

# Practical Computable General Equilibrium (CGE)

## Modelling: Online Course

### Course Description

This course **introduces** practical computable general equilibrium (CGE) modelling using the General Algebraic Modelling System (GAMS) software. The course is designed for individuals who have a well-developed background in economics, e.g., a masters degree, and want to develop an understanding of modern computable general equilibrium (CGE) modelling and/or the technical skills needed to become a CGE modeller. The course emphasises an understanding of CGE databases, GAMS coding skills and the interpretation of the results from simulation models; using a mix of video presentations (lectures and ‘how to’ videos), practical computer exercises and policy analyses exercises. This introductory course is a prerequisite for the Intermediate Single Country CGE Modelling that is offered in the first two months of the year; it can also be taken as a standalone course.

The materials are organised in 6 modules; the first five modules have a total of 24 components, each of which is designed to require approximately 2 to 3 hours of input from the participants. The final week of the course is devoted to a guided research project that should require 12 to 18 hours of input. Thus, participants should allocate 60 to 90 hours over 5 weeks to complete the course week (with a one week allowance for ‘slippage’). A fast track, two week (with a one week allowance for ‘slippage’), version of the course is available for those participants who can work full-time on the course.

Participants on this introductory course are required to study a pre-course on GAMS and Social Accounting Matrices (SAMs), and then, in the two weeks before the course starts, to complete two simple assignments. The pre-course materials are open source, which allows potential participants to make a more informed decision before committing to take the course. The first assignment is on GAMS and GAMS Integrated Development Environment (GAMSIDE), and the second is on SAMs.

The course is delivered via an electronic learning environment – Moodle. Moodle provides an environment that allows the delivery of learning materials in a structured and organised manner, and an asynchronous forum in which participants can engage with other participants and with the course tutor. The course tutor is available, by email and/or the Moodle message system, to answer specific questions and provide help with problems: questions and requests for advice submitted between 0800 and 1600 UTC will be responded to by the end of the next working (Monday to Friday) day, i.e., by 1600 UTC. Each module requires the participants to submit an assignment; this allows the tutor to monitor progress and understanding, and to intervene if participants are not understanding concepts and techniques or having difficulties. Feedback is provided for each assignment.

The course assumes that the participants have an in-depth knowledge of microeconomic theory, especially general equilibrium theory, and a reasonable understanding of standard techniques of mathematical economics, especially those relating linear homogenous functions. It is assumed that participants have no prior computer programming experience, but that they do have basic computer skills associated with MS Excel.

This course does NOT use a GUI (Graphical User Interface) to access GAMS. Experience has demonstrated that the programming skills developed during the course are important to an understanding of CGE models: an understanding of basic GAMS programming skills demonstrates that allegations that CGE models are ‘black boxes’ are false. Importantly, even basic programming skills greatly extend the ability of the user to explore the power of CGE models, while at the same time opening up the potential that participants can, in the future, become fully independent CGE modellers.

## **Course Aims and Objectives**

### Course Aims

To provide a practical introduction to CGE modelling using GAMS so that participants can understand

- i) databases used by CGE models;
- ii) the properties of behavioural relationships used in CGE models;
- iii) the formulation of appropriate CGE policy experiments; and
- iv) the results generated by simple CGE models.

## Course Objectives

On completion of the course the participants will have the ability to:

- i) formulate and code appropriate policy experiments;
- ii) modify simple behavioural relationships;
- iii) interpret the results from simple CGE models; and
- iv) identify and understand the strengths and limitations of CGE models.

## **Timetable**

	<b>Date</b>
Final date for registration	Monday 9 <sup>th</sup> October 2017
Final date for (cleared) payment of course fee	Friday 13 <sup>th</sup> October 2017
Assignments for pre-course released	Monday 16 <sup>th</sup> October 2017
(Standard) Practical CGE Modelling Course begins	Monday 30 <sup>th</sup> October 2017
(Short) Practical CGE Modelling Course begins	Monday 20 <sup>th</sup> November 2017
Practical CGE Modelling Course ends	Sunday 10 <sup>th</sup> December 2017

A c10% reduction in the course fee is offered to applicants that pay for the ‘Practical CGE Modelling course’ and the ‘Intermediate CGE Modelling course’ course by Friday 13<sup>th</sup> October 2017, i.e., £1,700 (professional developed); £1,400 (professional developing); £1,150 (student developed); £900 (student developing); £200 (scholarships).

## **Course Fees**

<b>Category</b>	<b>Developed Economy Rate</b>	<b>Developing Economy Rate</b>
Professional	£(GBP)900	£(GBP)750
Student	£(GBP)600	£(GBP)450
Scholarship		£(GBP)100

*Notes:*

1. Developing economies are those classified as ‘Low-income economies’ and ‘Lower-middle-income economies’ by the World Bank at the time an application is made.

2. Payments in GB pounds (sterling) are by electronic/wire transfer or international cheque. Payees should pay their own bank fees and any currency fees, but not the bank fees of CGEMOD. Clearance of payments typically takes 3 to 5 working days after the funds are received by a UK bank.
3. Students are required to correspond from an academic email address and provide confirmation of their status from an academic advisor with an academic email address.
4. A limited number of scholarships are available to students from developing countries. Applications for a scholarship must be made at the time of registration; applications must be accompanied by a case for being awarded the scholarship that is not longer than one-side of A4/US letter. Applicants must be registered at a degree awarding institution, correspond from an academic email address and provide a reference from an academic advisor.
5. A c10% reduction in the course fee for the 'Intermediate CGE course' is offered to applicants that pay (cleared) for both course by Friday 20<sup>th</sup> October 2017.

### Cancellations

All cancellations are must be sent to Dr Yontem Sonmez (yontem@cgemod.org.uk). A 75% refund, in GBP after our bank and currency charges but excluding the recipients bank fees, will be available for all cancellations received by Monday 2<sup>nd</sup> October 2017

### **Further Information and registration**

For further information and registration please contact Dr Yontem Sonmez.

Email: [yoontem@cgemod.org.uk](mailto:yoontem@cgemod.org.uk)

## Pre-Course

### Outline

#### Module P1: GAMS and GAMSIDE

	Topic	Tasks	Exercises
P1:1	Introduction to GAMS and GAMSIDE	Install and configure GAMS/GAMSIDE; Running a Model; Using a model library	Setting options; libraries; utilities; help; search
P1:2	A Transport Problem in GAMS	Understanding a GAMS programme; Reference files; Command line; Running an experiment	running programme; list & log files; ref files;.gdx output
P1:3	Debugging a Transport Problem	Resolve syntax & execution errors; DiffText files	Debugging a model
P1:4	Extending a Transport Problem	Adding markets, plants & data	Adding accounts to a model

#### Module P2: Introduction to Social Accounting Matrices

	Topic	Tasks	Exercises
P2:1	What is a SAM?	Structure of a SAM; Contents of a SAM	Converting T-Accounts to a simple SAM
P2:2	Inter industry accounts in a SAM	Supply and Use tables; Input-Output tables	Interpreting the price system in a SAM
P2:3	Analysing a SAM	Interpreting a SAM	Row and column coefficients; interpreting SAMs
P2:4	SAM Multipliers	Income & Price multipliers; Interpreting multipliers	Multipliers; interpreting multipliers
P2:5	Satellite Accounts in a SAM	Adding satellite accounts	Interpreting satellite accounts

## Practical CGE (Online) Course

### Module O1: A Basic Closed Economy CGE Model

	Topic	Tasks	Exercises
O1:1	Cobb Douglas Production and Utility Functions	Mathematics of CD functions	Primal & first order conditions; calibrating shift & share parameters
O1:2 & O1:3	Coding Production and Utility functions	Adding production & Utility functions	Coding a basic 2*2*2*2; testing a model
O1:4	Simple CGE experiments	Running experiments; interpreting results	Running experiments; interpreting results

### Module O2: A Closed Economy CGE Models

	Topic	Tasks	Exercises
O2:1	Adding Government, Investment & Intermediate inputs	Coding taxes, investment & intermediate inputs; testing a model	Coding an extended 2*2*2*2; testing the model
O2:2	Tax experiments in a closed economy	Coding tax policy experiments	Running tax experiments; interpreting the results
O2:3	Using LOOPS in GAMS	Running experiments in LOOPS	Using loops for experiments; interpreting results
O2:4	Tax experiments and factor market clearing	Coding compound experiments	Coding and interpreting compound experiments
O2:5	Collecting and interpreting results	Collecting results from experiments	Collecting and interpreting results

### Module O3: Basic 1\*2\*3 (Open Economy) CGE Model

	Topic	Tasks	Exercises
O3:1	CES and CET Functions	Primal & first order conditions;	Simple maths using CES
O3:2	Calibrating CES/CET function	Calibrating elasticity, shift and share parameters	Calculating elasticity, shift and share parameters
O3:3	Coding Imperfect substitution of imports and exports	Coding trade equations; testing a model; running experiments	Coding import and export equations
O3:4 & O3:5	Understanding CES and CET functions	Roles of shares and elasticities in CES/CET functions; GDX MERGE; Offer curves	Roles of share and shift parameters in operation of CES/CET functions

### Module O4: 1\*2\*3 (Open Economy) CGE Model

	Topic	Tasks	Exercises
O4:1	A 1*2*3 Model with government and investment	Coding Government & Investment; trade policy experiments; running experiments	Coding Government and investment accounts
O4:2	Macroeconomic closure rules	Coding macroeconomic closures; testing the revised model; GDX MERGE	Simple experiments with different closures
O4:3 & O4:4	Trade experiments and macroeconomic closures	Coding compound experiments; interpreting results; GDX MERGE	Compound experiments with different closures

## Module O5: A Simple CGE Model

	Topic	Tasks	Exercises
O5:1	Introduction to SMOD	Model code & structure; data inputs & outputs; testing a model	Setting up and testing a simple CGE model
O5:2	Trade policy experiments 1	Coding policy experiments; interpreting model results	Coding and interpreting compound experiments
O5:3	Trade policy experiments 2	Sensitivity to elasticities; interpreting model results	Coding and interpreting results
O5:4	Trade policy experiments 3	Coding macroeconomic closures; interpreting model results	Coding and interpreting results
O5:5	Trade policy experiments 4	Coding factor market clearing; interpreting model results	Coding and interpreting results
O5:6	Trade policy experiments 5	Systematic sensitivity analyses	Interpreting results from systematic sensitivity analyses

## Module O6: Course Project

The objectives of the project are to develop your ability to (i) set up and implement policy experiments in a small CGE model; and (ii) interpret the results of your policy experiments. There are five elements to the project; model recalibration, experiment programming, policy experiments and interpretation, sensitivity analyses and project report.

The available data are SAMs for (approx.) 15 countries, each of which has 12 commodities and activities, 5 factors, 7 taxes, 3 domestic institutions and 1 (one) rest of the world account.

Your remit is that of an economic consultant who has been employed to analyse policy issues that are relevant and current to your chosen country. You will be required to identify the policy issue, code the policy experiments, interpret and write up the results and conduct sensitivity analyses. The final report will be a maximum of 10 pages including tables and graphs.