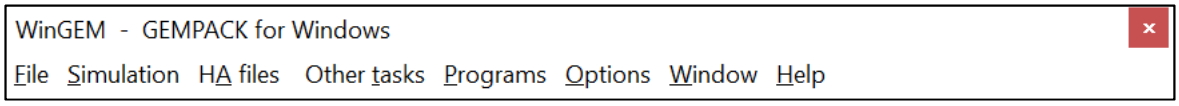
HANDS-ON COMPUTING WITH ORANI-G:
GETTING STARTED

1. Starting WinGEM

If the **WinGEM** icon appears on your desktop, double-click on it to start **WinGEM**. Otherwise, click on the ***Start*** button at the bottom left hand side of the screen. Choose ***All Programs*** then in the **GEMPACK** section select **WinGEM**.

WinGEM is a Windows interface to **GEMPACK**. When it starts it shows a narrow menu across the top of the screen:



Setting the working directory

You will be working inside the **WinGEM** shell as much as possible. To see how **GEMPACK** for Windows is used, you will check the database used for the **ORANI-G** model and run a simulation.

On the PC,

- All the **GEMPACK** and Windows **GEMPACK** programs files are in the folder or directory called **C:\GP**. This directory is called the **GEMPACK directory**. You would not normally alter the programs and other files in the **GEMPACK** directory.
- The directory called **C:\GPWork** contains various working directories, corresponding to different economic models.

You will be working (editing files, running simulations, looking at results) in the **working directory** of the ORANI-G model, **C:\GPWork\ORANIG.**

When using **WinGEM** the first step is always to specify the location of the working directory. Choose:

File | Change both default directories
(By this notation we mean first click on ***File*** in the **WinGEM** menu. This will produce a drop-down menu. In the drop-down menu, click on the menu item *Change both default directories*.)

In the file selection box that appears, choose drive **C:** then scroll down and *double*-click on the directory **GPWORK**. Next *double*-click on the subdirectory **ORANIG.** Check that the blue print above the directory box says C:\GPWORK\ORANIG**.** Click on the ***Ok*** button.

Viewing text files with TABmate

You'll often work with text files in **GEMPACK**, so you need a text editor. You could use a word processor but then you would always have to remember to save the file as a text or ASCII file. By default, **WinGEM** uses the **TABmate** editor which is part of **GEMPACK**.

To use **TABmate** to look at the TABLO Input file for the ORANI-G model, select in the **WinGEM** menu

File | Edit file...

The Open box should list several files associated with the ORANI-G model. You will briefly look at the TABLO Input file since it is the starting point for the ORANI-G model. It contains the equations of the model in a form very like algebra. Select the TABLO Input file to edit:

ORANIG.TAB

(If this file does not appear in the Open box and you have to change directories to find it, you have not set your working directory correctly.)

Various colours appear on the screen for different parts of the TAB file; for example, TABLO Keywords are in BLACK, comments are in royal blue and so on. The first page consists of a several comments (in blue) describing recent changes to the model.

Scroll down a page and you will see statements describing the two files used by this model:

- the input file BASEDATA containing input-out data and elasticities.
- the output (new) file SUMMARY which contains summary and checking data calculated from BASEDATA

Place your cursor on the word BASEDATA and press the ***Gloss*** button (at top middle of the screen). If this gives a message saying "*no info available: run Check to generate*" at the bottom of the screen, click on the button marked ***TABLO Check*** (to left of *Gloss*) and then try ***Gloss*** again. This should show you all places in the TABLO Input file where the file BASEDATA is mentioned -- all the places where initial data is read from file[1]. Click on the line number at the start of the Gloss line and **TABmate** will take you to that line.

Return to the top of the file (Ctrl and Home goes to the top of the file, Ctrl and End to the bottom of the file) and ***Search | Find | Search forward from top*** for the variable name **a1tot**. The first occurrences (in a comment) are not what we want, so do a Repeat Search ***(F3)*** until you find the line:

(**all**,i,IND) a1tot(i) *# All input augmenting technical change #*;

The "(all,i,IND)" means that a1tot is a vector variable with one value for each INDustry. Click on **a1tot** and press the ***Gloss*** button (at top middle of the screen). You can see that a1tot appears in 4 equations: the three demand equations E_x1_s, E_x1prim and E_x1oct and later on the long E_contGDPincE equation. Click on the red line number at left of equation E_x1_s and you should see:

Equation E_x1_s *# Demands for commodity composites #*
(**all**,c,COM)(**all**,i,IND) x1_s(c,i) - **[**a1_s(c,i) + a1tot(i)**]** = x1tot(i);

[1] You can click on any variable, coefficient or set and press the Gloss button to display a list of every statement in the file mentioning that symbol. For a variable, say, the first of these statements will usually furnish a definition. The remainder show how the variable is used. Line numbers accompany each statement; you can click on these to jump to that location in the TAB file. If you press Gloss when the cursor is not on a variable, coefficient or set, you get a different list showing the definition of each variable, coefficient or set mentioned in the current statement.

Click on the = sign in the equation above and press the **Gloss** button to see a definition of each symbol that is used.

The terms "(all,c,COM)(all,i,IND)" mean that Equation E_x1_s is actually a group or block of equations: there is one equation for each "commodity composite[2]" used by each industry. So, if there were 33 commodities and 27 industries in the database there would be 891 (=33*27) separate equations.

Each of the variables x1_s, a1_s, a1tot and x1tot is a percentage change: if x1tot("AgroPec") had value 5, that would mean that output of the AgroPec industry would be 5% greater than in the initial equilibrium described by the input data in the BASEDATA file. The "a" variables a1_s and a1tot are technological change variables, normally exogenous (values fixed outside the model). Suppose output were fixed (x1tot=0), a shock of 10% to a1tot("AgroPec") would mean that for each commodity c, the values of x1_s(c,"AgroPec") must also increase 10% to keep the equation balanced. If you looked at the other equations where a1tot appears, you would find that a shock of 10% to a1tot("AgroPec") would mean that 10% more of *all* inputs were needed to produce given AgroPec output [note: positive a1tot implies technical *regress*].

Press ESC or spacebar to close the Gloss window.

Exit from **TABmate** 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.)

2. Data for the ORANI-G model

Viewing the data directly using **VIEWHAR**

The input-output data used during this course for the ORANI-G model is contained in the data file **BASEDATA.HAR**. This is a *binary* file used in **GEMPACK** programs - called a Header Array (HAR) file - so we cannot just look at it in a text editor. Instead we will look at **BASEDATA.HAR** using a special viewing program, **ViewHAR**. Select from the main **WinGEM** menu:

*HA Files | View **VIEWHAR***

The **VIEWHAR** window will appear. Click on

File | Open Header Array file

and open the file **BASEDATA.HAR** in directory ORANIG on drive C:

This will open the **file BASEDATA.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:

[2] An example of a "commodity composite" might be QuimicDivers by the AgroPec industry. The QuimicDivers is potentially a mixture of local and imported chemicals, so we call it a "dom/imp composite".

	Header	Type	Dimension	Coeff	Total	Name
1	COM	1C	33 length 12			Set COM commodities
2	IND	1C	27 length 12			Set IND industries
3	OCC	1C	1 length 12			Set OCC occupations
4	MAR	1C	1 length 12			Set MAR margin commodities
5	1BAS	RE	COM*SRC*IND	V1BAS	1055601	Intermediate Basic
6	2BAS	RE	COM*SRC*IND	V2BAS	2191065	Investment Basic

The first item, COM, is the list of commodities in this database. The array is of type 1C which means an array of strings. Double click on COM to see the commodity names.

To return to the Contents Screen, double-click on any cell [or click on ***Contents*** in the **VIEWHAR** menu].

Have a look at item 8, 4BAS, showing exports of each commodity. Double-click on the 4BAS row to look at the numbers. Values in this file are measured in million of 2001 Reais. Would you say Agriculture/Food exports were as large as non-food Manufacturing exports?

Double-click on any cell to return to the Contents Screen, then double-click on item 22 (header 1CAP), which shows the values of capital rentals in each industry. Note down below the following database value -- you will need to know it later:

- V1CAP("AgroPec") =

Double-click on any cell to return to the Contents Screen, then double-click on item 7, 3BAS to see the numbers. The panel at the bottom of **ViewHAR** tells you that you are seeing household consumption, split according to commodity (COM) and SRC (domestic or imported). What is the single largest category of household expenditure?

ViewHAR for shares

ViewHAR can present numbers as shares. To see Row shares, look at the box in the top left hand corner beside the green and yellow bands. Click on the arrow beside this box and choose ***Row***. You should see shares that add to 1 across each row. The shares show the proportion of domestically-produced or imported goods for household use of each commodity.

Try ***Col*** to calculate column shares, and ***Matrix.*** What share of household spending goes on *GasoAlcool*?

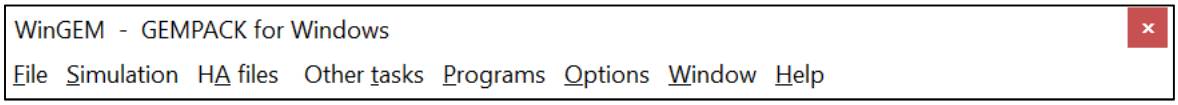
Close **VIEWHAR** in the normal Windows way ***File | Exit.***

HANDS-ON COMPUTING WITH ORANI-G: INTERROGATING THE DATA

1. Starting WinGEM

If the **WinGEM** icon appears on your desktop, double-click on it to start **WinGEM**. Otherwise, click on the ***Start*** button at the bottom left hand side of the screen. Choose ***All Programs*** then in the ***GEMPACK*** section select ***WinGEM***.

WinGEM is a Windows interface to **GEMPACK**. When it starts it shows a narrow menu across the top of the screen:



2. Setting the Directory for Model ORANIG

To keep all examples files for this model together in one area, we have created a separate directory called ORANIG on your C: drive. First choose

File | Change both default directories

In the file selection box, choose drive **C**: and subdirectory **C:\GPWork\ORANIG**

TABLO Input file for ORANIG

Choose ***File | Edit*** and open the TABLO Input file **ORANIG.TAB**. You will need to refer to both the TABLO Input file and the data file for ORANIG to answer the following questions because the sets in the TABLO Input file are read from the data file. For example, the set of commodities is read from the Header array called “COM”.

3. Looking directly at the Data file for ORANIG

There is one data file associated with ORANIG, a Header Array file called **BASEDATA.HAR**.

Use **ViewHAR** to look at this file. You can access **ViewHAR** by choosing the menu item on the **WinGEM** main menu: ***HA*** Files.

Questions

1. Which Header contains the set of industries?
   How many commodities are there, and how many industries?

2. How many margins commodities are there? Which commodities are they?

3. What does the Header “ITEX” contain? What is the name of the set containing individual exports?
   What are the individual export commodities?

4. What are the names of the COEFFICIENTs used in ORANIG.TAB to represent the Armington elasticities? From what Headers are their values read?

5. What are the values used for the Armington elasticities? What do these parameters represent? Which products have the highest elasticities? Which have the lowest? Why?

6. What is the value at basic prices of household consumption of imports of commodity "Automoveis"? What is the value of household consumption of domestically-produced commodity "Automoveis"?

7. What is the value of capital rental for industry "SIUP"?

8. What is the value at basic prices of the intermediate input of domestically produced commodity "SIUP" to production in industry "Minerio"?

Note: **ViewHAR** can only view two dimensions at a time. Use one of the little boxes at top right for aggregating matrices in different dimensions and choose "SIUP". See the **ViewHAR** help under "Options for real matrices" for more details.

Consequences of the data

You will also need to look at consequences of the data (for example, totals and shares calculated from the data which is read in).

The main TABLO Input file **ORANIG.TAB** can be used for this purpose. As well as solving the model, it writes out various useful data calculated from the original data to a SUMMARY file. You can use **GEMSIM** to produce this file without actually performing a simulation.

Look at ORANIG.TAB in the editor (***File | Edit...***). Search for "summary". To produce the SUMMARY file proceed as follows. Choose

Simulation | TABLO Implement

The TABLO window appears: click the ***Options*** item in *this* window, and choose

Run from STI.

Then use the ***Select*** button to choose the file **ORANIG.STI**. [This file contains instructions for 'condensation', which we explain later.]

Click the ***Run*** button to run TABLO.

Then ***Go to GEMSIM***... and ***Select*** the Command file **FORMULAS.CMF**.

Then ***Run*** **GEMSIM**. This **GEMSIM** run will read all the data, calculate all coefficients, and write the summary data.

Once the run has finished, press the button ***View Input/Output files*** to see the name of the data file read in and also the name of the SUMMARY file which is created by **GEMSIM**.

Use **ViewHAR** to examine the summary file. You can answer the questions below by examining **ORANIG.TAB**, **BASEDATA.HAR**, and **SUMMARY.HAR**.

Later you will add statements to **ORANIG.TAB** to compute and write more data to **SUMMARY.HAR**. These will be used to answer more questions.

Questions

Most of the following questions can be answered by examining **SUMMARY.HAR**. Each data item there has a descriptive "long name". As a guide, you might in each case look first in the TAB file to find

- the correct name of the COEFFICIENT
- how each item was calculated (and whether it is really what you want to find out)
- the Header used in writing this COEFFICIENT to file SUMMARY.
- Then look in SUMMARY.HAR in **ViewHAR** to find the Header and double-click on it to see the values.
- **ViewHAR** options: You can get **ViewHAR** to show the name of the Coefficient by selecting *File | Options* and then clicking on the box *Show coefficient names.*
- Another good idea is to select *File | Use advanced editing menu* rather than *Use simplified, read- only menu.*

Headers CSTM and FACT are useful for the next two questions:

9. The COEFFICIENT used for the total labour bill in industry "i" is V1LAB_O(i).

(a) What COEFFICIENT is used for the total cost in industry "i" (plus tax)?
(b) What COEFFICIENT is used for the total factor input to industry "i"?
(c) What are the calculated values of these three coefficients for industry "ProdConstCiv"?
(d) What is the share of labour in the total costs of industry " ProdConstCiv"?

10. (a) What is the total payments to labour summed over all industries (V1LAB_IO)?
(b) What is the total primary factor payments for all industries (V1PRIM_I)?
(c) What is the share of labour in total factor cost for all industries?

11. What is the value at purchasers' prices of exports of domestically-produced commodity "Metais"?

12. What is the different between the Coefficients SALE, SALES and DOMSALES? What is the value at basic prices of total sales of domestically-produced commodity "SIUP"?

13. Which header in SUMMARY.HAR tells us about Sales structure? Look at the Sales shares. Which industry sells the highest fraction of its output to investment? After that, which is second highest? Explain.

14. Look at the header CSTM in SUMMARY.HAR which tells us about Cost structure. What is unusual about the cost structure of "AlugImoveis"? What does the production of this industry represent?

15. The header MSHR in SUMMARY.HAR shows the import penetration for each commodity: ratio of (sales of imported good)/(total domestic sales of domestic+imported good) Look at the Formula for IMPSHR in the ORANIG.TAB file. Which commodity has the highest import penetration[3]?

16. Which header shows the share of exports of commodity c in total export earnings. (Use the value at purchasers' prices.) What commodity has the greatest share? Hint: use the "column share" feature in **ViewHAR**.

17. Use the header SALE to see the ratio of export sales to total sales of domestically-produced commodity c (using basic prices). Which commodities export more than 50 percent of the value produced? Which commodities are not exported?

[3] Once you are skilled, two buttons at top left help you answer "which is greater" questions: the green Sparse Sorted and yellow Transpose buttons.

GDP questions

18. Are the values of Nominal GDP from the income and expenditure sides equal?

19. Nominal GDP from the expenditure side is often given by

the formula GDP = C + I + G + X - M

where C is Consumption, I is Investment, G is Government, X is Exports, M is Imports.

What COEFFICIENT names are used for C, I, G, X and M in the ORANIG TABLO Input file? Find the values of all these quantities and verify whether the above formula is correct.
(Hint: Textbook definitions of GDP often ignore inventories.)

Fill in the following list of values:

	Coefficient Name (in TAB file)	Value (in Summary file)	("col" share of EMAC)
C =		=	=
I =		=	=
G =		=	=
X =		=	=
-M =		=	=
Stocks =		=	=
GDP =		=	= 100%

20. Nominal GDP from the income side is given by the formula

V0GDPINC = V1PRIM_I + V0TAX_CSI

What do V1PRIM_I and V0TAX_CSI represent?

Fill in the following list of values:

V1PRIM_I =
V1LND =
V1LAB_IO =
V1CAP_I =
V0TAX_CSI =
V0GDPINC =

Basic, Margin and Tax Components for Main Users

An elaborate example of an addition calculating and writing out values calculated from the data file is in Excerpt 40 of ORANIG.TAB.

The excerpt constructs a four-dimensional matrix showing:
for each good
for each source (dom, imp)
for each main user (Intermediate, Investment, Household, ... etc.)
basic, margin, and tax components
of purchasers' values.

By manipulating this matrix within **ViewHAR**, a variety of information may be learned.

Use **ViewHAR** to examine the matrix MKUP in file SUMMARY.HAR. Use the matrix to answer the following questions -- you will need to make extensive use of **ViewHAR**'s facilities for viewing shares and for slicing or summing.

21. Which commodity has the highest rate of tax? (Use **ViewHAR** row shares)
What share of total commodity tax revenue does that good account for? (Use col shares)

22. For which commodity does margins form the highest share of purchase cost?

23. What is the value at purchasers prices of household consumption of domestically-produced commodity Acucar?

24. Adding all commodities together, what fraction of purchasers' prices do commodity taxes form? For domestic commodities only? For imported commodities only?

25. What % of government demands are imported? What commodity is the biggest part of government spending?

26. What is the value at purchasers' prices of household consumption of imports of commodity OuProdAlim?

HANDS-ON COMPUTING WITH ORANI-G:
FIRST SIMULATION

1. Simulating the long-run effect of improved agricultural productivity

In this section you will implement the ORANI-G model and use it to simulate the short-run effects of reduced productivity in Agriculture.

Overview of the process

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

TABLO Implement
Compile & Link
TABmate Implement
Run TG Program
GEMSIM Solve
SAGEM Johansen Solve
View Solution (ViewSOL)
AnalyseGE
GEMPIE Print

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

TABLO Implement
GEMSIM Solve
View Solution (ViewSOL)

TABLO, **GEMSIM** and **ViewSOL** are the names of programs which carry out the three steps of a simulation:

- Step 1 - Implement the model with **TABLO**
- Step 2 - Solve the equations of the model with **GEMSIM**
- Step 3 - View the results with **ViewSOL**

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

Step 1 - Implementing the ORANI-G model using TABLO

As we saw previously, the **TABLO** Input file (which contains the theory of the ORANI-G model) is called **ORANIG.TAB**. Choose

Simulation | ***TABLO** Implement*

A window for **TABLO** will appear. Click the Options menu item at the top of this **TABLO** window and select "Run from STI file". Then click on the ***Select*** button to select the name of the STI file, ORANIG.STI. The STI (stored input) file contains some instructions which **TABLO** needs to

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

Click on the ***Run*** button. **TABLO** runs in a DOS box[4] and when completed returns you to the **TABLO** window with the names of files it has created: the Information file ORANIG.INF and the Log file GPXX.LOG. Briefly look at both of these files by clicking the ***View*** buttons beside them.

The Information file ORANIG.INF gives information about the **TABLO** Input file such as whether there are any syntax or semantic errors found by **TABLO** when it was checking the **TABLO** Input file. Error messages in the INF file are flagged by the characters '%%'. Search the file for %% to see if there are any errors (hopefully none).

Go to the top of the INF file and search for INPUT CHECK SUMMARY to see how many syntax errors and semantic problems there are (if any). Go to the end of the INF file to see what actions **GEMSIM** can carry out with the **GEMSIM** Statement and Table files produced in this run of **TABLO**.

Look briefly at the top of the LOG file. It should say the time and date when the log file was created. What **GEMPACK** Release was used? When you run **TABLO** in **WinGEM**, there is no output to the screen as it runs. Instead all, the screen output produced by **TABLO** goes to the LOG file. If there is some problem in running **TABLO**, consult both the LOG file and the INF file to find out what went wrong. Since this is a working model, no errors should occur provided you remember to run **TABLO** using the STI file ORANIG.STI.

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

Step 2 - Solve the equations of the model using GEMSIM

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

First ***Select*** a Command file called FIRSTSIM.CMF.
Look at this Command file in the text editor by clicking the ***Edit*** button. Command (or CMF) files are used to specify the details of a simulation. The main bits of information in this CMF file are:

- the model to use, in the line: auxiliary files = ORANIG;
- the solution method: Gragg 2 4 6
- the actual file names, BASEDATA.HAR and SUMMARY.HAR, that correspond to the logical file names, BASEDATA and SUMMARY, which are mentioned in the TAB file. By default, the solution file is named after the CMF file -- so in this case the solution will be stored in file FIRSTSIM.SL4.
- the closure, or list of exogenous variables. The model can determine the value of most *but not all* variables. Some variables must be held fixed (or shocked) by the modeler. These are called *exogenous*. The choice of *which* variables are to be exogenous varies between simulations. In

[4] The TABLO DOS box might briefly appear as an icon on the Windows task bar which is normally at the bottom of the screen.

this simulation, industry real rates of return to capital (variable fgret) are held exogenous, while capital stocks are free to adjust. This identifies the simulation as long-run.

- the shocks are at the end of the file. In this simulation we shock the variable **a1tot** to increase by 10% for each of the agricultural industries, **AgroPec**. **a1tot** is a measure of overall technical efficiency -- the 10% means either that with inputs held constant output will be 10% more, or that 10% less inputs will be needed to produce the original output[5]. These shocks are used to simulate the increase in agricultural productivity.

Use ***File | Exit*** to return from **TABmate** to the **GEMSIM** window.

Click on ***Run*** to run **GEMSIM** with the Command file FIRSTSIM.CMF. The simulation could take a few minutes to run. Do not touch the keyboard or mouse during this time.

Eventually, the *Accuracy Summary* window should appear [it is headed "via **WinGEM**: Whole simulation"]. You should see that nearly all the results are accurate to 5 or 6 significant figures[6]. The accuracy is indicated by two smiling faces (click on the key to see the range of facial expressions). Click OK to close the Accuracy Summary.

If there is an error, view the Log file.

If **GEMSIM** produces the Solution file, several new buttons will appear. There is no point in trying to look at the Solution file in the text editor because it is a binary file, not a text file. Instead, look at the Solution file using the Windows program **ViewSOL**, as described next.

Step 3 - View simulation results using ViewSOL

First click on the button ***Go to ViewSOL.*** The Contents screen shows the names of the variables. To see the values of a variable, double-click on its name. To return to the Contents screen, double-click on any number (or select ***Contents*** in the **ViewSOL** menu).

Start by double clicking on the first Contents row: **Macros** (Macros are scalar variables or variables with just one component.) You should see a list of macro variables and the value of their changes. You can click on the variable names -- a description will appear at the bottom of **ViewSOL**. Use the decimal places combo box at top right to set the number of decimal places to 2.

Most of the variables are percentage changes, but some (their names start with "del") are ordinary changes, measured in million-dollars. Values for exogenous variables are shown in red. Scroll down the list to find price indices (first letter "p"), nominal values (first letter "w"), and quantity indices (first letter "x"). Write down below what happened to:

- x4tot: aggregate exports
- x0gdpexp: real expenditure side GDP
- employ_i: aggregate employment
- x1cap_i: aggregate capital stock
- x0cif_c: aggregate imports
- p4tot: export price index
- p3tot: consumer price index
- p1lab_io: average nominal wage
- p1lnd_i: average return to agricultural land

[5] You can remind yourself how a1tot is used with the ORANIG.TAB file. From TABmate, use File..Open to re-open the TAB file, and search for (or Gloss on) a1tot.

[6] The Accuracy Summary gives separate estimates for Variables and for Data. Data will be more accurate than Variables. This is simply because most variables are %change. If some data has initial value X and increases by y% [accurate to 3 figures], the new value, X*[1+y/100], will be accurate to about 5 figures.

Double-click on any number to return to the Contents screen. Then scroll down till you find the variable x1tot (industry outputs). Double-click to view the numbers. Which non-agricultural industry was most affected?

Return to Contents and view results for:

- x4: exports
- x3: household use
- x1lab: employment
- regx1prim_i: state real GDP. Which state *gained*? Can you think why?

Note down below the following two results -- you will need them later.

- x1cap("AgroPec") =
- p1cap("AgroPEc") =

2. Other output files

The Summary file

Return to the **GEMSIM** window, that is, bring it to the front by clicking on it. Look at the data files used in this simulation by clicking on the button marked ***View Input/Output Files*** and view the output file *SUMMARY*. This SUMMARY.HAR file contains various useful tables and data summaries which are calculated only from the initial input data file BASEDATA.HAR[7].

Experienced modelers rely on a good knowledge of the main features of their database. To understand why some industries perform better than others in a simulation, we have to know the special characteristics of each sector. The SUMMARY file contains various data that have proved useful in the past. Some of the most useful are:

Header	Dimension	Coefficient	Name
SALE	COM*SRC*DEST	SALE	Sales aggregates
EMAC	EXPMAC	EXPGDP	Expenditure Aggregates
IMAC	INCMAC	INCGDP	Income Aggregates
TMAC	TAXMAC	TAX	Tax Aggregates
CSTM	IND*COSTCAT	COSTMAT	Cost Matrix
MKUP	COM*FLOWTYPE *SRC*SALECAT2	SALEMAT2	Basic, margin and tax components of purchasers values
MSHR	COM	IMPSHR	Share of imports in local market
SRSE	IND	SUPPLYELAST	Short-run supply elasticity
FACT	IND*FAC	FACTOR	Primary Factor Costs
1TOT	IND	V1TOT	Total industry cost plus tax
RV1P	IND*REG	REGV1PRIM	Factor bills

[7] Thus, even though SUMMARY.HAR is recreated each time you run a simulation, its contents will not change -- unless the input BASEDATA file was changed.

Use the SUMMARY file to answer the following questions:

- What is the share of exports in GDP? [Header EMAC, Col share]
- Intermediate inputs are ??% of the costs of the MeatDairy industry? [CSTM, row share]
- For which commodity do imports have the largest market share? [MSHR]
- Which two industries are most[16] labour intensive? [FACT, row share]
- Which two industries have highest short-run supply elasticity? [SRSE]
- Which region earns most from Minerio? [Header RV1P]

The Updated Data file

Return to the **GEMSIM** window (click it to bring it to front). Look at the data files used in this simulation by clicking on the button marked ***View Input/Output Files*** and view the updated file *BASEDATA*. This file (actual name FIRSTSIM.UPD) contains post-simulation values for the same data items as are contained in the input BASEDATA file, BASEDATA.HAR. Have a look at header 18, 1CAP.

Write down the new value for the AgroPec industry in the "updated" column below:

	Initial	**Updated**	**Percent Change**
V1CAP("AgroPec")			

Write down the original value of V1CAP("AgroPec") in the "initial" column above (you were asked to note this previously). Then write down the percentage change between Initial and Updated, using the formula[8]:

%change = 100*(Final - Initial)/Initial

The V1CAP vector contains values of capital rentals. Each value is the product of a price, P1CAP, and a quantity, X1CAP. The solution file contains values (you were asked to note these previously) for percent changes in these two variables. Write in these two values below.

	p1cap	**x1cap**
V1CAP("AgroPec")		

Use the two variable results above to check that:

updated V1CAP = [original V1CAP]*[1+p1cap/100]*[1+x1cap/100]

How does **GEMPACK** know which price and quantity variables must be used to update V1CAP? That information comes from a line in the file ORANIG.TAB, which reads:

Update (**all**,i,IND) V1CAP(i) = p1cap(i)*x1cap(i);

This updated data file has the same headers as the original input file. In fact, it is possible to use the updated data as the starting point (or initial data) for a second simulation. We might do this if we wanted to find the effect of one shock *followed by* another shock. Updated data files are used in a similar way by recursive dynamic models, a type of multiperiod CGE model which solves one year a time. The simulation for year T produces an updated data file which is used as input by the simulation for year T+1.

[8] If you are too tired to do mental arithmetic, click the Programs menu item at the top of **ViewHAR**, then click on the Calculator icon which appears.

3. Running simulations using RunGEM

If the RunGEM icon appears on your desktop, double-click on it to start RunGEM. Otherwise, click on the ***Start*** button at the bottom left hand side of the screen. Choose ***All Programs*** then in the ***GEMPACK*** section select ***RunGEM***.

Click on ***RunGEM*** to start it running. [If this is the first time RunGEM has been used, you may be asked to select a model to work with. Click OK and select the model ORANIG.GSS in the directory C:\GPWork\ORANIG. RunGEM may also tell you that the default closure is missing. Just ignore this and click OK.]

The RunGEM screen has the appearance of a Tabbed notebook with separate pages. Click in turn on the pages labelled **Model/Data Closure Shocks** and so on to change from one page to another.

Below you will use RunGEM to repeat the FIRSTSIM simulation from earlier.

On the Model/Data page select the button ***Change Model*** and select the file created in **TABmate**

C:\GPWork\ORANIG\ORANIG.GSS

In the box below place your cursor on the line

file BASEDATA = ...

and **right-click.** Select the menu line *Select or change file name* and select the file

C:\GPWork\ORANIG\BASEDATA.HAR

since this is the data file for the model ORANIG.

On the Closure page, click the Load Closure button and choose file ORANIGLR.CLS (which contains the usual long-run closure for the ORANIG model). Click ***Check Closure*** to ask RunGEM to check the closure. After a few seconds you will be told that the closure is OK.

On the Shocks page, first click the *Clear Shocks* button. Then, click on the arrow beside the box marked

Variable to Shock and select the variable **a1tot**

In this simulation, you are to give shocks for industries AgroPec, which you specify in the *Elements to shock* box. Click on the down arrow on this box.

Select the element “AgroPec” and give it a shock of 10%. Add this shock to the shock list by selecting the ***Add to Shock List*** button.

Look at the page Output Files (probably no changes are needed).

Then go to the Solve page. Change the solution method to Gragg 2,4,6 steps. Add a few words to describe the simulation in *Verbal description* box. Then click on the **Solve** button to run the simulation. To see the results, go to the Results page. These results should be the same as those calculated earlier using **WinGEM** and the Command file FIRSTSIM.CMF.

Exit from RunGEM as usual.

HANDS-ON COMPUTING WITH ORANI-G:
TARIFF CUT SIMULATION

1. Running the tariff cut simulation

The simulation shows the short-run effects of a reduction in the tariff on imported Textile and Footwear (*TexteisCalc*). The details of the simulation are contained in the file TARFCUT.CMF. Briefly examine this file using **TABmate**:

What variable is shocked and by what value? What type of closure is used?

Using **TABmate**, search through **ORANIG.TAB** and find the description (between # characters) of the shocked variable.

Now run the TARFCUT simulation using **WinGEM**.

When using **WinGEM** the first step is always to specify the location of the working directory. Choose:

File | Change both default directories

and check that the working directory is set to C:\GPWORK\ORANIG. Let us review the three steps in running a simulation.

- Step 1 - Implement the model with **TABLO**
- Step 2 - Solve the equations of the model with **GEMSIM**
- Step 3 - View the results with **ViewSOL**

To carry out **Step 1**, choose

Simulation | TABLO Implement

A window for **TABLO** will appear. Click the Options menu item at the top of this **TABLO** window and select "Run from STI file". Then click on the ***Select*** button to select the name of the STI file, **ORANIG.STI**.

Click on the ***Run*** button.

Because we have not changed the **TABLO** Input file of the model, there is no need to run **TABLO**. However, we have included this step for practice in running **TABLO**.

To carry out **Step 2**, choose

Simulation | GEMSIM Solve

Select the Command file for this simulation called **TARCUT.CMF**. Click on the ***Run*** button and wait until the simulation has finished.

To carry out Step 3, select the ***Go to ViewSOL*** button and look at the results of the simulation in the file **TARFCUT.SL4**.

2. A first look at the results using ViewSOL

First check that the right shock was applied—examine the variable ***t0imp***. Set the number of decimal places to 2. Then have a look at the imports vector ***x0imp***. Only one value is much different from zero.

What happened to imports of *TexteisCalc*? What other import changed, and by how much?

Now have a look at the industry outputs, ***x1tot***. What happened to output of *TexteisCalc*?

What happened to the other industry? Can you see a pattern in the other industry outputs?

Summary: …

The Fan Decomposition

The **Fan decomposition** variable ***fandecomp*** shows how the change in demand for a locally-produced commodity, say, *TexteisCalc*, may be divided between:

- local market effect: change in non-export demand for *TexteisCalc domestic plus imported*;
- domestic share effect: change in dom/imp ratio for *TexteisCalc* demand.
- export effect: change in demand for *TexteisCalc* exports

Examine the ***fandecomp*** variable and fill in the table below:

fandecomp	**LocalMarket**	**DomShare**	**Export**	**Total**
TexteisCalc				

Summary: ...

Macro Variables

Now look at the **macro variables**. Macro variables are scalar variables that have just one component. Some of the macro variables are red (***x3tot, x2tot_I, x5tot, phi***). These red variables are exogenous in the simulation.

All the macro results except for the ***del…*** variables are percentage changes. Variables whose names start with ***del*** are ordinary changes.

Check whether all of the percentage changes in macro variables are less than one percent. What variable is the numeraire in this simulation? The exchange rate (phi) or the CPI (p3tot)?

In **ViewSOL** you can copy the macro variables from the table shown on the screen into a spreadsheet. In the **ViewSOL** menu, select **Export | Copy** to copy the results to the clipboard. Next open the spreadsheet program Excel and select the Excel menu item **Edit** | **Paste** to paste the values from the clipboard into Excel. You will see that **ViewSOL** has helpfully added the variable descriptions to the table.

If you are not sure what the asterisked variables are, search through the TAB file with **TABmate** to find the equations defining them.

Save the Excel file as TARFCUT.XLS in directory C:\GPWORK\ORANIG (but leave the file open).

Fill in the table of macro variables below.

Description	Variable	Value
Real household consumption	*x3tot*	
Real investment	*x2tot_i*	
Real government demands	*x5tot*	
Export volume	*x4tot*	
Import volume CIF	*x0cif_c*	
Real GDP	*x0gdpexp*	
Aggregate capital stock	*x1cap_i*	
Aggregate employment	*employ_i*	
Absorption price index*	*p0gne*	
GDP price index	*p0gdpexp*	
CPI	*p3tot*	
Exports price index	*p4tot*	
Real devaluation*	*p0realdev*	
Average nominal wage	*p1lab_io*	
Average real wage	*realwage*	
Contribution of BOT to real GDP	*contBOT*	
Terms of trade*	*p0toft*	
Change in aggregate tariff revenue	*delV0tar_c*	

Results relating to Textile and Footwear

Next, in **ViewSOL**, change the combo box at top left (the 'filter' box) from "Everything" to "*TexteisCalc*". This causes **ViewSOL** to show only results that relate to the *TexteisCalc* sector.

On the **ViewSOL** Contents page, double-click the first item: *Vector elements matching TexteisCalc.* You will see the *TexteisCalc* part of each vector variable. Again, use **Export..Copy** to paste these results into another Excel sheet within TARFCUT.XLS.

Summary: ...

3. Investigating results, data, and equations with AnalyseGE

Start **AnalyseGE** running by returning to the **GEMSIM** window in **WinGEM** and clicking on the button ***Go to AnalyseGE*.** Click on the **Select/Change** button and select the Solution file **TARFCUT.SL4** . This may happen automatically if you are starting **AnalyseGE** from **WinGEM**.

This Solution file contains the results of the ORANI-G tariff cut simulation.

Go to the **TABmate** form (which is probably already the top one of the three forms associated with **AnalyseGE**). If not, select ***Front | Bring TABmate to the front***.

AnalyseGE makes it easy to see the values of any variable or coefficient.

To see the value of a variable *t0imp*, find the declaration of variable *t0imp* (for example, search using the Search menu). **Left-click** anywhere in the declaration of *t0imp*. Then **right-click** anywhere on the **TABmate** form. A menu will appear. Select the option **Evaluate this Variable**. A **ViewHAR** window will appear to show the values of all components of variable t0imp.

Confirm that the right tariff was reduced.

To get back to the **TABmate** window, select menu item ***Front | Bring TABmate to the front*** from **ViewHAR**'s main menu.

To see the corresponding feature for Coefficients, go to the top of the **TABmate** form (click there) and then search for the declaration of coefficient **TARFRATE(c)**. Look at the formula for this coefficient. Left-click on **TARFRATE** in the Coefficient statement, and then **right-click** and select the menu option **Evaluate this Coefficient**. Again, the **ViewHAR** window will appear, with values for TARFRATE.

Write down the initial ad valorem tariff rate for *TexteisCalc*:
Note: the power of the tariff [t0imp] is defined as *one plus the ad valorem rate*.

Write down the initial power of the tariff for *TexteisCalc*:

Write down the percentage change in t0imp("*TexteisCalc*"):

Use the Windows calculator to compute the post-simulation power of the tariff for *TexteisCalc*:

Write down the post-simulation ad valorem rate:

You can also find the values of variables or coefficients from any equation or formula where they appear. To see this, return to the **TABmate** form, go to the top and then find the equation E_p0B. Left-click on the p0 term on left-hand side (for example, between the "p" and the "0"). Then right-click and select menu option Evaluate (selection or coeff/var at cursor). Again, the **ViewHAR** form will appear and you will see the values of variable p0.

Write down the percentage change in p0("*TexteisCalc*","imp"):

Select menu item ***Front | Bring TABmate to the front*** to return to **TABmate**.

AnalyseGE lets you know which variables are exogenous and which are endogenous. Exogenous variables are coloured **red**; those not shocked are shown in italics and those shocked are bolded.

Endogenous variables are **green** while variables which have been substituted out are coloured **grey** and shown in italics (which indicated that results are not available). If a variable has some components exogenous and some endogenous, the variable is coloured **purple**. Omitted variables are shown as red italics to indicate they have not been shocked. (However, in the **ViewHAR** window, red just means that the value is negative.)

Summary: …

Effect of the tariff cut on imports

Next, we investigate the variable *x0imp*, aggregate imports. This variable appears in the next equation, E_delV0TAR. Click on *x0imp* and press the **Gloss** button at the top of **TABmate**.

A window appears, listing all statements in the **TABLO** file involving *x0imp*. The first mention defines the variable *x0imp*. The second mention is Equation E_x0imp, the name of the equation, "E_x0imp" suggest that this is the equation that explains variable x0imp. Line numbers are shown in red on the left side of the Gloss window. You can click on these red numbers to jump to that line. Use this method to jump to Equation E_x0imp. You should see:

Equation E_x0imp # *Import volumes* #
(all,c,COM) 0.01*[TINY+V0IMP(c)]*x0imp(c) = sum{u,LOCUSER,delSale(c,"imp",u)};

The left-hand side of this equation shows, for each commodity, the ordinary change in import volumes (measured at current prices). The right-hand side shows how the total change in imports is split between various usage categories [Gloss on the set "LOCUSER" to see these categories].

Left-click on the *delSale* term on the right-hand side. Then **right-click** and select menu option **Evaluate (selection or coeff/var at cursor)**. Again, the **ViewHAR** form will appear and you will see the values of variable delSale.

Above, **ViewSOL** told us that aggregate imports (*x0imp*) changed much only for 1 commodity: *TexteisCalc*. The *delSALE* values show us which demanders are responsible for these changes.

Fill in the following delSale values:

delSale (c,"imp",u)	Intermediate	Household	Rest
TexteisCalc			tiny

Summary: ...

4. Using AnalyseGE to examine an ORANI-G tariff cut simulation

Analysing results for *TexteisCalc*

Import-domestic substitution: Household demand for TexteisCalc

In this section you will analyse why household demand for imports of *TexteisCalc* increased so much. Go back to the **TABmate** window via the menu item ***Front | Bring TABmate to the front***.

Again, **Gloss** on delSale and go to the following equation:

E_delSaleC (all,c,COM)(all,s,SRC) delSale(c,s,"HouseH")=0.01*V3BAS(c,s)*x3(c,s);

V3BAS is a real amount while x3 is the percentage change in a quantity. Suppose that quantity units are determined by what one real will buy. Then V3BAS is also the initial quantity and the product V3BAS*x3 is 100 times the quantity change[9]. The 0.01 in the equation above cancels out this 100 and so the RHS is the quantity change (where one quantity unit is what one pre-simulation dollar will purchase).

For example, evaluate V3BAS, x3 and delSale for c=*TexteisCalc* and s=imp. A ???? increase in quantity x3 corresponds to a sales increase of ???? (delSale), from initial sales of ???? (V3BAS).

Then **Gloss** on x3, and go to the following equation:

Equation E_x3 # *Source-specific commodity demands* # (all,c,COM)(all,s,SRC)
x3(c,s)-a3(c,s) = x3_s(c) - SIGMA3(c)*[p3(c,s)+a3(c,s) - p3_s(c)];

The form of this CES demand equation is quite common in CGE modelling. The x3_s term on the right-hand side is the so-called **"expansion effect"**. This dictates the increase in demand of each commodity from a given source, based on the overall increase in imp/dom composite for that commodity. If relative prices are unchanged, then this is the end of the story. The second term on the right-hand side of this equation is the **"substitution effect"**. It captures the tendency to source products from the cheapest source. SIGMA3 is the elasticity of substitution between imported and domestic sources, and the negative of this value pre-multiplies the percentage change in the ratio of source-specific price to the average price. When one is conducting analysis of simulation results, it is often quite important to know how much of the change in import demand is due to the expansion effect, and how much is due to the substitution effect. The "intelligent" decomposition tool in **AnalyseGE** makes this easy to do.

In order to decompose the RHS of the equation above, click anywhere on this equation in the **TABmate** form. Then right click and select menu item **Decompose Part of this Equation**. Then, in the "Type of Decomposition" form, select **RHS** (in the top box) to indicate that you are seeking to decompose the right hand side of this equation, select **Intelligent** (in the middle box) to indicate that you want **AnalyseGE** to adopt the usual decomposition approach to this demand equation, select **First** (in the third box) to indicate that you want the decomposition toggle to come first in the **ViewHAR** file. and finally, click **Ok**. In the **ViewHAR** form which appears, make sure that the combo boxes read "All IntDec1", "*TexteisCalc*", and "All SRC".

[9] If X is the initial quantity, delX is the change in X, and pX is the percentage change in X, then pX=100*delX/X. Hence X*pX=100*delX.

Fill in the table below

	1 dom	**2 imp**
1 x3_s		
2 SIGMA3		
Total		

By definition, the expansion [x3_s] term is the same for both dom and imp *TexteisCalc*. In each case the substitution [SIGMA3] term is much more important. You can identify the separate parts of this. Use **Evaluate (selection or coeff/var at cursor)** to fill in the table below:

	x3 (c,"dom")	**x3 (c,"imp")**	**x3_s**	**p3 (c,"dom")**	**p3 (c,"imp")**	**p3_s**	**SIGMA3**	**S3 (c,"imp")**	**S3 (c,"imp")**
TexteisCalc									

The composite (average dom/imp) price is defined in the next equation, E_p3_s. Omitting a3 taste change terms, the two equations of this CES nest read:

E_x3 x3(c,s) = x3_s(c) - SIGMA3(c)*[p3(c,s)- p3_s(c)];
E_p3_s p3_s(c) = sum{s,SRC, S3(c,s)*p3(c,s)};

For c = *TexteisCalc*, using values from the table above,

p3_s(c) = sum{s,SRC, S3(c,s)*p3(c,s)}
p3_s(c) = ???? = ????

the price of *TexteisCalc* composite p3_s has decreased by ????,

x3(c,"dom") = x3_s(c) - SIGMA3(c) * [p3(c,"dom")-p3_s(c)]
x3(c,"dom") = ???? = ????

there is substitution away from the domestic good (????), towards the imported good (????).

x3(c,"imp") = x3_s(c) - SIGMA3(c) * [p3(c,"imp")-p3_s(c)]
x3(c,"imp") = ???? = ????

We could substitute out the p3_s average price variable to get:

x3(c,"dom") = x3_s(c) -SIGMA3(c)*S3(c,"imp")[p3(c,"dom")-p3(c,"imp")]
x3(c,"imp") = x3_s(c) -SIGMA3(c)*S3(c,"dom")[p3(c,"imp")-p3(c,"dom")]

In each case the substitution term consists of the product of: the Armington elasticity, a share, and the percent change in the ratio of domestic to imported prices. In the first equation, the term SIGMA3(c)*S3(c,"imp") [called the "import pressure"] show that domestic producers are more vulnerable to import competition where both Armington elasticity and import share are larger.

Summary: …

Explaining purchasers' prices: Household imports of TexteisCalc

You might have wondered why the price of imported *TexteisCalc* to households, p3("*TexteisCalc*","imp") [=????] fell less than the duty-paid price of imported *TexteisCalc*, p0("*TexteisCalc*","imp") [=????]. To understand why, Gloss on the variable p3 and go to the equation E_p3:

Equation E_p3 # *Purchasers prices - households* # (all,c,COM)(all,s,SRC)
[V3PUR(c,s)+TINY]*p3(c,s) = [V3BAS(c,s)+V3TAX(c,s)]*[p0(c,s)+ t3(c,s)]
+ sum{m,MAR, V3MAR(c,s,m)*[p0dom(m)+a3mar(c,s,m)]};

The above equation states that the purchasers' price, p3, is composed of three components: basic values, consumption tax, and trade and transport margins. You can see (by colours) in **AnalyseGE** that, in this simulation, the variable a3mar (technical change) is exogenous and unshocked (i.e., 0). Also, the variable t3 (tax rate) is zero for all commodities c and sources s. To see why, Gloss on t3, go to equation E_t3 and note that the two variables on the RHS are both exogenous and unshocked. Thus, although it is formally endogenous, the variable t3 is zero "almost exogenously". Now go back to the equation E-p3 (shown above) in **TABmate**. You can ignore the a3mar and t3 terms in this simulation.

If we divided both sides in equation E_p3 by V3PUR+TINY we would get the percent change equation:

$p3 = [1-S_m]p0 + S_m p_m$

where S_m is the share of margins in purchasers' price, and p_m is the average change in the cost of margins. **Intelligently decompose** the RHS of equation E_p3 to see that the second, margin, term contributes relatively little to the above. **Evaluate** p0dom in equation E_p3 above to see that margins prices decrease by only a small amount.

The conclusion of the above must be that, for imported *TexteisCalc*, the $[1-S_m]$ share must be around 0.13. To check this, Gloss on V3PUR and go to the formula defining it:

(all,c,COM)(all,s,SRC)
V3PUR(c,s) = V3BAS(c,s) + V3TAX(c,s) + sum{m,MAR, V3MAR(c,s,m)};

Right click and select **Decompose the RHS of this Formula**. In **ViewHAR**, set the combo boxes to "All IntDec?", "*TexteisCalc*", "All SRC" and choose Column Shares.

Fill in the table below:

Coeff	1 dom	2 imp
V3BAS		
V3TAX		
V3MAR		
Total		

Thus, when you divide both sides of equation E_p3 by V3PUR+TINY, this equation for c=*TexteisCalc* and s=imp tells us that

p3(“*TexteisCalc*”,”imp”) = ????*p0(“*TexteisCalc*”,”imp”) + ????*SUM(m,MARG,p0dom(m))

Here p0(“*TexteisCalc*”,“imp”) is –10 and the SUM(m,MARG,p0dom(m)) term is small. Thus the margins share of ???? explains why p3(“*TexteisCalc*”,“imp”) is only about ????. This is an example where a share from the base data is vital in understanding the size of results.

Summary: ...

Search for and evaluate the SALEMAT2 matrix.

Set combos to "All COM", "All FLOWTYPE", "imp", "HouseH". Which commodity has the highest rate of distribution margin, and why?

What if you look at domestic commodities? [change “imp” to “dom”.]

Estimating household demand elasticities

In ORANI-G, intermediate, investment and government demands for composites (imp/dom combined goods) are insensitive to the prices of composites. For example, the Clothing industry will use composite *TexteisCalc* in proportion to Clothing output, regardless of composite *TexteisCalc* price. For these users, the only substitution between commodities is import-domestic substitution. This is because the top nest in the intermediate demand nest is Leontief between composite commodities.

Households, however, **do** substitute between composite commodities. As we saw, above, a fall in the price of composite *TexteisCalc* leads to a rise in household use (even though total household consumption x3tot is held fixed).

Use the changes in price and quantity to write down an estimate of the elasticity of household demand for *TexteisCalc*:

	x3_s	**p3_s**	**demand elasticity = %x / %p**	**B3LUX**
TexteisCalc				

ORANI-G uses the linear expenditure system [LES] to model household demands. One way to think of LES is that demand for each composite good is split into two parts:

- a fixed or "subsistence" component representing necessities.
- a variable ("supernumerary") component representing luxuries.

The first part does not change, so its demand elasticity is zero. The second, supernumerary, part is modelled as Cobb-Douglas and so has a demand elasticity near to -1. The total demand elasticity will be a share-weighted average of these two elasticities:

demand elasticity = (Fixed share) x 0 + (Luxury share) x -1

Above, the shares add to 1 and "Luxury share" is defined as:

[Value of supernumerary use of *TexteisCalc*]/[Value of all household use of *TexteisCalc*]

Therefore, the demand elasticity will be close to the [negative of the] value of the "Luxury Share". In the ORANI-G TAB file, this share corresponds to the coefficient B3LUX.

Search for and evaluate B3LUX("*TexteisCalc*") and fill the final column of the table above. Is the value close to the previous estimate of demand elasticity? Why are the two estimates not identical?

Total demand for domestic TexteisCalc

We have seen above that purchasers' prices of imported *TexteisCalc* to households fell directly as a result of the shock (even after taking account of margins). Of course, the same happens for the purchasers' price of imported *TexteisCalc* used by firms. The amount of this fall can be understood using the equation E_p1 (which also involves margins).

We have seen above that households substitute towards imported *TexteisCalc*, away from domestic *TexteisCalc*. This is because the shock has reduced the price of imported *TexteisCalc*.

For the same reason, firms (intermediate inputs) substitute towards imported *TexteisCalc*. There is an Armington nest in each case. For example, the equation for intermediate inputs x1 is E_x1:

Equation E_x1 # *Source-specific commodity demands* # (all,c,COM)(all,s,SRC)(all,i,IND)
x1(c,s,i)-a1(c,s,i) = x1_s(c,i) -SIGMA1(c)*[p1(c,s,i) +a1(c,s,i) -p1_s(c,i)];

What about the other uses of imports of *TexteisCalc*? No *TexteisCalc* (imported or domestic) is used for capital creation, as the V2BAS values will show you. Also, there is no change in government demands for *TexteisCalc* (domestic or imported) since total government demand x5tot is exogenous and fixed and there are no changes in government demands for the different commodities since the shifters f5 are exogenous and not shocked. Thus, we can concentrate on intermediate and household demands.

Suppose for the moment that total demand for composite *TexteisCalc* remains approximately unchanged. Then, since more imports and less domestic are used for intermediate inputs and households, you can see that total demand for imported *TexteisCalc* will increase and total demand for domestic *TexteisCalc* must fall.

To see the sizes of the changes, search for the variable delSale and Evaluate it. Set the combo boxes to *TexteisCalc*/All SRC/All DEST.

Complete the following table (in which we ignore the columns which are all zero):

delSale ***TexteisCalc***	**Interm**	**HouseH**	**Export**	**Total**
dom				
imp				
Total				

As expected from the discussion above, intermediate and household demand drop significantly for the domestic commodity but increase for the imported commodity.

The only use of *TexteisCalc* we have not considered above is exports. The table above shows that

exports (only the domestic is exported, the imported commodity cannot be re-exported in this model) do increase, but not by sufficient to offset the other declines. [You will look more closely at the size of this export increase below.] Thus, total demand for domestic *TexteisCalc* decreases. To see that another way, look at the value of x1tot("*TexteisCalc*") = ????.

Why did domestically-produced TexteisCalc get cheaper?

So far, we have seen that the tariff cut caused imported *TexteisCalc* to become cheaper (relative to domestically-produced *TexteisCalc*) so that users switched from domestic to imported. However, the domestic price of *TexteisCalc* also decreased—this moderated the price difference between domestic and imports and helped to protect demand for the domestic product.

Find and evaluate the variable p0 (basic prices) and fill in the two values below.

	s=dom	**s=imp**
p0("*TexteisCalc*",s)		

Relation between commodity prices and industry costs

The price of the domestic *TexteisCalc commodity* is nearly equal to the output price of the *TexteisCalc industry*, p1tot.

What is the value of the output price for the industry, p1tot?

The two prices [p1tot, p0("dom")] would be identical if:

(a) all *TexteisCalc* commodity was made by the *TexteisCalc* industry; *and*
(b) the *TexteisCalc* industry made *only* the *TexteisCalc* commodity.

These conditions are only approximately satisfied. To check them, find and evaluate the MAKE matrix. Use **ViewHAR**'s shares view to answer these 2 questions:

What fraction of *TexteisCalc* commodity is made by the *TexteisCalc* industry?
What fraction of *TexteisCalc* industry output is *TexteisCalc* commodity?

In compiling Input-output tables, most statistical bureaus build up industry statistics from facts about "establishments", e.g. individual factories. The factories are grouped according to the commodity that they *mainly* produce.

The main equations connecting industry prices to commodity prices are shown below:

Formula
(all,i,IND) MAKE_C(i) = sum{c,COM, MAKE(c,i)};

Equation E_x1tot # *Average price received by industries* # (all,i,IND) p1tot(i) = sum{c,COM, [MAKE(c,i)/MAKE_C(i)]*pq1(c,i)};

Equation
E_pq1 # *Each industry gets the same price for a given commodity* # (all,c,COM)(all,i,IND) pq1(c,i) = p0com(c);

Summary: …

Conclusion: …

Why did the output price p1tot("TexteisCalc") decrease?

In the absence of technological change, the output price of each industry, p1tot, can be expressed as a cost-share-weighted average of the price of each industry input. ORANI-G contains an equation, E_p1cst, which computes this average input cost.

Find the equation E_p1cst.

```
Equation E_p1cst (all,i,IND) p1cst(i) = [1/V1CST(i)]*[ sum{c,COM,sum{s,SRC,
                                        V1PUR(c,s,i)*p1(c,s,i)}}
                                      +   V1OCT(i)      *p1oct(i)
                                      +   V1CAP(i)      *p1cap(i)
                                      +   V1LND(i)      *p1lnd(i)
                                  + sum{o,OCC, V1LAB(i,o)     *p1lab(i,o)}];
```

Evaluate the p1cst variable and check that p1cst("*TexteisCalc*") = p1tot("*TexteisCalc*") = ????

Now left-click within equation E_p1cst, then right-click. Select **Decompose Part of this Equation**. This time click on **Complete** (rather than Intelligent) and, as previously, select RHS and Toggle first. The complete decomposition shows the contributions of each variable. The decomposition in **ViewHAR** shows you how each category of input price contributes to the total change, p1cst.

Fill in the table below:

TexteisCalc	**contribution**
1 p1	
2 p1oct	
3 p1cap	
4 p1lnd	
5 p1lab	
Total p1cst	

You should see that p1 (material inputs) is much the largest contributor.

Breaking down the reduction in intermediate input prices?

You can use **AnalyseGE** to see which material inputs contributed to the negative p1 contribution. Return to the **TABmate** form and select with your mouse the expression *V1PUR(c,s,i)*p1(c,s,i).* Now **right-click** and select menu option Evaluate (selection or coeff/var at cursor). Again the **ViewHAR** form will appear and you will see the values of the expression *V1PUR(c,s,i)*p1(c,s,i).*

Set the combo boxes to All COM/All SRC/*TexteisCalc*.

The numbers you see now are *real contributions* from price changes to total cost [i.e., if they were divided by V1CST(i), they would show components of the percent change in p1cst]. Set **ViewHAR** to show *matrix shares* (the whole matrix adds to one) so you will see the share of each commodity and source in the whole p1 contribution.

What share of the p1 contribution comes from price change in domestic *TexteisCalc*?
What share of the p1 contribution comes from price change in imported *TexteisCalc*?

- You should see that the largest matrix share corresponds to imported *TexteisCalc*. Thus, cheaper *TexteisCalc* imports significantly reduce costs for the domestic industry as well competing with it.
- The next biggest matrix share corresponds to domestic *TexteisCalc*. That is, cheaper domestic *TexteisCalc* also contributes significantly to cost reduction—implying that the industry is a customer of itself! This is quite usual, especially when data has fewer (more aggregated) sectors.

What share of *TexteisCalc* sales go to the *TexteisCalc* industry? [Hint: V1BAS/SALES[10]]

Why did the capital rental p1cap("*TexteisCalc*") decrease?

In this short-run closure of ORANI-G industry capitals stocks are fixed, and profits are a residual item. The CES between capital and labour in the production function implies a "declining marginal product of labour"—labour is less productive as the L/K ratio rises. Conversely, as output falls with K fixed, L (and thus L/K) must fall by more than output, so labour becomes more productive. You will confirm these assertions below.

To see this search for the equation E_p1cap. You should see equations like:

```
Equation
   E_x1lab_o     # Industry demands for effective labour #
    (all,i,IND) x1lab_o(i) = x1prim(i) - SIGMA1PRIM(i)*[p1lab_o(i)-
   p1prim(i)]; E_p1cap          # Industry demands for capital #
    (all,i,IND) x1cap(i) = x1prim(i)-SIGMA1PRIM(i)*[p1cap(i)-
   p1prim(i)]; E_p1prim         # Effective price term for factor demand
   equations #
    (all,i,IND) V1PRIM(i)*p1prim(i) = V1LAB_O(i)*p1lab_o(i)+V1CAP(i)*p1cap(i);
```

Above, technical change variables and demands for land are omitted as irrelevant to this example.

Why is land irrelevant here? [Hint: Decompose RHS of formula for V1PRIM] For which industries would land be relevant?

Rewriting the equations for factors

If you divide Equation E_p1prim by V1PRIM, it can be written [dropping subscripts] as p1prim = SL.p1lab_o + SK.p1cap

[10] You can evaluate this share by going to the AnalyseGE form (bring that to the Front). Click on the **Clear** button. Then enter V1BAS("*TexteisCalc*","dom","*TexteisCalc*")/SALES("*TexteisCalc*"); (don't forget the semi-colon at the end) into the memo. Then click **Evaluate**. You will see the answer.

where SL is the share of labour in factor costs (V1LAB_O/V1PRIM) and SK is the share of capital in factor costs (V1CAP/V1PRIM).

If you subtract E_p1cap from E_x1lab_o, you get

$$x1lab\_o - x1cap = -SIGMA1PRIM.[p1lab\_o - p1cap]$$

With some manipulation, the first equation becomes x1prim = SL.x1lab_o + SK.x1cap

The three equations have become

x1prim = SL.x1lab_o + SK.x1cap p1prim = SL.p1lab_o + SK.p1cap
$$x1lab\_o - x1cap = -SIGMA1PRIM.[p1lab\_o - p1cap]$$

The short run equations for factors

With no change in x1cap, we can drop the x1cap terms, so these equations become:

(a) x1prim = SL.x1lab_o
(b) p1prim = SL.p1lab_o + SK.p1cap
(c) x1lab_o = –SIGMA1PRIM.[p1lab_o – p1cap]

With output (=x1prim) and wages (p1lab_o) given, we see that:

(i) From (a), if output falls 1%, employment must fall more than 1% [=1/SL]
(ii) From (c), if employment falls, p1cap must fall relative to p1lab_o. p1lab_o is linked to the CPI, so does not change much. Therefore, p1cap must fall.
(iii) From (b) if p1cap falls, p1prim (price of value-added) must also fall.

This explains why the capital rental p1cap("*TexteisCalc*") falls in your simulation. You know that capital stocks (x1cap) and technology are fixed in that simulation.

You have also seen (and explained) that (domestic) output x1tot of *TexteisCalc* falls by about ????.

But x1prim is equal to x1tot since there is no technical change (see equation E_x1prim). Thus x1prim("*TexteisCalc*") falls by about ???? and so, from (i) and (ii) above, it follows that p1cap("*TexteisCalc*") must fall.

Estimating how much p1cap("*TexteisCalc*") falls

What's more, the equations above give a pretty good estimate as to how much this price must fall. Suppose for the minute that p1lab_o does not change. [This is not correct. However, it is true that the p1lab_o is small.]

Then, from (a):

$$x1lab\_o = (1/SL)*x1prim=(1/SL)*(????).$$

Then, (c) above can be rewritten as

$$p1cap = x1lab\_o/SIGMA1PRIM + p1lab\_o.$$

Ignoring the tiny p1lab_o change, we get:

p1cap = x1lab_o/SIGMA1PRIM = (1/SL)*(????)/SIGMA1PRIM

The SL value is about ???? (this is easily calculated from the base data) and the SIGMA1PRIM value for *TexteisCalc* is ???? (as is easily seen from **AnalyseGE**). This gives the rough estimate that

p1cap("*TexteisCalc*") = (1/????)*(????)/???? = ????.

This is very close to the exact result (see the worksheet below).

Fill in the worksheet below to validate equations (a) to (c) above. Your Excel sheet with industry results may save time. For the Factor shares SL and SK, find and evaluate the coefficient FACTOR, then use **ViewHAR**'s shares view.

SL = labour share	
SK = 1 - SL	
x1cap	
x1lab_o	
RHS(a) = SL.x1lab_o + SK.x1cap	
LHS(a) = x1prim	
x1tot	
p1lab_o	
p1cap	
RHS(b) = SL.p1lab_o + SK.p1cap	
LHS(b) = p1prim	
SIGMA1PRIM	
RHS(c) = -SIGMA1PRIM * [p1lab_o-p1cap]	
LHS(c) = x1lab_o	

Checking calculations such as that above are very often done when developing or extending a model to ensure that the equations are working properly. If the single-step, Johansen, solution method is used, we expect good agreement between LHS and RHS of linearized equations. Agreement is usually pretty good (but not exact) for results from multi-step [non-linear] solution methods.

Summary: ...

Why did exports of TexteisCalc increase?

You saw above that exports of *TexteisCalc* increase. Check to find how much exports of *TexteisCalc* increased.

Find the equation in ORANIG.TAB which "explains" exports x4. [Hint. Gloss on x4 and look for an equation with x4 on the LHS. When you find it, are you surprised at the name?]

In fact, there are two equations explaining exports, one for the commodities in the set TRADEXP

and one for the commodities in the set NTRADEXP.

Gloss on TRADEXP to find out about that set. You will see

Set TRADEXP # Individual export commodities # = (all,c,COM:IsIndivExp(c)>0.5);

This is the set of commodities whose exports are determined individually. They are sometimes called the traditional export commodities. They are usually commodities whose exports are substantial.

To see which commodities are in this set TRADEXP, bring the **AnalyseGE** form to the front (via the **Front** menu). Select menu item ***View | Sets, Subsets, Variables, Coefficients***. You will see a list of the sets (under the **Sets** tab on the form shown). Run down these sets until you see TRADEXP and click on it. The members of this set are then shown.[11]

Is *TexteisCalc* in the set TRADEXP?

Since *TexteisCalc* is in the set TRADEXP, demand for its exports is explained by equation E_x4A (rather than equation E_X4B). Close the sets form and go back to the **TABmate** form (via the **Front** menu). Look at the equation E_x4A. You should see

Equation E_x4A # *Individual export demand functions* #
(all,c,TRADEXP) x4(c) - f4q(c) = -ABS[EXP_ELAST(c)]*[p4(c) - phi - f4p(c)];

Note that the variables f4p and phi are exogenous and not shocked.

How can you tell this? What does that mean about their values?

Hence this equation says that

x4("*TexteisCalc*") = -ABS[EXP_ELAST("*TexteisCalc*")]*p4("*TexteisCalc*")

This connect exports x4 to a price p4 and an elasticity EXP_ELAST.

What is the value of EXP_ELAST("*TexteisCalc*")?

Hence you can see that

x4("*TexteisCalc*") = ????*p4("*TexteisCalc*")

Thus, you will understand why exports of *TexteisCalc* increased (and by how much) when you understand why the export price p4 fell (and by how much).

The export price p4 of *TexteisCalc*

What happens to the export price p4 of *TexteisCalc*?

What would you expect to influence the export price of *TexteisCalc*?

[11] Another way of checking to see the elements of TRADEXP is to look at the values of the Coefficient IsIndivExp which determines the set. These values are read from the BASEDATA file. To see the values, search for IsIndivExp and evaluate. Note that the value for *TexteisCalc* is 1. This means that *TexteisCalc* is in TRADEXP since the value is larger than 0.5.

Firstly, the basic price p0("*TexteisCalc*","dom"). Secondly any export taxes or subsidies. Thirdly, the cost of getting exports from the factory to the port (that is, margins). You will see how all of these are involved in the equations shown below.

Find the equation which "explains" the price p4. As you would expect, this is equation E_p4 which says:

Equation E_p4 # *Zero pure profits in exporting* # (all,c,COM) [V4PUR(c)+TINY]*p4(c) =
[V4BAS(c)+V4TAX(c)]*[pe(c)+t4(c)]
+ sum{m,MAR, V4MAR(c,m)*[p0dom(m)+a4mar(c,m)]};

This connect p4 to another export price pe, to export taxes t4 and to margins (the last term). To find about pe, look at equation E_x0dom which says

Equation E_x0dom # *Supply of commodities to export market* # (all,c,COM) TAU(c)*[x0dom(c) - x4(c)] = p0dom(c) - pe(c);

Find the values of the Coefficient TAU. In fact, they are all zero, so that this equation simply says that pe(c) is equal to p0dom(c) for all commodities c.

Finally, in this chain of price connections, find the equation which "explains" p0dom. This is the simple equation E_p0dom which says

Equation E_p0dom # *Basic price of domestic goods = p0(c,"dom")* # (all,c,COM) p0dom(c) = p0(c,"dom");

Hence you can see that

pe("*TexteisCalc*") = p0dom("*TexteisCalc*") = p0("*TexteisCalc*","dom")

Thus, equation E_p4 can be rewritten as

(all,c,COM) [V4PUR(c)+TINY]*p4(c) = [V4BAS(c)+V4TAX(c)]*[p0(c,"dom")+t4(c)]
+ sum{m,MAR, V4MAR(c,m)*[p0(m,"dom")+a4mar(c,m)]};

which makes the expected connection between p4 and domestic prices, export taxes and margins clear.

Decompose the equation E_p4 (Intelligent decomposition). Complete the table below for *TexteisCalc*.

V4BAS	
V4MAR	
Total	

You know that the basic price of *TexteisCalc* has fallen and why. Nothing has happened to export taxes t4 in this simulation so they are all zero. [You can check that by evaluating t4. A look at equation E_t4A will make it clear why t4 is zero here.]

Suppose for the minute that nothing much happens to the prices p0dom(m) of the margins commodities. [If you evaluate those, you will see that this is not a bad assumption.] Then, dividing

the equation above by V4PUR+TINY and setting t4 and p0dom(m) to zero, the equation becomes

p4(c) = {[V4BAS(c)+V4TAX(c)]/[V4PUR(c)+TINY]}*p0(c,"com")

You can find out about this share by glossing on V4PUR and going to the formula for V4PUR. [It is at about line number 201.] **Decompose the RHS** of this formula. For *TexteisCalc* you will see that the above share is equal to 0.86. Thus, approximately,

p4("*TexteisCalc*")= ????*p0("*TexteisCalc*","dom")= ????*(????)= ???? which, if you evaluate the LHS, is a pretty good approximation to the result. This explains why p4("*TexteisCalc*") falls and by how much.

Summary: …

Why exports of *TexteisCalc* increase and by how much

You saw that

x4("*TexteisCalc*") = ????*p4("*TexteisCalc*")
(where the "????" is the value of the elasticity EXP_ELAST).

In section above, you explained why p4("*TexteisCalc*") fell and by how much.

Given that p4 falls by about ???? %, it is clear that exports x4 must increase by about ???? times that, namely by about ????%. [The exact result is ????%.]