COURSE SYLLABUS

1. Course: Applied General Equilibrium Models I and II

2. Instructor: Eduardo A. Haddad

Prof. Haddad is Full Professor at the Department of Economics at the University of Sao Paulo, Brazil, where he directs the Regional and Urban Economics Lab (NEREUS). He also holds a position as Affiliate Research Professor at the Regional Economics Applications Laboratory – REAL – at the University of Illinois at Urbana-Champaign, USA. He is a Senior Fellow at the Policy Center for the New South, Rabat, Morocco.

Prof. Haddad has published widely in professional journals on regional and interregional input-output analysis, computable general equilibrium modeling, and various aspects of regional economic development in developing countries; he has also contributed with chapters in international books in the fields of regional science and economic development. His research focuses on large-scale modeling of multi-regional economic systems, with special interest in modeling integration applied to transportation, climate change and spatial interaction.

Prof. Haddad received his B.A. in Economics from the Federal University of Minas Gerais, Brazil, in 1993, and his Ph.D. in Economics from the University of Illinois at Urban-Champaign in 1997. In January-December 1998 he held a post-doctoral position at the University of Oxford. He has served as the president of the Brazilian Regional Science Association (2008-2010), and as the first president of the Regional Science Association of the Americas (2008-2010). He is now the Elect-President of the Regional Science Association International (RSAI). He was the Director of Research of the Institute of Economic Research Foundation – FIPE – from 2005 to 2013. He has spent the period January 2014 to June 2015 on sabbatical as a visitor at the Department of Economics (International Economics Section) at Princeton University, and at the Edward J. Bloustein School of Public Policy and Planning at Rutgers University. In 2017-2018, he was the Chairman of the Department of Economics at USP.

Full CV: http://www.usp.br/nereus/?professores=eduardo-a-haddad-english

3. Guest instructor: Fernando S. Perobelli

Prof. Perobelli has a degree in Economics from Federal University of Juiz de Fora (1992), Master in Economics from Federal University Fluminense (1995), and PhD in Economics from the University of São Paulo (2004). He is currently a Full Professor at Federal University of Juiz de Fora, Researcher Leader at the Sectorial and Territorial Analysis Laboratory (LATES/UFJF), and Associate Researcher at The University of São Paulo Regional and Urban Lab (NEREUS/USP). He has experience in economics, with an emphasis on regional economics, mainly on the following themes: regional development, input-output, computable general equilibrium models, and sector analysis (energy, transport, health, and services). He was the Coordinator of the Post-graduate Program in Economics (MSc/PhD) at UFJF from 2006 to 2011; President of the Brazilian Regional Science Association from 2011 to 2012 and Pro-rector of Post-graduation studies at the Federal University of Juiz de Fora from 2011 to 2012. Council Member at the International Input-Output Association from 2017 to 2020. Member of the CNPq (Brazilian Federal Research Agency) Advisory Committee in Economics (2017-2020).

As a consultant, he has experience in international projects – Inter-American Development Bank (IDB) – as well as national projects – Federation of Industries of Minas Gerais (FIEMG), Energy Research Company (EPE), Amazon Development Superintendence (SUDAM), Minas Gerais Energy Company (CEMIG), Pernambuco Energy Company (CELPE), Institute of Applied Economic Research (IPEA), Government of Minas Gerais State, Government of São Paulo State, and Government of Rio Grande do Sul State.

4. Teaching assistant: Inácio F. Araújo

Dr. Araújo is a Post-Doc researcher at the Department of Economics and the Regional and Urban Economics Lab (NEREUS) at the University of Sao Paulo, Brazil. His major research interests lie in the field of regional analysis. He has experience in the implementation and application of economic models, especially input-output and computable general equilibrium models.

5. Class meeting:

Dates: August 11 - December 10, 2020

Time: Tuesday and Thursday, 8h00 to 9h50

Time zone: GMT-3:00 (Brasília)

6. Learning objectives:

The course goals are:

- To introduce students to the ideas and techniques of input-output analysis and computable general equilibrium modelling, and to equip them to start using operational models, adapting such models for their own simulations.
- To equip students to start using different methods in multisectoral and multirregional analysis
- To develop skills that help analyzing development policies
- To introduce students to some of the commonly-used tool kits in regional science that help understanding and interpreting the complexity of the spatial structure of sub-national economies

7. Readings:

Textbooks:

Dervis, K., De Melo, J. and Robinson, S. (1982). General Equilibrium Models for Development Policy. Cambridge University Press.

Dixon, P. D., Jerie, M. and Rimmer, M. T. (2018). Trade Theory in Computsble General Equilibrium Models: Armington, Krugman and Melitz. Springer.

Dixon, P. B. and Jorgenson, D. W. (2013). Handbook of Computable General Equilibrium Modeling. Volumes 1A and 1B. North-Holland, Amsterdam.

Dixon, P. B., Parmenter, B. R., Sutton, J. and Vincent, D. P. (1982). ORANI: A Multisectoral Model of the Australian Economy. North-Holland, Amsterdam.

Dixon, P. B., Parmenter, B. R., Powell, A. A. and Wilcoxen, P. J. (1992). Notes and Problems in Applied General Equilibrium Economics. Advanced Textbooks in Economics 32, Eds. C. J. Bliss and M. D. Intriligator, North-Holland, Amsterdam.

Dixon, P. D. and Rimmer, M. T. (2002). Dynamic General Equilibrium Modelling for Forecasting and Policy: A Practical Guide and Documentation of MONASH. Amsterdam, North-Holland.

Ginsburgh V. and Keyzer M. (1997). The Structure of Applied General Equilibrium Models. The MIT Press, Cambridge.

Haddad, E. A. (1999). Regional Inequality and Structural Changes: Lessons from the Brazilian Economy. Ashgate, Aldershot.

Hertel, T. W. (1997). Global Trade Analysis: Modeling and Applications, Cambridge University Press.

Isard, W. et al. (1998). Methods of Interregional and Regional Analysis. Ashgate, Aldershot.

Miller, R.E. and Blair, P.D. (2009). Input-Output Analysis: Foundations and Extensions. Englewood Cliffs: Prentice-Hall.

Shoven, J. B. and Whalley, J. (1992). Applying General Equilibrium. Cambridge Surveys of Economic Literature. Cambridge University Press, Cambridge.

Complementary readings:

To be indicated by the instructor. A list of complementary readings will be available at the website of the course.

8. Link for class material distant access:

Moodle: https://ediscipliinas.usp.br/acessar/

NEREUS: http://www.usp.br/nereus/

9. Examination and grading:

Final mark composition :

- ☑ **Final exam (course project):** **60%**
- ☑ **Continuous controls (homework) :** **30%**
- ☑ **Assiduity and in-class participation :** **10%**

10. Homework and attendance:

Some of the techniques used will be included in homework assignments, which should be delivered on previously established dates. While student cooperation is encouraged to resolve exercises, each student will have to submit his/her own answers. There will be quizzes throughout the course that will be part of the grading.

11. Late assignments:

Regular attendance is expected as well as delivery of homework (quizzes, group exercises, presentations and simulation exercises). In addition, there will be an individual project at the end of each part of the course. The Final Exam will consist of a paper based on an application of an inter-regional input-output model (Part I), and an inter-regional CGE model (Part II).

12. Class attendance:

This year's course will be online, using the Zoom Platform. This makes possible to open the course for a broader audience in Brazil and in the Lusophone world. Students with working knowledge of Portuguese are welcome to register. The course will be conducted in Portuguese. Applicants therefore must be proficient or have a sound understanding of the Portuguese language in order to understand, communicate, and participate actively in the course activities. Despite lectures being taught in Portuguese, the bibliography will be mainly in English.

13. Course Project:

In previous editions of the course, we have developed with students applied models for different countries: Greece (2017), Chile (2018), and Colombia (2019). The development of such models has relied on collaboration with scholars and institutions from those countries (e.g. Prof. Yannis Psycharis at Panteion University, the team led by Patricio Aroca at UAI, and Dr. Jaime Bonet and his research team at Banco de la República). In essence, they have helped us with the country's data and we have developed the models. At the end of the course, students engaged in collaborative research projects using one of the models developed during the semester. Many of the projects the students worked on then became the basis for publications.

Given the unique nature of this year's course, the focus will be on Brazil. We will update the interstate IO table for Brazil, using 2015 data, and calibrate not only a national CGE model but also an inter-regional CGE model using the IO system. Students will engage on research projects supervised by professors with large experience in multisectoral and multirregional modeling. The best projects will become chapters of a volume on "The

Brazilian Economy and its Regional Structural Challenges", edited by Eduardo A. Haddad, Fernando S. Perobelli, and Inácio F. Araújo, and intended to be published electronically together with free access to all databases and models' codes needed for replication of the exercises.

14. Application:

[All students enrolled in the graduate program at IPE-USP, masters and doctoral students, have direct access to the course through the usual registration procedures.]

This course is designed for graduate students and early career faculty. Priority will be given to candidates currently enrolled in graduate programs (Masters/MSc and Doctoral/PhD courses). We encourage applications from students/faculty from different institutions provided their academic work and study is related to the themes of the course and related topics. Participants outside USP will be selected based on the merit of their application information, and the relevance of the academic work and studies related to the course themes.

Registration procedures for prospective non-USP students follow **two steps**:

Step 1: The applicants should send a letter of intent together with the applicant's CV to ehaddad@usp.br and inacio.araujo@usp.br until **July 15, 2020**.

Step 2: Selected applicants should complete the official registration procedure on the website https://www.fea.usp.br/economia/pos-graduacao/processo-seletivo/candidato-a-aluno-especial

More information can be obtained directly with FEAUSP Graduate Program Office : spg@usp.br

15. Course detailed outline:

PART I

Classes	Detailed contents & evaluation	Date
Class# 1	**Topic**: "General Equilibrium: Pure Theory, Applied Theory, and Practice" **Key learning outcome**: Intellectual legacy of general equilibrium theory and applied general equilibrium models "Cournot's Problem" **Manual chapters and readings** Dixon and Parmenter (1996) Friedman (1955) Schumpeter (1954)	August 11, 2020
Class# 2	**Topic**: "Economic Base Models I" **Key learning outcome**: Broad perspective of regional policies, with an overview of the theoretical background and rationale which are essential to the definition of priorities and strategies Review the simple Keynesian model and the elementary economic-base models Methods of estimating the values of EB multipliers **Manual chapters and readings**	August 13, 2020

	Capello and Nijkamp (2019): chapter 27 Schaffer (2010): chapter 3 Treyz (1993): chapter 2	
Class#3	***Topic***: "Economic Base Models II" ***Key learning outcome***: Review key elements of regional accounts Introduce students to EB structural models ***Manual chapters and readings*** Schaffer (2010): chapter 3 Treyz (1993): chapter 2	August 18, 2020
Class# 4	***Topic***: "Theoretical Structure of Input-Output Models" ***Key learning outcome***: Investigate the fundamental structure of the input-output model, the assumptions behind it, and some of the simplest kinds of problems to which it is applied ***Manual chapters and readings*** Miller and Blair (2009): chapters 1 and 2 Guilhoto (2011): chapters 1-3	August 20, 2020
Class# 5	***Topic***: "Impact Analysis and Multipliers" ***Key learning outcome***: Assess the effects on an economy of changes in elements that are exogenous to the model of that economy Develop summary measures derived from the elements of the Leontief inverse matrix ***Manual chapters and readings*** Miller and Blair (2009): chapter 6 Guilhoto (2011): chapter 6	August 25, 2020
Class# 6	***Topic***: "Regional and Inter-regional Input-Output Models" ***Key learning outcome***: Incorporate features of a regional economy into an input-output framework ***Manual chapters and readings*** Miller and Blair (2009): chapter 3 Guilhoto (2011): chapter 5	August 27, 2020
Class# 7	***Topic***: "Applications of Input-Output Models I"	September 01, 2020

	Key learning outcome: Linkage measures Key sector analysis Output decomposition ***Manual chapters and readings*** Miller and Blair (2009): chapter 12 Haddad et al. (2013) – *Tourism Economics* Haddad et al. (2015) – *Interisland model*	
Class# 8	***Topic***: "Applications of Input-Output Models II" ***Key learning outcome***: Extraction method ***Manual chapters and readings*** Miller and Blair (2009): chapter 12 Haddad et al. (2020a) – *Economic Systems Research* Haddad et al. (2020b) – *COVID-19*	September 03, 2020
Class# 9	***Topic***: "Applications of Input-Output Models III" ***Key learning outcome***: Structural decomposition analysis ***Manual chapters and readings*** Miller and Blair (2009): chapter 13 Neto et al. (2014) Haddad et al. (2020) – *Journal of Economic Structures*	September 08, 2020
Class# 10	***Topic***: "Global Input-Output Models" ***Key learning outcome***: Review different global input-output databases Present potential applications ***Manual chapters and readings*** Owen (2017): chapters 1-2 Araújo et al. (2020) Vale et al. (2018)	September 10, 2020
Class# 11	***Topic***: "Methods of Regionalization" ***Key learning outcome***: Estimate an inter-regional input-output system using the IIOAS method ***Manual chapters and readings*** Miller and Blair (2009): chapters 7 and 8 Haddad et al. (2017) – *Interstate model*	September 15, 2020

Class# 12	**_Topic_**: "Applications of Input-Output Models IV" **_Key learning outcome_**: Miyazawa extended input-output framework Explore the nature and strength of economic interdependence in metropolitan areas Analyze interactions between different groups sectors **_Manual chapters and readings_** Hewings et al. (2001) Fritz et al. (1998)	September 17, 2020
Class# 13	**_Topic_**: "Social Accounting Matrix" **_Key learning outcome_**: Inspect the different dimensions of income flows embedded in a SAM Explore the relationships between output, factor demands and income, and the decomposition of these relationships into separate effects **_Manual chapters and readings_** Francois and Reinert (1997): chapter 4 Pyatt and Round (1979)	September 22, 2020
Class# 14	**_Topic_**: "The Johansen Approach" **_Key learning outcome_**: How microeconomic theory – cost-minimizing, utility-maximizing – underlies the equations of a CGE model The use of nested production and utility functions How input-output data are used in equations How model equations are represented in percent change form How the choice of exogenous variables makes a model more flexible **_Manual chapters and readings_** Dixon et al. (1992): chapter 3 Dixon et al. (1980): chapter 2 (2.3) and 4 (4.2 and 4.20)	September 24, 2020
Class# 15	**_Topic_**: "Introduction to GEMPACK" **_Key learning outcome_**: Use GEMPACK to solve a CGE model **_Manual chapters and readings_** Dixon et al. (1992): chapter 3	September 29, 2020

Class# 16	**_Topic_**: "Course Projects" **_Key learning outcome_**: Develop presentation skills	October 01, 2020

PART II

Classes	Detailed contents & evaluation	Date
Class# 1	**_Topic_**: "The ORANI Model I" **_Key learning outcome_**: Understand the equation system of a national CGE model **_Manual chapters and readings_** Dixon et al. (1982) Horridge (2000)	October 13, 2020
Class# 2	**_Topic_**: "The ORANI Model II" **_Key learning outcome_**: Calibrate a CGE model Use of a national CGE model for policy analysis **_Manual chapters and readings_** Dixon et al. (1982) Horridge (2000) Haddad et l. (2020) – _Wine Economics and Policy_	October 15, 2020
Class#3	**_Topic_**: "The Miniature MONASH Model I" **_Key learning outcome_**: Introduce recursive-dynamics in CGE models **_Manual chapters and readings_** Dixon and Parmenter (1996)	October 20, 2020
Class# 4	**_Topic_**: "The Miniature MONASH Model II" **_Key learning outcome_**: Build baseline and policy scenarios using dynamic CGE models **_Manual chapters and readings_** Dixon and Parmenter (1996)	October 22, 2020
Class# 5	**_Topic_**:	October 27, 2020

	"The EFES Model I"	
	Key learning outcome: Introduce students to forecasting exercises with a CGE model for Brazil Top-down regional disaggregation of national results **_Manual chapters and readings_** Haddad and Domingues (2001) Haddad et al. (2002) – _Journal f Policy Modeling_	
Class# 6	**_Topic_**: "The EFES Model II" **_Key learning outcome_**: Review non-academic, government and business-related applications of CGE models **_Manual chapters and readings_** Haddad and Domingues (2001)	October 29, 2020
Class# 7	**_Topic_**: "Spatial CGE Models I" **_Key learning outcome_**: Introduce students to applied general interregional equilibrium models **_Manual chapters and readings_** Isard et al. (1998): chapter 8	November 03, 2020
Class# 8	**_Topic_**: "Spatial CGE Models II" **_Key learning outcome_**: Develop an operational spatial CGE model under conditions of limited data availability **_Manual chapters and readings_** Bröcker (1998) Almeida et al. (2010)	November 05, 2020
Class# 9	**_Topic_**: "The B-MARIA Model I" **_Key learning outcome_**: Develop bottom-up interregional CGE model Introduce a transportation sector and non-constant returns to scale into CGE models **_Manual chapters and readings_** Haddad (1999) Haddad and Hewings (2005) Peter et al. (1996)	November 10, 2020

Class# 10	**_Topic_**: "The B-MARIA Model II" **_Key learning outcome_**: Understand the role of transportation costs in spatial CGE models Integrate CGE models to transportation networks Apply CGE models for assessing the impacts of transportation infrastructure **_Manual chapters and readings_** Haddad and Hewings (2005) Haddad et al. (2011) – _Journal of Development Effectiveness_ Elshahawany et al. (2017) Rokicki et al. (2020)	November 12, 2020
Class# 11	**_Topic_**: "The B-MARIA Model III" **Key learning outcome**: Understand the equation system of a bottom-up interregional CGE model Integrate spatial/metropolitan CGE models to travel demand models **_Manual chapters and readings_** Haddad et al. (2019) – _Transport Policy_	November 17, 2020
Class# 12	**_Topic_**: "The B-MARIA Model IV" **_Key learning outcome_**: Calibrate a bottom-up interregional CGE model Use of an ICGE model for policy analysis **_Manual chapters and readings_** Haddad an Araújo (2020) – _BMMX_	November 19, 2020
Class# 13	**_Topic_**: "The IMMPA Model I" **_Key learning outcome_**: Strengthen understanding of the micro-macro linkages that are essential for the design of growth and poverty reduction strategies **_Manual chapters and readings_** Agénor et al. (2007): chapter 5	November 24, 2020
Class# 14	**_Topic_**: "The IMMPA Model II" **_Key learning outcome_**:	November 26, 2020

	Familiarize participants with the IMMPA framework developed at the World Bank that can be used to quantify poverty reduction strategies ***Manual chapters and readings*** Agénor et al. (2007): chapter 5	
Class# 15	***Topic***: "The GTAP Model" ***Key learning outcome***: Introduce students to the structure of the standard GTAP model, a multi-country, multi-sector, CGE model, with perfect competition and constant returns to scale Overview of the GTAP database Introduce students to GTAP applications ***Manual chapters and readings*** Hertel (1997): chapter 2-3	December 01, 2020
Class# 16	***Topic***: "Course Projects" ***Key learning outcome***: Develop presentation skills	December 03, 2020

16. Complementary activities:

We may schedule eventual tutorial meetings, outside regular course hours, to discuss and carry-on hands-on applications of the concepts and techniques discussed in the sessions. Such activities may be complemented by the introduction of extensions of the basic models.