have worked through above for this Stylized Johansen simulation is unusually complete. You were able to explain virtually all the results only because of the simple and specialised nature of the model. When you use AnalyseGE on your own (probably more complex) model, you should not expect to be able to analyse your results in such detail.

Note that AnalyseGE comes with an extensive on-line Help file. You can learn much about AnalyseGE from that Help file.

6.1.17 Appendix – Proof that Real GDP and Price Indices are Equal from Both Sides

In this section we give a self-contained proof that, in the notation of SJLNA.TAB,

```
realGDPEXP = realGDPINC
```

and

```
piGPDEXP = piGDPINC              [price indices]
```

for Stylized Johansen. You confirmed these results above in the special case of the SJLNALB.CMF simulation.

This result is know to hold for models which are much more complicated than Stylized Johansen. In particular, section 42.4 of Dixon and Rimmer (2001) contains a proof of this result for the MONASH model.

The proof given here for Stylized Johansen is relatively straightforward. However it is not essential for your GE modelling skills that you work through the proof, and accordingly **you should feel free to skip it**.

The notation used in this proof is taken from SJLNA.TAB.

In this proof, we also use the following notation.

C = SUM(i,SECT, DVHOUS(i)).

COSTS(j) [costs in sector j] = SUM(i,SECT, DVCOMIN(i,j)) + SUM(f,FAC, DVFACIN(f,j)).

VA [value-added] = SUM(f,FAC,DVFAC(f)).

Note that C and VA are equal in a balanced data set.

In this proof, "SUM(i," is abbreviation for "SUM(i,SECT,"
"SUM(j," is abbreviation for "SUM(j,SECT,"
"SUM(f," is abbreviation for "SUM(f,FAC,"

In this proof, lower case w is an abbreviation for p_W. That is,
xh(i) is an abbreviation for p_XH(i),
pf(f) is an abbreviation for p_PF(f),
and so on.

The proof below is based entirely on linearized equations from SJLNA.TAB and the fact that the data base is balanced. In each step in the algebra below, we give a reason for the equality. Usually this is done by indicating the name of the relevant equation from SJLNA.TAB.

First we aim to prove that C*cR = VA*realVA, from which it will follow that cR = realVA, which is essentially the real GDP equality we need.

We begin with the left-hand side of this equation we wish to prove.

C*cR

[use equation E_cR]

= SUM(i,DVHOUS(i)*xh(i))

[use equation Com_clear]

= SUM(i, DVCOM(i)*xcom(i) - SUM(i,SUM(j, DVCOMIN(i,j)*xc(i,j)))

= SUM(j, DVCOM(j)*xcom(j)) - SUM(j,SUM(i, DVCOMIN(i,j)*xc(*i,j)))

[use equation Intermediate_com]

= SUM(j, DVCOM(j)*xcom(j)) - SUM(j,SUM(i,DVCOMIN(i,j)*[xcom(j) - pc(i) + pc(j)]))

[collect xcom terms together]

= SUM(j, {DVCOM(j) - SUM(i,DVCOMIN(i,j))}*xcom(j)) +

SUM(j,SUM(i, DVCOMIN(i,j)*[pc(i) - pc(j)]))

[use DVCOM(j) = COSTS(j) – this must be true for a balanced data set]

= SUM(j, {COSTS(j) - SUM(i,DVCOMIN(i,j))}*xcom(j)) +

SUM(j,SUM(i, DVCOMIN(i,j)*[pc(i) - pc(j)]))

[use definition of COSTS(j)]

= SUM(j,SUM(f,DVFACIN(f,j))*xcom(j)) +

SUM(j,SUM(i, DVCOMIN(i,j)*[pc(i) - pc(j)])) (1)

Now we look at the right-hand side of the identity "C*cr=VA*realVA" we wish to prove.

VA*realVA

[use equation E_realVA]

= SUM(f, DVFAC(f)*xfac(f))

[use non-share version of equation Factor_use]

= SUM(f,(SUM(j,DVFACIN(f,j)*xf(f,j)))

[use Factor_inputs]

= SUM(f,SUM(j, DVFACIN(f,j)*[xcom(j) - pf(f) + pc(j)]))

[rearrange]

= SUM(j,SUM(f, DVFACIN(f,j)*xcom(j))) +

SUM(f,SUM(j, DVFACIN(f,j)*[pc(j) - pf(f)])) (2)

We will prove later that (1) and (2) are equal.

Note firstly that the xcom terms in (1) and (2) agree.

What about the price terms?

Price term in (2)

= SUM(f,SUM(j, DVFACIN(f,j)*[pc(j) - pf(f)]))

[rearrange]

= SUM(j, {[-SUM(f,DVFACIN(f,j)*pf(f)] + [SUM(f, DVFACIN(f,j))*pc(j)]})

[use equation Price_formation to replace pf(f) term]

= SUM(j, {[SUM(i, DVCOMIN(i,j)*pc(i))] - COSTS(j)*pc(j) + [SUM(f, DVFACIN(f,j))*pc(j)]})

[collect together pc(j) terms, using definition of COSTS(j)]

= SUM(j, {[SUM(i, DVCOMIN(i,j)*pc(i))] - [SUM(i, DVCOMIN(i,j))*pc(j)]})

[rearrange]

= SUM(i, SUM(j, DVCOMIN(i,j)*[pc(i)-pc(j)]))

= Price term in (1)

Hence (1) = (2).

That is,

C*cR = VA*realVA

which gives (since C=VA in a balanced data set)

cR = realVA

This is the same (in this model – see equations E_realGPDEXP and E_realGDPINC) as

realGDPEXP = realGPDINC.

Thus real GDP is the same from both sides.

Now we turn our attention to proving that the price indices are equal.

Now C = VA in a balanced data set (see, for example, DPPW).

Linearizing gives

C*SUM(i, DVHOUS(i)*[pc(i) + xh(i)])

= VA*SUM(f,SUM(j, DVFACIN(f,j)*[pf(f) + xf(f,j)]))

That is,

C*SUM(i,DVHOUS(i)*xh(i)) + C*SUM(i,DVHOUS(i)*pc(i))

= VA*SUM(f,SUM(j, DVFACIN(f,j)*xf(f,j))) + VA*SUM(f,SUM(j, DVFACIN(f,j)*pf(f)))

The quantity terms on LHS equal C*cR while the quantity terms on RHS equal VA*realVA.

Since these are equal, the price terms are equal. Thus

C*cpi

[use equation E_cpi]

= C*SUM(i,DVHOUS(i)*pc(i))

[use the equality of the price terms above]

= VA*SUM(f, SUM(j, DVFACIN(f,j)*pf(f)))

[use equation Factor_use]

= VA*SUM(f, DVFAC(f)*pf(f))

[use equation E_piVA]

= VA*piVA

Thus, since C=VA,

cpi = piVA.

In this model (see equations E_piGDPEXP and E_piGDPINC) this means that

piGDPEXP = piGDPINC

so that the price indices of GPD from the two sides are equal.

6.2 What Next ?

You might like to work through Pearson *et al* (2002) which lets you work in detail to analyse two simulations with GTAP.

You will find that you can use the same techniques you have learnt above to analyse results from simulations with your own model. Of course your analysis should **start from the shocks**, as we have done in section 6.1 above.

AnalyseGE can be used in conjunction with data-manipulation TAB files – see section 8.6 of GPD-3. You can find a detailed hands-on example of this in section 6.8.2 of GPD-3.

Note that AnalyseGE comes with an extensive on-line Help file. You can learn much about AnalyseGE from that Help file.

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[52] 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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