APPLIED GENERAL EQUILIBRIUM ANALYSIS
FALL SEMESTER, 2010
http://ae761-e.agecon.purdue.edu/AgEcon_618/default.asp

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Course time:
Lectures offered over the web. Weekly class discussions will take place once a week for a maximum of one and a half hours from 6:00 – 7:30pm on Monday evening in Krannert 661. Exceptions will occur in the weeks of September 6 and October 11 when the course meeting will be on Wednesday night. Special sessions will be arranged during the final week of classes to permit presentation of student projects.

Office hours:
Thursday, 3 – 4pm, as well as other times by appointment (use email to make appointments). Questions and discussions on the web board are strongly encouraged.

Intended Audience:
PhD students, MS students with strong a foundation in micro-economics and an interest in the quantitative analysis of economy-wide issues relating to public policy, marketing and international trade, economic development, resources, technology and the environment. In the past, students in other fields, such as production economics have found this course to provide them with a useful perspective.

Prerequisites:
Graduate level microeconomics (ECON 511 or ECON 607 or equivalent).

Readings:
All readings will be available on-line, through the password-protected course website.

Software:
Grading:
Weekly Homework (50% of grade) – These generally take 2-3 hours to complete and they are submitted electronically on a weekly basis. They comprise the core of the coursework.
Midterm Exam (25% of grade). The purpose of this exam is just to ensure that you have absorbed the key lessons of the weekly assignments during the first seven weeks.
Individual presentation and write-up of special project (25% of grade). This is the ‘main event’. You will choose a topic of interest to you, replicate and extend an existing study, and present your findings to the class.

Emergencies:
In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor’s control. I will post such changes on the class web page and will send an email to your @purdue.edu account. YOU ARE EXPECTED TO READ YOUR @PURDUE.EDU EMAIL ON A FREQUENT BASIS.

Students with Disabilities:
If you have a disability that requires special academic accommodation, please make an appointment to speak with me within the first three weeks of the semester in order to discuss any adjustments. It is important that we talk about this at the beginning of the semester. Please note that university policy requires all students with disabilities to be registered with http://www.purdue.edu/drc/ before classroom accommodations can be provided.

Academic Integrity:
University policy on academic misconduct is clear - academic dishonesty in any form is strictly prohibited. A guide to academic integrity is provided by the Dean of Students office: http://www.purdue.edu/odos/aboutodos/academicintegrity.php. As a student you should be familiar with this material.
**Course Description:**

This course has two objectives. First, and foremost, the course seeks to *provide students with a conceptual framework for looking at issues from an economy-wide perspective*. It is hoped that this will remain with participants regardless of whether they choose to conduct their own applied general equilibrium (AGE) analyses in the future. This is accomplished via a set of lectures, homework assignments, and structured computer simulation exercises. These are designed to provide insights into the basic mechanisms and key parameters that determine inter-sectoral linkages in the economy. They are also structured in a way that emphasizes connections to the literature in production, consumption, marketing, trade, resources, welfare and environmental economics. As such, it often helps students to conceptualize the connections between some of their other, more specialized, coursework.

The other objective of this course is to *expose participants to an operational framework* (including theory, software and data) *for conducting AGE analysis*, which they can draw upon in future research efforts. They will exercise this framework in the context of a class project to be written up and presented to the class at the end of the semester. This project will involve replication of an existing applied general equilibrium application, followed by some further extension of the work.

The computer assignments and the course project will all be implemented in the context of the RunGTAP software interface (Horridge, 2009) to GEMPACK. This is a Windows environment for conducting applied general equilibrium analysis with the Global Trade Analysis Project (GTAP) model, designed to allow users to focus on economics with the programming details being largely taken care of behind the scenes. The reception to this software in previous courses has been very positive, and its use has largely eliminated the time required to get participants “up to speed” on the software front. RunGTAP runs GEMPACK programs “behind the scenes”. GEMPACK is an algebraic modeling language that permits the user to write out the model in a transparent fashion. It is specifically designed for application to large-scale applied general equilibrium models in a policy-oriented environment. Students will become expert users of these tools, but the design of the course is such that they will not need to become expert programmers in GEMPACK.

The GTAP Data Base we will use is amenable to a wide range of applications. It is currently in use by about 8,000 researchers on five continents. Many of the leading national and international policy-oriented agencies are also using it, including: World Bank, the WTO, the UN Conference on Trade and Development, the European Commission, the US International Trade Commission, and the USDA. Current GTAP applications span a wide range of areas, including: trade policy reform, regional economic integration, resource and environmental economics, impacts of technological progress, climate change impacts and mitigation, and international migration. There is a searchable database of GTAP applications on the web at: https://www.gtap.agecon.purdue.edu/resources/res_list.asp?SearchField=Type&SearchValue=GTAP+Application
Course Requirements

The central tool for learning in this course will be weekly homework assignments designed to reinforce the material covered in the lectures. In the second half of the semester, there will be a few additional assignments, but these will diminish in frequency as students become more engaged in their class projects. These projects will involve the replication of an existing, published study, thereupon extending it in some meaningful way. This final presentation and write-up of this work will be in lieu of a final exam. Grades will be based homework assignments (50%), midterm exam (25%), individual presentation and write-up of special project (25%).

Course Overview

Part I: Closed Economy Analysis
- Week 1: Getting Started
- Week 2: Overview of the Closed Economy Model
- Week 3: Producer Behavior
- Week 4: Household Behavior
- Week 5: Markets - Supply Response
- Week 6: Markets - Equilibrium Demand Elasticities
- Week 7: Welfare Analysis in a Second-best Setting
- Midterm: Review of Closed Economy Model

Part II: Open Economy
- Week 8: Midterm & Overview of the GTAP Database
- Week 9: Introduction to the multi-region model
- Week 10: Global Sectors, Macroeconomic Closure and Welfare Decomposition
- Week 11: Analysis of technological progress and economic growth in a global economy

Part III: Advanced Topics: weeks 11-14
- Week 12: Systematic Sensitivity Analysis
- Week 13: Imperfect competition and scale economies
- Week 14: International migration or global land use: TBA

Part IV: Synthesis, Course Wrap-up and Class Presentations: week 15
COURSE SYLLABUS

In the course outline that follows each week’s activities may involve seven different types of tools for learning. They are listed in the order in which we recommend they be done.

Lectures: These are both voice-over PowerPoint lectures, as well as lecture notes intended to be carefully read and digested. They are designed to introduce the topics of the week.

Illustrative simulation: This offers an opportunity to get your hands “dirty” with a simulation, before all of the material is covered. This can be a useful motivating factor for delving more deeply into the material.

Required Readings: Must be read.

Supplementary reading: These are optional.

Homework: Homework assignments are due Friday by 5pm. This gives us the weekend to correct them so that we can discuss any weaknesses/challenge areas the following Monday. Check the course calendar on the website for updates in case assignment dues dates are changed.

Weekly discussion: Each week there will be a session at which students can discuss the assignments, lectures and readings, as well as raising other issues. Ongoing discussion will be facilitated via the website bulletin board.

Special Project: During the second half of the semester, there will be weekly tasks associated with participants’ special projects, culminating in presentation of their own extension of an existing study.

Part I: Closed Economy Analysis

Week 1. Getting Started

Lectures:

Introduction to AGE Analysis: Why General Equilibrium?
Motivation for starting with a one-region model

Illustrative simulation:

Introduction to RunGTAP for the one region model: OneGTAP tutorial

Required Reading:


Supplementary Reading:

Week 2. Overview of the Closed Economy Model

Lectures:
Overview of the Closed Economy, GTAP Framework
Accounting Relationships in the One Region Model
Price linkage relationships
Tax/subsidy conventions
Model equations

Illustrative simulation:
Output tax shock: viewing OneGTAP output

Required Readings:
Brockmeier, M. “A Graphical Exposition of the GTAP Model”, sections 1 - 3, GTAP Technical Paper No. 8, Center for Global Trade Analysis, Purdue University. This can be downloaded from: http://www.gtap.agecon.purdue.edu/resources/tech_papers.asp

Supplementary reading:
Participants should read one of the following surveys of applied general equilibrium analysis to get a feel for how these models have been used in the past:


Week 3. Producer Behavior

Lectures:
Introduction to Producer Behavior
General and particular restrictions on a production function
The nested CES production function: theory and a specific example

Illustrative simulation:
Conditional (output constant) producer response to a change in input price
Required Readings:
GTAP book: pp. 38 - 46


Supplementary reading:

Homework: Simulating firm behavior

Week 4. Household Behavior

Lectures:
Overview of Final Demand
General and particular restrictions on consumer demand
Treatment of government and savings demands
CDE expenditure function
Final demand in the presence of non-homothetic separability

Illustrative simulation:
Household response to a price change. Introduction to AnalyseGE software.

Required Readings:
GTAP book, pp. 46 - 51 and 133 - 147.

Hertel, Thomas W., 2001. "Notes on Final Demand in the Presence of Non-homothetic, Weak Separability", Center for Global Trade Analysis, Purdue University (PDF from course website Module 4).


Supplementary reading:


McDougall, R.M. “A New Regional Household Demand System for GTAP,” GTAP Working Paper no. 14, Center for Global Trade Analysis, Purdue University. This can be downloaded from: [http://www.gtap.agecon.purdue.edu/resources/working_papers.asp](http://www.gtap.agecon.purdue.edu/resources/working_papers.asp)

Homework: Analysis of consumer behavior


**Week 5: Markets -- Supply Response**

*Lectures:*

Supply Response in the one region model  
The case of a single fixed input  
Introducing factor mobility  
An aside on own-use

*Illustrative simulation:*

Supply response to a change in producer prices

*Required Readings:*


*Supplementary reading:*


*Homework:* Determinants of supply response

**Week 6: Markets -- Equilibrium Demand Elasticities**

*Lectures:*

Market demand  
Equilibrium demand elasticities & Dalton’s Law  
Links between AGE analysis and input-output/social accounting matrix based analysis  
Partial vs. General Equilibrium closures

*Supplementary Lectures:*

Derivation of Equilibrium Demand Elasticities  
Social Accounting Matrices by Martina Brockmeier  
Macro-economic Accounting in a SAM by Channing Arndt

*Illustrative simulation:*

Market demand response to a price change

*Required Readings:*


\textit{Supplementary reading:}


\textit{Homework:} Equilibrium Demand Elasticities and the Incidence of a Subsidy

\textbf{Week 7: Welfare Analysis in a Second-best Setting}

\textit{Lectures:}

Equivalent variation as a measure of welfare change
Welfare decomposition

\textit{Illustrative simulation:}

Welfare change due to an output tax

\textit{Required Readings:}

Huff and Hertel, 1996 “Decomposing Welfare Changes in the GTAP Model”, GTAP Technical Paper #5, part 1, Center for Global Trade Analysis, Purdue University. This can be downloaded from: \url{http://www.gtap.agecon.purdue.edu/resources/tech_papers.asp}

\textit{Supplementary readings:}

Hanslow, K., 2001. “A General Welfare Decomposition for CGE Models,” GTAP Technical Paper #19, Center for Global Trade Analysis, Purdue University. This can be downloaded from: \url{http://www.gtap.agecon.purdue.edu/resources/tech_papers.asp}


\textit{Homework:} Welfare analysis of a manufactures subsidy, review study guide

\textit{Midterm examination}
Part II: Open Economy

Week 8: The Global GTAP Data Base

Lectures:

Data Base Overview and Discussion of the Domestic Data Bases: Robert McDougall

Bilateral Merchandise Trade Data: Mark Gehlhar

Other International Data Sets: Robert McDougall

Required Readings:

Badri Narayanan G. and Terrie L. Walmsley, Editors (2008). *Global Trade, Assistance, and Production: The GTAP 7 Data Base*, Center for Global Trade Analysis, Purdue University, chapters 1-3 (also browse through the more detailed chapters so that you know what is available) on the web at: https://www.gtap.agecon.purdue.edu/databases/v7/v7_doco.asp

Supplementary Reading:


There will be no homework this week; this is when the in-class and take-home midterms will take place.

Week 9: Introduction to the multi-region model

Lectures:

Overview
Accounting
Price Linkages
Armington structure
Summary of Model Equations

Required Reading:

Brockmeier, M. “A Graphical Exposition of the GTAP Model”, section 4, GTAP Technical Paper No. 8, Center for Global Trade Analysis, Purdue University. This can be downloaded from: http://www.gtap.agecon.purdue.edu/resources/tech_papers.asp

Remainder of chapter 2 in GTAP book, also chapters 3 - 5.

*Homework:* Exercises with behavioral equations
Week 10: Global Sectors, Macroeconomic Closure and Welfare Decomposition

Lectures:
Global Transport Sector
Global Bank
Macroeconomic Closures
Multiregion welfare and terms of trade decomposition

Supplementary Lectures:
Alternative Closures in the GTAP Model
General Equilibrium Mechanisms at Play in the Model

Readings:


Supplementary Readings:


Homework: Welfare decomposition of a trade policy shock

Week 11: Analysis of technological progress in a global economy

Lectures:
- Analysis of technological progress
- Discussion of methods for construction of the global, GTAP data base

Required Readings:
Supplementary Readings:

Van Meijl, H. and Frank van Tongeren, 1998 “Endogenous International Technology Spillovers and Biased Technical Change in the GTAP Model”, GTAP technical paper no. 15, Center for Global Trade Analysis, Purdue University. This can be downloaded from: http://www.gtap.agecon.purdue.edu/resources/tech_papers.asp

Homework: Replication and analysis of portion of the Frisvold study, GTAP book, chapter 13 using AnalyseGE.

Part III: Special Topics

Week: 12 Systematic Sensitivity Analysis:

Guest Lecture by Paul Preckel

Guest Lecture by Channing Arndt

Required Readings:


Supplementary Reading:


Week 13: Imperfect competition and Scale Economies:

Lecture:

Introduction to imperfect competition and scale economies in GTAP

Required Reading:


Supplementary readings:

Francois, J. (1998) “Scale Economies and Imperfect Competition in the GTAP Model”, GTAP technical paper No. 14, Center for Global Trade Analysis, Purdue University. This can be downloaded from: http://www.gtap.agecon.purdue.edu/resources/tech_papers.asp

Week 14: International migration or Global land use (TBA)

Part IV: Synthesis and course wrap-up <Ginger: We should have this on the web and associated with week 15; there is no assignment as they will be doing their presentations, but it will be a useful reference>

Readings:

McDougall, R. A., 1993, Uses and Abuses of CGE Analysis, mimeo, Center for Global Trade Analysis, Purdue University, Working Paper No. 5, download from: http://www.gtap.agecon.purdue.edu/resources/working_papers.asp


Hertel, T., 1999, Future Directions in Global Trade Analysis, paper presented at the Second Annual Conference in Global Economic Analysis, Fuenen, Denmark. GTAP Working paper #4, download from: http://www.gtap.agecon.purdue.edu/resources/working_papers.asp
Annex: List of potential studies for replication and extension

I. International trade policy

A. Multilateral trade liberalization:


B. Trade Policy Response to Stochastic Shocks: Special Safeguard Mechanism


C. Regional trade agreements:


D. Poverty impacts of trade policy:


II. Climate impacts and climate policy

A. Analysis of Emissions Trading


B. Poverty impacts of climate change


C. Global General Equilibrium Analysis of GHG Abatement

III. Biofuels

A. Impact of Multinational Mandates


B. Global Land use Impacts and GHG Emissions from Biofuels


C. Impacts of Biofuels on the Global Livestock Sector


IV. International Migration


https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=2529

V. Technological change


VI. Trade facilitation

VII. Methodology

A. Imperfect Competition


B. Nested Partial-General Equilibrium Analysis


C. Systematic Sensitivity Analysis (SSA)