Computable General Equilibrium Modelling

UPGEM Training Course

8-12 May 2017

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CGE modelling is a challenging field. It requires mastery of economic theory, meticulous preparation of data and familiarity with underlying accounting conventions, knowledge of econometric methods, and an understanding of solution algorithms and associated software for solving large equation systems. However, the most important requirement is the ability to communicate. CGE modelling is primarily about shedding light on real-world policy issues. For CGE analyses to be influential, modellers must explain their results in a way that is comprehensible and convincing to their fellow economists, and eventually to policy makers.

While CGE modelling is challenging, it is also rewarding. CGE models are used in almost every part of the world to generate insights into the effects of policies and other shocks in the areas of trade, taxation, public expenditure, social security, demography, immigration, technology, labour markets, environment, resources, infrastructure and major-project expenditures, disasters, and financial crises. CGE modelling is the only practical way of quantifying these effects on industries, occupations, regions and socioeconomic groups.

Peter B. Dixon & Dale W. Jorgenson
Handbook of CGE Modeling

Course Overview

Dynamic computable general equilibrium (CGE) models are primarily designed for practical policy analysis. CGE models can accommodate a high level of detail within a rigorous theoretical framework. Consumers of CGE analysis often include governments and large institutions who wish to understand the economy-wide effects of proposed policies or unanticipated economic shocks. CGE models help policymakers and stakeholders to identify the potential winners and losers of such events in order to strengthen their policy formulation and response framework.

The *Computable General Equilibrium Modelling* course brings together decades of CGE modelling and training experience in a comprehensive one-week package built around the University of Pretoria General Equilibrium Model (UPGEM) of South Africa. The course aims to teach participants to be **responsible CGE model users**. We understand that becoming a fully-fledged CGE modeller is a massive task beyond the scope of a single course. As such, our focus will be on developing participants' ability to run simulations and properly interpret results. The training model used for this course is a condensed version of the dynamic single-country UPGEM, developed in collaboration with the Centre of Policy Studies in Melbourne, Australia. The GEMPACK software platform, synonymous with the CoPS-style of CGE modelling, will be used throughout the course. A copy of the **UPGEM training model** and an executable-image version of the **GEMPACK software**, courtesy of the Centre of Policy Studies, will be provided to all participants.

Training sessions are designed with the course and CGE methodology's practical focus in mind. Lectures on the theoretical and technical aspects of UPGEM and CGE modelling in general will be interspersed with practical hands-on sessions using GEMPACK in which those aspects will be brought to life. Where appropriate, simulations from research projects and papers will be presented as illustrative examples during these sessions. Proper interpretation of simulation results is the final and most important task in CGE modelling, requiring an understanding of the model's theory, database and closure settings. With this in mind, the tail-end of the course is devoted to practical exercises where participants will be required to set up simulation scenarios and interpret the results produced by UPGEM.

In order to successfully complete this course, participants must display competence in the key technical aspects of CGE modelling and be able to clearly interpret and communicate the results produced by UPGEM simulations. Participants who are interested in building a CGE model or database for their own institution or country will have the opportunity to consult with the UPGEM team after completion of the course.

Instructors

Dr. Heinrich Bohlmann   heinrich.bohlmann@up.ac.za

Dr. Bohlmann holds a PhD in Economics from the Centre of Policy Studies in Melbourne, Australia. He is currently employed in the Department of Economics at the University of Pretoria where he specialises in economic policy research using CGE modelling methods. Dr. Bohlmann has over 10 years of academic and professional experience as an economist and brought dynamic CGE modelling expertise to the University of Pretoria. Dr. Bohlmann's research work has mainly focused on macroeconomic planning, energy and environmental policy, and labour market topics.

Prof. Jan van Heerden   jan.vanheerden@up.ac.za

Prof. Van Heerden holds a PhD in Economics from Rice University in Houston, USA. He is currently employed in the Department of Economics at the University of Pretoria where he specialises in economic policy research using CGE modelling methods. Prof. Van Heerden has over 30 years of academic and professional experience as an economist and was the co-author of the first version of UPGEM with colleagues from the Centre of Policy Studies in Melbourne. Prof. Van Heerden's research work has mainly focused on regional economic planning, energy and environmental policy, and fiscal policy topics.

Learning Outcomes

Upon completion of the course, participants will be able to:

- Understand the general methodology and capabilities of CGE models;
- Understand the structure of a CGE database and its various inter-linkages;
- Run CGE simulations using the GEMPACK solution software;
- Interpret and present CGE simulation results in a comprehensive manner.

Who Should Attend

Economists and analysts interested in the economy-wide effects of proposed policy changes or external shocks on their industry or the macro economy at large, in particular: national and provincial government officials involved in policy design, analysis or planning; industry-specific research organisations; economic research consultants; and academics.

Recommended Background

We recommend that participants have at least some experience in general equilibrium or economy-wide analysis. Previous experience in using the GEMPACK software platform will be an added advantage. Since CGE modelling involves various economic and national accounting concepts, a bachelor's degree in Economics is strongly recommended. Computer literacy and experience of using a Windows PC are essential. Most importantly, participants must have a strong desire to learn CGE modelling.

Registration and Course Fees

Registration for the *Computable General Equilibrium Modelling* course may be completed online through the links provided on the Enterprises University of Pretoria website at http://www.enterprises.up.ac.za/training-solutions or via phone at +27 (0)12 434 2500. The course is listed as *P002923* in the *Financial Science and Economics Courses* catalogue. The standard course fee per individual is **R13,500** for the week and includes all lectures, training material and lunches. Participants will receive a flash disc containing course notes, model documentation and instructions for installing and using GEMPACK. A copy of the UPGEM training model used during the course and an executable-image version of the GEMPACK software, courtesy of the Centre of Policy Studies, will also be included. Discounts are available to academic staff, students and institutions that send more than two participants. Please contact the course leader, Dr. Bohlmann, for more information in this regard.

Course Dates and Other Information

The *Computable General Equilibrium Modelling* training course will be presented on an annual basis across a one-week period from Monday to Friday. The next course is scheduled to run from **8-12 May 2017** and will be hosted by the Department of Economics at the University of Pretoria. Dates and venues for upcoming courses will be confirmed on the Enterprises University of Pretoria website. Participants are required to bring their own Windows-based laptop and mouse. Note that administrator rights for the laptop will be required to install the GEMPACK software. Special requests, such as tailored in-house courses, should be directed to Enterprises University of Pretoria.

CONTENT AND SCHEDULE

The *Computable General Equilibrium Modelling* course will be presented over an intensive five-day period. Training sessions will run from **08:30 to 17:00** every day. Initially, training sessions will place more emphasis on the theoretical and technical aspects of CGE modelling, whereas later sessions will have a more practical focus. During the final two sessions, participants will work on their group assignments. The highlight of the course is the group presentations on the final day during which participants will be able to showcase the skills they have learnt throughout the week. Participants should be prepared to work extremely hard during the course. Key references listed under each session will be included on the course disc. Participants are encouraged to consult as many of these references as possible.

Session 1
- Installing and preparing GEMPACK and UPGEM
- Evolution of economy-wide analysis from input-output models to dynamic CGE models
- Overview of the basic tasks in CGE based analysis
- Structure of a typical CGE model database
- Practical exercise: How are capital rentals determined within the SNA?
- Key references: Burfisher (2017), Dixon et al. (2013), Dixon & Rimmer (2013)

Session 2
- Overview of the GEMPACK suite of programs
- First look at the UPGEM database in ViewHAR
- Data sources and requirements for building a single-country CGE model database
- Practical exercise: Interrogating S-U tables, I-O tables and SAM datasets
- Practical exercise: Who will be worst affected by a drought?
- Key references: Horridge et al. (2013), Roos et al. (2015), StatsSA (2016)

Session 3
- Basic functional forms used in the theoretical specification of CGE models
- The percentage-change approach to implementing and solving CGE models
- Representation of CGE models in GEMPACK notation
- First look at the UPGEM theory in TABmate
- Practical exercise: Understanding the CES functional form and nesting structure
- Key references: Dixon et al. (1992), Harrison & Pearson (1996), Horridge et al. (2013)

Session 4
- Overview of the theoretical structure of dynamic UPGEM
- Reading and writing TABLO code in TABmate
- Practical exercise: How to program splitting land rentals from capital rentals
- Key references: Dixon & Rimmer (2002), Dixon et al. (2013)

Session 5
- A back-of-the-envelope representation of a CGE model
- Basic model closures in CGE modelling
- Practical exercise: Setting up and running a baseline forecast simulation with UPGEM
- Practical exercise: Using ViewSOL to look at simulation results
- Key references: Adams (2005), Dixon & Rimmer (2002; 2013), Giesecke & Schilling (2010)

Session 6
- Strategies for interpreting and presenting CGE modelling results
- Practical exercise: Setting up and running a policy simulation with UPGEM
- Practical exercise: Using AnalyseGE to look at simulation results
- Special lecture: The impact of the 2014 platinum mining strike in South Africa
- Key references: Bohlmann et al. (2015), Dixon et al. (2013), Dixon & Rimmer (2013)

Session 7
- Discussion of model extensions and other advanced modelling topics
- Practical exercise: Simulations with UPGEM
- Special lecture: The effects of a carbon tax in South Africa
- Key references: Van Heerden et al. (2006), World Bank (2016)

Session 8
- Practical exercise: Simulations with UPGEM
- Special lecture: Immigration policy and the occupation-mix effect
- Key references: Dixon et al. (2011), Bohlmann (2012)

Session 9
- Discussion and preparation of group assignments
- Special lecture: Latest developments in CGE modelling

Session 10
- Presentation of group assignments
- Review and closing

KEY REFERENCES

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