



A Single Country Computable General Equilibrium Modeling Course Exercises S3

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This document is subject to ongoing revisions. If you find any errors, please let us know so that we can correct them ASAP. If you have suggestions as to how the exercises can be improved, please send them to the email address above.

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1. Introduction

These exercises are designed to help develop your abilities to interpret model results. This is done using two sets of pre-defined experiments; each is designed to produce results that are, to a greater or lesser extent, counterintuitive. The tasks set require you to explain the causes of the results; you should not just report the results, rather you should explain WHY the results emerge. These processes can be frustrating, since the reasons may initially be difficult to explain, even though in retrospect they may be ‘obvious’: this can be the most rewarding feature of CGE models.

The model files are basically the same as those used in Module S2; the exceptions being the Excel data and data definitions files, the data load files and the experiment files. HOWEVER, we ask you to set up separate directories for the Interpreting Model Results exercises to ensure that the models run as intended and produce the intended results; we have ensured that the codes for each exercise generate the ‘correct’ results for the learning objectives of this module.

In Exercise S3.1 you will be required to conduct an analysis of uniform trade reform and **explain** why the model produces seemingly contradictory results, i.e., results that do/may not conform to **prior** expectations. In Exercise S3.2 you will learn some additional (GAMS) technical skills while examining the results from changes in world prices; again, you will be required to **explain** why the model produces results that do/may not conform to **prior** expectations.

Note the emphasis on PRIOR expectations. For both exercises you should develop prior expectations/hypotheses that you are using the models to test. It is through testing your expectations that you will learn most.

The outputs from Exercises S3.1 and S3.2 are the projects for this module.

RESIST THE TEMPTATION TO EXPLORE THE CONTENTS OF THE LIBRARY; THIS WAY LIES CONFUSION. YOU GET TO SEE AND USE ALL THE FILES.

Exercise S3.1 Interpreting Model Results 1

This exercise is designed as the first (semi) independent single country CGE experiment for you. In this exercise you will implement a predesigned set of trade policy experiments, with which you are familiar, and then interpret the simulation results. You should expect this exercise to take some 6 to 8 hours. The challenge here is to move from learning how to run a model, set up experiments and access results to the interpretation of model results for policy analyses purposes.

Policy Context

South Africa has made a political decision to engage in a radical programme of unilateral trade liberalisation. You have been employed to advise the government on some of the possible implications of the proposed programme of liberalisation. The plan is to remove 75% of all tariffs on all imports.

Setup

The setup process for this exercise should be familiar: establish a working directory and New Project and populate the directory from the GAMS User Library.

1. Create a subdirectory `interp1` in the directory `C:\cgemod\stg_t\interp`.
2. Create a New Project using GAMS Studio.
3. Open the GAMS User Library Single CGE Course Library and Download `stg_t_3` from the GAMS User Library (SeqNr: 03)
4. Unzip the file `stg_t_3.zip` in your working directory.
5. It is assumed that you will use Save and Restart to run the experiments.
6. The experiments are pre-coded to generate a specific pattern of results. **DO NOT CHANGE THE EXPERIMENTS.**

WE ARE DELIBERATLEY DUPLICATING THE FILES USED. THIS IS BECAUSE YOU MAY, LEGITIMATELY, HAVE MADE CHANGES WHILE USING THESE FILES DURING MODULE S2 THAT MAY CAUSE THE RESULTS TO CHANGE.

Running the Experiments

As before, the experiment uses two master files that need configuring to operate with the model data and the experiment data and experiment file.

1. The core model is `stg_t.gms` and uses the data in `stg_t_data_sam_3_1.xlsx`.
2. Set up the core model, run the programme and check it runs correctly.
3. The master experiment file is `stg_t_expt.gms` for which the datafile is `stg_t_expt_3_1.xlsx` and the experiment file is `stg_t_expt_3_1.inc`. Set up the master experiment file, run the programme, check it runs correctly, and all the results files have been produced.
4. The experiment file `stg_t_expt_3_1.inc` is pre-coded to produce intended results. **DO NOT CHANGE THE EXPERIMENTS.**
5. NB: It is legitimate to EXTEND the number of experiments IF and ONLY IF you are doing so to provide additional information about the preset experiments.

NOTE: YOU WILL NEED TO COLLECT THE RESULTS FILES INTO ANOTHER DIRECTORY BEFORE EXERCISE S3.2

Formulate your Hypotheses

Use economic theory to formulate your hypotheses as to the expected outcomes of these experiments. The hypotheses should detail the expected outcomes, e.g., signs and approximate magnitudes of changes in model variables, and the **theoretical reasons** for the expected outcomes.

This should always be the first step. If you do not develop prior expectations, you are likely to allow your thinking to be directed by the results; an all-too-common analytical failure. Rather the process should involve critically evaluating the results against your hypotheses

Some Preliminary Analyses

The second step is always to examine the structure of the economy before analysing the results; this process may induce you to revise your prior expectations. The file

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results\stg_t_struct.gdx provides some summary structural information that can be used with the SAM and the variable values from the core model, see stg_t.gdx. Below are some suggestions.

1. Review the macroeconomic summary data.
2. Review the composition of government income and expenditure.
 - a. How important are different tax instruments for government income?
3. Review savings and investment.
 - a. How important are different sources of savings?
4. Review the structure of demand and supply by commodity.
 - a. How important is intermediate consumption?
 - b. Are any commodities especially important for imports and/or exports?
5. Review the structure of production.
 - a. How important are mining and manufacturing to employment/
6. Etc.

Challenges

A preliminary review of the results has indicated that some of the results are confusing. Your task is to explain these apparently contradictory results:

1. Why are the signs on the changes in real private consumption different under cl_tyh_sol and cl_tv_sol?
2. Why are the signs on the changes in government private consumption different under cl_tyh_sol and cl_tv_sol?
3. Why are the signs on EV for Other low ed, Other high education and White high education so different under cl_tyh_sol and cl_tv_sol?
4. Why do real aggregate exports increase so much when real total domestic production increases so little?

Report

In all cases you should use tables, diagrams etc., to report your results, and then comment on the policy implications of your results.

Requirements

1. You need to compile the Excel files that you will use to generate the report.
2. Make explicit reference in your write-ups to key points in the model code that are important for explaining the results.

The report must NOT exceed 6 pages including tables, figures and graphs (using small print is cheating!!!)

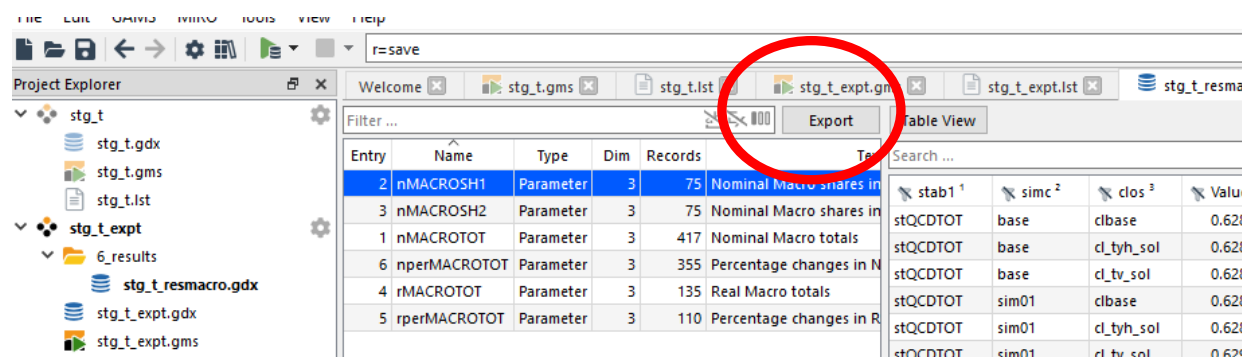
Using Export and Excel Pivot Tables

So far, the course has, implicitly, assumed that you have filtered results in GDXViewer and then you have copied the filtered results and pasted them into Excel to produce tables and charts. This is a simple procedure that has been adequate so far and will remain useful: but there are options that may be more efficient, especially when working with larger models. The method outlined here involves using Studio with Excel's PivotTables and PivotCharts. The operations for exporting from the GDXViewer in Studio are simple, but the full benefits can only be realised if some time is spent learning to use PivotTables and PivotCharts in Excel. The guidance notes provided here only provide a brief introduction to the Excel end of the process; the illustrations below are derived using results from Exercise O9.1.

Export From GDXViewer

In the experiment project for Ex S3.1 open one of the results gdx files in 6_results; the examples below use the *stg_t_resmacro.gdx* file as an illustration (see Figure S3.1). If you click on the highlighted Export button, an GDX Export dialogue box opens (see Figure S3.2), which allows you to choose the parameters to export. Choose the List View, NOT the Table View, this is because the intention is to use PivotTables in Excel. For this illustration it is assumed that you want to export all the parameters in *stg_t_resmacro.gdx* in unfiltered form so choose Select All and select Export. This is the best option if you want to do the filtering in PivotTables.

Figure S3.1 Results in GDXViewer

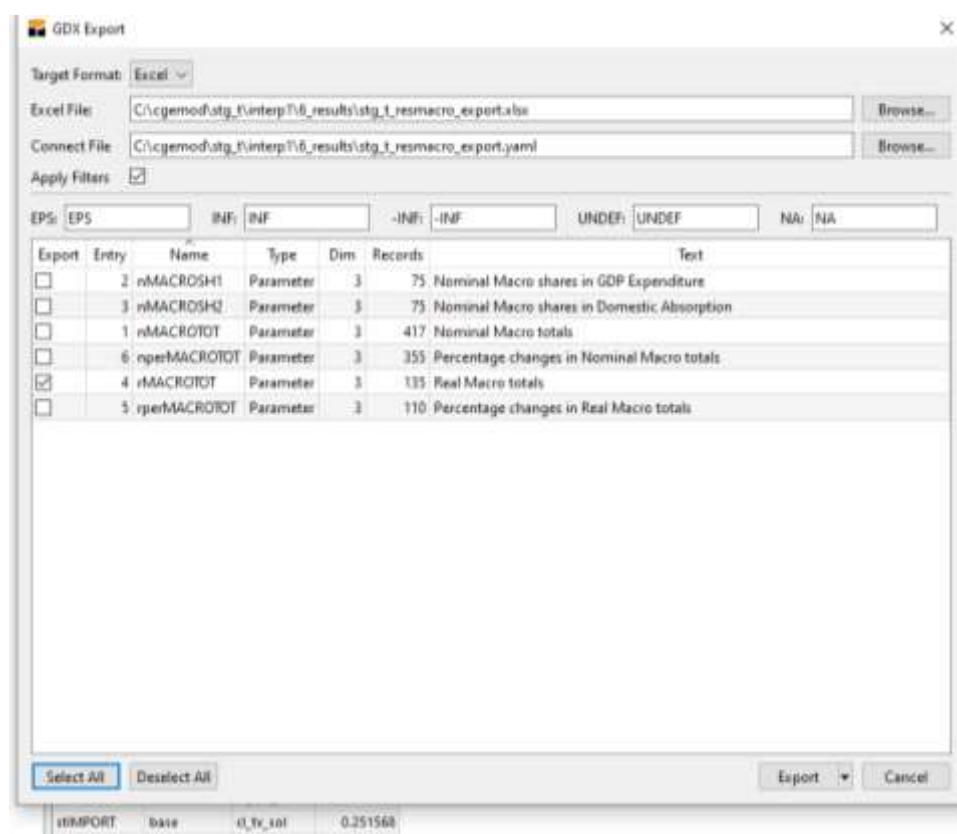


This causes Studio to generate the CONNECT code required to export the contents of the GDX file to Excel; the code is in a *yaml* file. Currently, Studio only supports exports to

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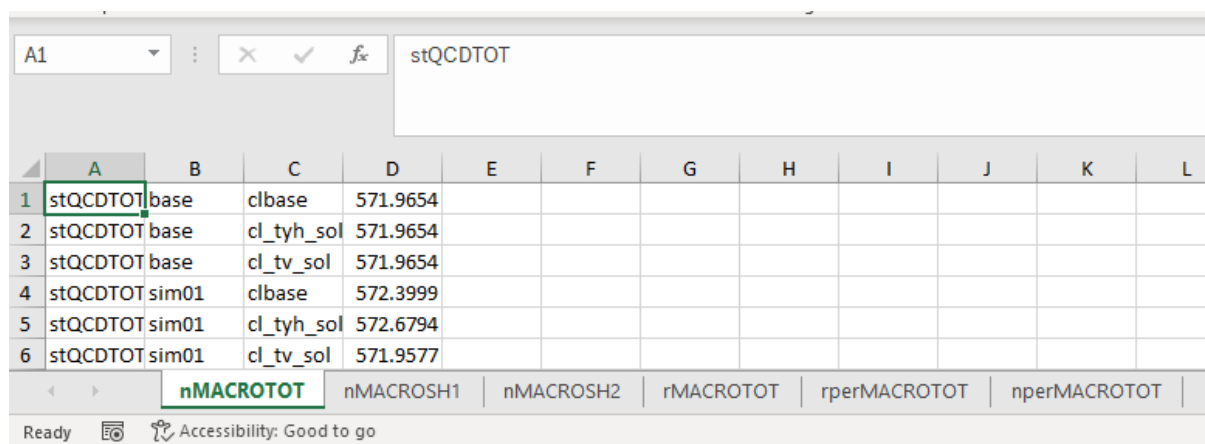
Excel, but this is likely to change. Also note that if a file of the same name exists in the destination directory you will get a message before it is overwritten. Once the data are exported there will be a file `stg_t_resmacro.xlsx` in the project's working directory, which when opened looks like Figure S3.3. You could have chosen a different name for the Excel file and a different location for the Excel file.

Figure S3.2 GDX Export



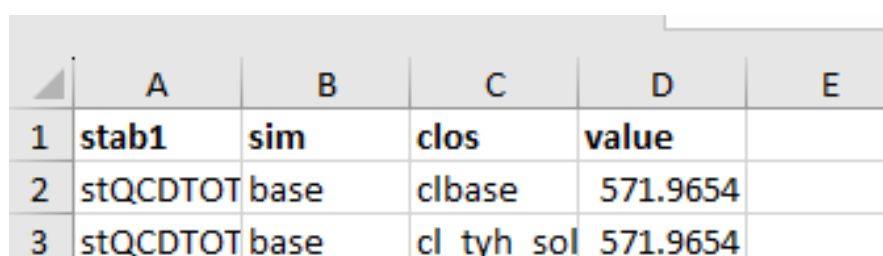
As shown in Figure S3.3 there is a tab in the Excel workbook for each parameter that has been exported and the data are organised in List View format, i.e., a better format for PivotTables. **There is one weakness with this export utility: it does not export the set labels that would ideally be in the first row. (GAMS is currently reviewing this utility to see if the set labels can also be exported.) For now, the best option is to add the set labels yourself; it will take a few minutes, but it makes life easier (see Figure S3.4).** Excel refers to these labels as ‘headers’.

Figure S3.3 Results in Excel



	A	B	C	D	E	F	G	H	I	J	K	L
1	stQCDTOT	base	clbase	571.9654								
2	stQCDTOT	base	cl_tyh_sol	571.9654								
3	stQCDTOT	base	cl_tv_sol	571.9654								
4	stQCDTOT	sim01	clbase	572.3999								
5	stQCDTOT	sim01	cl_tyh_sol	572.6794								
6	stQCDTOT	sim01	cl_tv_sol	571.9577								

Figure S3.4 Results with Headers



	A	B	C	D	E
1	stab1	sim	clos	value	
2	stQCDTOT	base	clbase	571.9654	
3	stQCDTOT	base	cl_tyh_sol	571.9654	

Forming PivotTables

Forming PivotTables is simple. With the cursor in cell '1A', choose the **Insert (Menu)** and **PivotTable**; this opens a dialogue box with the range preselected (because the cursor was in cell '1A'), see Figure S3.5. Assume you want the PivotTable in the same worksheet as the data by selecting the option **Existing Worksheet** (in some uses this is not the better option, but it is useful in this instance) and then set the location by clicking somewhere in the worksheet (near the top and to the right of the data seem to be better choices), see Figure S3.6.

Figure S3.5 Setting up a PivotTable

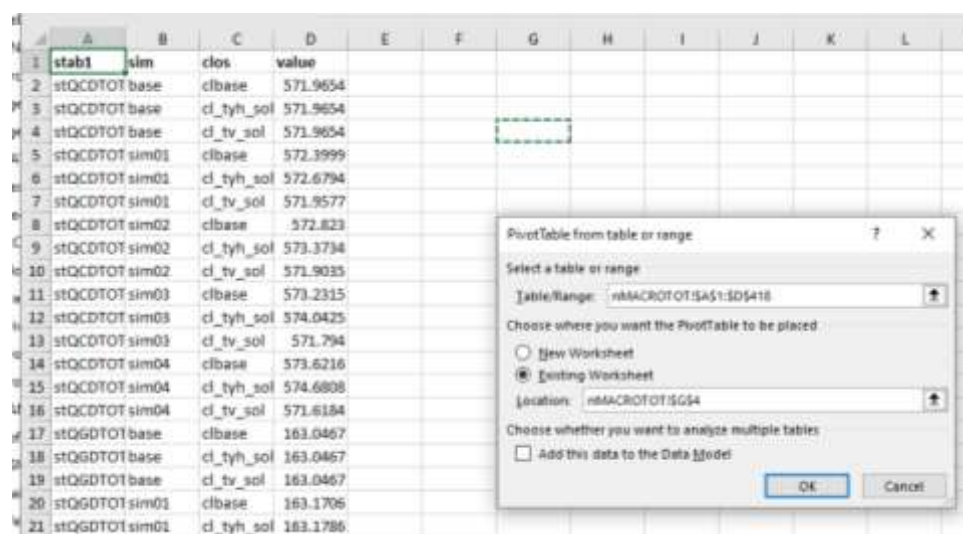
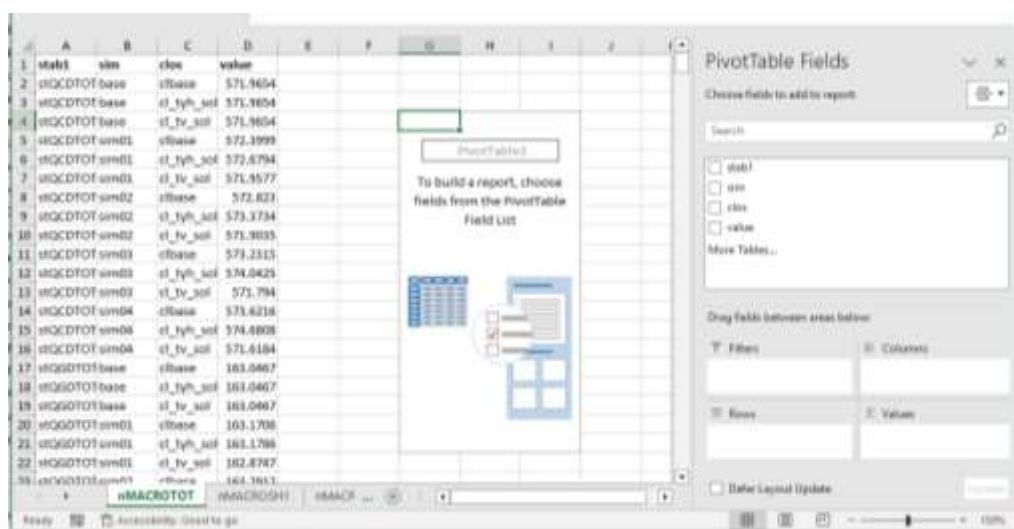


Figure S3.6 Inserting a PivotTable



The column headers are listed in the top box of the PivotTable Fields dialogue box, and these are the headers, i.e., set labels from the results file, which is what makes life a bit easier, see Figure S3.6. This establishes the PivotTable but now it is necessary to determine the layout of the PivotTable: assume you want *stab1* in the rows and *sim* and *clos* in the columns and *values* in the values box, see Figure S3.7. This will populate the PivotTable using the data, see Figure S3.8.

Figure S3.7 Setting PivotTable Dimensions

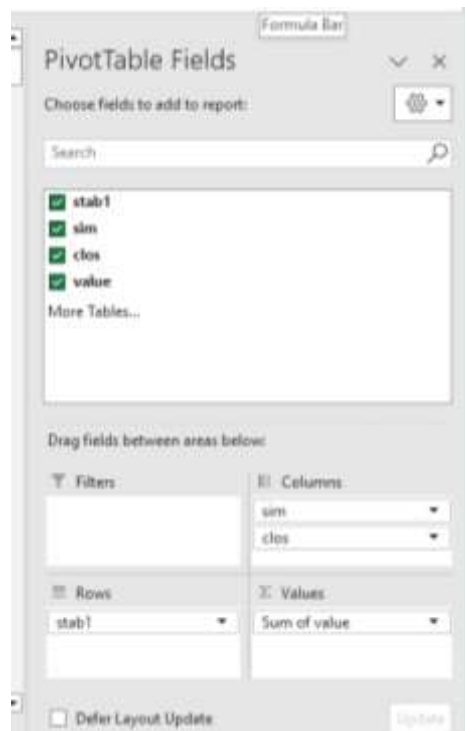


Figure S3.8 **PivotTable**

[illegible]

The PivotTable can now be filtered by changing the elements displayed by choosing the contents of the `Column Labels` and or `Row Labels` and, where there is more than one label in a column or row by clicking on the boxes next to the labels (See Figure S3.9). ‘Trial

and error' are probably the only realistic option to appreciate the extent to which PivotTables can be used to filter tabulated results.

Figure S3.9 PivotTables with Filtering Options

C	D	E	F	G	H	I	J	K
yh_sol	571.9654							
v_sol	571.9654			Sum of value	Column Labels			
ase	572.3999				base			base Tot
yh_sol	572.6794			Row Labels	cl_tv_sol	cl_tyh_sol	clbase	
v_sol	5	A↓ Sort A to Z			119.5279606	119.5279606	119.5279606	358.583
ase	5	Z↓ Sort Z to A			119.5103562	119.5103562	119.5103562	358.531
yh_sol	5				255.3752152	255.3752152	255.3752152	766.125
v_sol	5	More Sort Options...			24.27699523	24.27699523	24.27699523	72.830
ase	5				2.368621359	2.368621359	2.368621359	7.10586
yh_sol	5	Clear Filter From "stab1"			-18.35139599	-18.35139599	-18.35139599	-55.0541
v_sol	5	Label Filters			910.1262229	910.1262229	910.1262229	2730.37
ase	5	Value Filters			-20.28635551	-20.28635551	-20.28635551	-60.8590
yh_sol	5				6.929102799	6.929102799	6.929102799	20.787
v_sol	5	Search			237.2702334	237.2702334	237.2702334	711.810
ase	1				3.058565998	3.058565998	3.058565998	9.17565
yh_sol	1	☒ (Select All)			8.31118892	8.31118892	8.31118892	24.9335
v_sol	1	☒ stDEPREC			883.7100522	883.7100522	883.7100522	2651.13
ase	1	☒ stDTAX			571.9654434	571.9654434	571.9654434	1715.8
yh_sol	1	☒ stEXPORT			163.0467182	163.0467182	163.0467182	489.140
v_sol	1	☒ stEXTAX			148.6978906	148.6978906	148.6978906	446.093
		☒ stFSAV						

PivotCharts can be inserted into worksheets using Insert>PivotChart. The charts can be inserted using filtered or unfiltered data. An example with unfiltered data is illustrated in Figure O9.10. One nice feature of PivotTables and PivotCharts is that the data can be filtered in either the Chart or the Table, and the filtering of both is linked, see Figure S3.11.

Moreover, as with normal Excel charts simply right clicking on the chart offers options, including the option to change the chart type. Other formatting options allow the hiding of legends and filtering boxes and all the different options available when using Excel charts. Again 'trial and error' are probably the only realistic option to appreciate the extent to which PivotCharts can be customised.

Exercise 3.2 Interpreting Model Results 2

This exercise is designed as a second independent single country CGE experiment to develop your skill in interpreting the results from models. In this exercise you will start by implementing a predesigned set of experiments and then interpreting the simulation results. You should expect this exercise to take some 8 to 10 hours. The challenge here is to move from learning how to run a model, setup experiments and access results to the interpretation of model results for policy analyses purposes.

Policy Context

The long run world prices of certain agricultural commodities have changed due to changes in the domestic agricultural policies of OECD countries. You have been employed by the South African government to advise on some of the possible implications of these exogenous changes on South African consumers, producers and institutions.

Setup

The files for this exercise will already be in your working directory.

1. The experiments are pre-coded to generate a specific pattern of results. **DO NOT CHANGE THE EXPERIMENTS.**
2. **NOTE: YOU WILL NEED TO COLLECT THE RESULTS FILES INTO ANOTHER DIRECTORY BEFORE RUNNING THIS EXERCISE**

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Running the Experiments

The experiment uses two master files that need configuring to operate with the model data and the experiment data and experiment file.

1. The core model is `stg_t.gms` and uses the data in `stg_t_data_sam_3_2.xlsx`.

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2. Set up the core model, run the programme and check it runs correctly.
3. The master experiment file is `stg_t_expt.gms` for which the data file is `stg_t_expt_3_2.xlsx` and the experiment file is `stg_t_expt_3_2.inc`. Set up the master experiment file, run the programme, check it runs correctly, and all the results files have been produced.
4. The experiment file `stg_t_expt_3_2.inc` is pre-coded to produce intended results. **DO NOT CHANGE THE EXPERIMENTS.**
5. NB: It is legitimate to extend the EXTEND the number of experiments IF and ONLY IF you are doing so to provide additional information about the preset experiments.

Task

Explain why the commodity outputs produced by agricultural activities change in the way they do.

Stages

1. Formulate your Hypotheses
Formulate your hypotheses as to the expected outcomes, and the **theoretical reasons** for the expected outcomes.
2. Some Preliminary Analyses
Examine the structure of the economy before analysing the results.
3. Challenges
Are the results consistent with your prior expectations.
4. Report
In all cases you should use tables, diagrams etc., to report your results, and then comment on the policy implications of your results.
5. The report should NOT exceed 6 pages including tables, figures and graphs (using small print is cheating!!!)