Single Country Computable General Equilibrium (CGE) Modelling: Online Course

Course Description

This course is an intermediate course in (practical) single-country 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 and basic CGE modelling, who wish to develop the technical skills needed to become a CGE modeller and/or become competent users of modern comparative static single country CGE models. The course emphasises the development of the skills required to develop systematic policy experiments and the interpretation of the results from those experiments. The course also develops the participants understanding of the behavioural relationships in, and the calibration of, CGE models, while enhancing GAMS coding skills. The course uses a mix of video presentations (lectures and 'how to' videos), practical computer exercises and policy analyses exercises.

The materials are organised in 4 modules offered over 5 weeks, with support offered in a sixth week to allow for 'slippage'. The first two modules have a total of 13 components, each of which requires approximately 3 hours of input from the participants. The third module has three components: the first is a series of presentations providing advice on interpreting and presenting CGE results, while the second and third are exercises in interpreting model results, each requires approximately 9 hours. The final module of the course is devoted to a guided research project that requires about 18 hours of input. Thus, participants should allocate upto 90 hours over 5 weeks to complete the course. Each module requires the participants to submit a deliverable; this allows the tutor to monitor progress and understanding.

Participants on this course are required to have completed the 'Practical Computable General Equilibrium (CGE) Modelling course' (see www.cgemod.org.uk/introcge.html for

details) or provide proof of equivalent or greater skills.[1] The methods used in this course require an understanding of Social Accounting Matrices (SAMs), and the relationships between SAMs and CGE models.

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 appreciable experience with programming in GAMS and in the use of MS Excel.

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.

This course does NOT use a GUI (Graphical User Interface) to access GAMS. Experience has demonstrated that the use of GUI's by participants on training programmes typically limits the development of the skills needed to be a good CGE modeller or user of CGE models, while encouraging the belief that CGE models are 'black boxes'. Basic GAMS programming skills, and an understanding of economic theory, demonstrates that allegations that CGE models are 'black boxes' are false. The development of GAMS, or GEMPACK, programming skills greatly extends the ability of the user to exploit the power of CGE models, and, at the same time, opens up the potential that participants can, in the future, change behavioural relationships in CGE models.

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[1] We provide a set of exercises for which satisfactory completion is deemed 'proof of equivalent or greater skills'.

A time limited licence for GAMS is available courtesy of GAMS Corporation.

Course Aims and Objectives

Course Aims

To develop the CGE modelling skills of participants (using GAMS) so they

 i)   understand the behavioural relationships used in CGE models;
 ii)   understand the impact of different behavioural relationships used in CGE models;
 iii)   understand the calibration of the behavioural relationships in CGE models;
 iv)   can formulate appropriate CGE policy experiments; and
 v)   can interpret the results generated by single country CGE models.

Course Objectives

On completion of the course the participants will be able:

 i)   formulate and code appropriate policy experiments;
 ii)   identify and understand the strengths and limitations of CGE models;
 iii)   modify behavioural relationships;
 iv)   interpret the results from single country CGE; and
 v)   identify, and present, the policy implications of simulations using single country CGE models.

STAGE Models

This course uses the STAGE_t CGE model, which is also used in the single country variant of the 'Recursive Dynamic CGE Modelling Course' (www.cgemod.org.uk/rdyn_cge.html). STAGE_t is a development of the open source STAGE_1 and STAGE_2 models (www.cgemod.org.uk/stage.html). STAGE_t is a state-of-the-art CGE model designed for the analyses of a wide range of real-world policy issues and an advanced base for the further (academic) model development.

Participants on this course will be given access to versions of the STAGE_3 model. There are no future plans (as of early 2020) to make STAGE_3 (or GLOBE_3) open source; the plan is to restrict the distribution of STAGE_3 (and GLOBE_3) to participants of the single country (and global) CGE courses offered by CGEMOD.

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Timetable

Online courses are run in four cycles – Oct/Nov, Nov/Dec, Jan/Feb and March/April – with recruitment for each course limited to c12 participants. This course will be offered in cycles 2, 3 and 4.

The timetables for courses are available at www.cgemod.org.uk/ttable.html

Course Fees

The course fees and conditions are detailed at www.cgemod.org.uk/fees.html

Discounts are offered for participants from developing countries ('Low-income economies' and 'Lower-middle-income economies' as classified by the World Bank) and students. Additional discounts are offered for participants who take multiple courses offered by CGEMOD.

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 confirmation of their status from an academic advisor.

Registration

Registration is online at www.cgemod.org.uk/regist.html

Further Information and registration

For further information please contact Professor Karen Thierfelder
Email: karen@cgemod.org.uk

Intermediate CGE (Online) Course

Outline

Module O7: STAGE_t CGE Model: Theory

	Topic	Tasks	Exercises
O7:1	Intro to STG_t	Review the model and note the extensions to SMOD_on used in the Practical CGE modelling course	Exercise 1: Model set up and calibration
O7:2	Prices and accounting relationships	Understand the relationship between information in the SAM and prices in the model.	Calculating prices & accounting matrices (Deliverable O7.1)
O7:3	Tax relationships	Code trade lib. simulations; Loop over sim; use GDX to access results.	Exercise 2: Trade Policy, *Ad Valorem* Tariff Changes
O7:4	Setting up & checking the STG_t model	Understanding the structure of, and data used in, stg_t model	Exercise 3: Loading data, calibrating and checking the stg_t model
O7:5	Tariff changes	Review Excel files needed to use SeeResults	Exercise 4: Accessing Model Results using SeeResults
O7:6	Tariff changes & tax replacement	Code alternative macroeconomic closures; loop over sim, clos, and elas	Exercise 5 & 6: Trade Policy: and Tax Replacement & Sensitivity Analysis (Deliverable O7.2)

Readings:

Robinson, S., Yunez-Naude, A., Hinojosa-Ojeda, R., Lewis, J.D. and Devarajan, S., (1999). 'From Stylised to Applied Models: Building Multisector CGE Models for Policy Analysis', *North America Journal of Economics and Finance*, Vol 10, pp 5-38

Stone, R. (1954). "Linear Expenditure Systems and Demand Analysis: An Application to the Pattern of British Demand," *Johansen's legacy to CGE modelling: Originator and guiding light for 50 years* 64(255): 511-527.

Dixon, P. and Rimmer, M. (2016). "Johansen's legacy to CGE modelling: Originator and guiding light for 50 years," *Journal of Policy Modeling*, 38(3): 421- 435.

Module O8: STAGE_t CGE Model: Exercises

	Topic	Tasks	Exercises
O8:1	Introduction to the database for STG_t model	Understanding the structure of the database	No computer exercises
O8:2	Configuring the STG_t model	Understanding the structure of, and data used in, stg_t model	Exercise 7: Loading data, calibrating and configuring the stg_t model
O8:3	Policy experiment in STG_t	Other Features of the stg_t model	Coding and analysing a simple policy experiment using SeeResults
O8:4	Save and Restart	Implement experiments using Save and Restart	Comparing results with different methods for running experiments
O8:5	Production tax changes 1	Code alternative factor input subsidies and factor market clearing behaviour	Exercises 8: Factor Input Subsidies and Factor Market Clearing
O8:6	Production tax changes 2	Factor inputs subsidies; loop over sim, clos, elas	Exercises 9: Analyses of input subsidies with sensitivity analyses (Deliverable O8.1)
O8:7	Additional options in STG_t	Customising the stg_t model	Running experiments with different model configurations

Readings:

Go, D., Korman, V., Robinson, S., and Thierfelder, K. (2010). "Wage Subsidy and Labour Market Flexibility in South Africa," Journal of Development Studies 46(9): 1481-1502.

Robinson, Sherman (2006). Macro Models and Multipliers: leontief, Stone, Keynes, and CGE Models. In Alain de Janvry and Ravi Kanbur, eds., Poverty, Inequality and Development: Essays in Honor of Erik Thorbecke, New York: Springer Science. 205-232.

Lofgren, Hans (1994). "A Brief Survey of Elasticity Values for CGE Models," mimeo, presented to the Ford Foundation.

Module O9: Interpreting Model (STAGE_t) Results: Exercises

	Topic	Tasks	Exercises
O9:1	Analysing and reporting results	Appreciating the formulation and interpretation and presentation of policy experiments	No computer exercises
O9:2	Interpreting model results (I)	Trade liberalisation by RSA	Interpreting trade liberalisation experiments for RSA
O9:3	Interpreting model results (II)	Changes in World prices	Interpreting world price experiments for RSA

Readings:

Perroni C & Rutherford T (1995). Regular flexibility of nested CES functions. European Economic Review 39:335-343.

Keller, WJ.(1976). "A nested CES-type utility function and its demand and price-index functions," *European Economic Review* 7(2): 175-186.

Module O10: Course Project

The objectives of the project are to develop your ability to (i) set up and implement policy experiments in a 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.

This part of the course not only synthesizes the coding skills you have developed in the previous exercises, it will help develop your ability to set up a database for a model. The emphasis is on interpreting results, particularly in the context of the structure of the economy. The policy simulations, closure assumptions and sensitivity analysis conducted are not prescribed. Instead, you must design the simulation to answer a policy question.

The database provided has databases for 10 countries

You are an economic consultant hired to analyse policy issues that are relevant and current to your chosen country. The final report will be a maximum of 10 pages.

		Topic	Tasks	Exercises
O10:1		STAGE_t project	The project aims are 1. set up and implement policy experiments in the stg_t CGE model; 2. interpret the results of your policy experiments	There are seven elements to the project; 1. choose country, write-up the 'backstory' 2. Setup the model's Excel database 3. model recalibration and testing; 4. experiment programming; 5. policy experiments and interpretation; 6. sensitivity analyses; and 7. project report

Readings:

Devarajan S., and Robinson, S. (2005). "The Influence of Computable General Equilibrium Models on Policy," in Kehoe, T., Srinivasan, T., and Whalley, J. (eds) *Frontiers in Applied General Equilibrium Modeling*, Cambridge University Press.

Devarajan S., and Robinson, S. (2013). "Contribution of Computable General Equilibrium Modeling to Policy Formulation in Developing Countries," in Dixon, P. and Jorgenson, D. (eds) *Handbook of Computable General Equilibrium Modeling,Vol 1A,* North Holland Press.