Theory and econometrics of individual and collective choice analysis: choice and controlled experiments

Course Lecturers:

1. Prof Eric Mungatana, Centre for Environmental Economics and Policy in Africa (CEEPA), University of Pretoria
2. Prof Thomas Lundhede, University of Copenhagen/CEEPA (University of Pretoria)
3. Prof Stefano Farolfi, Agriculture Research for Development (CIRAD. France)/CEEPA (University of Pretoria)
4. Dr Damien Jourdain, Agriculture Research for Development (CIRAD. France)/CEEPA (University of Pretoria)

General overview

The course is designed to give students the theoretical and practical tools they require to analyse choices originating from stated preference (SP) surveys and controlled experiments. It begins with an introduction to how economics as a science conceptualizes discrete choices made by agents based on their preferences, which can be analysed as either being fixed as in choice experiments or influenced by external factors (e.g. including other people) as in some experimental economics.

In the choice experiments (CE) section, the course will initially present a solid foundation on the different approaches to modelling economic choices, followed by the different steps of a stated choice experiment. The presentation of the steps of a CE will alternate between theory and lab exercises to cover topics like research question formulation, questionnaire design, experimental design, survey design, sample design, and data analysis, where students will work with standard choice models including conditional logit, mixed logit, and latent class models. The following more advanced topics will be presented at the end: the possibility to detect other choice heuristics and their influence on the results of a CE, and the possibility to integrate perception and attitudinal variables that could influence choices in a CE.

In the controlled experiments section, basic concepts and methods of economic experiments in the laboratory and field will initially be presented. Key concepts of experimental economics (e.g. validity of an experiment, framing, etc.) will follow. Students will learn all steps of an experimental protocol, from design through data analysis. Practical examples will be used to augment class lectures, and real experiments with students as subjects will be run.

The final half a day of the course will be dedicated to the analysis of students case studies. For this reason, this course encourages participation of PhD students at different stages of developing their research projects on any aspect related to how individual or collective decision-making connects with the economic valuation of non-market goods and services.

Aims and objectives of the course

This course is designed to prepare students for a research career in environmental and natural resources economics.

Development of knowledge and understanding: *see detailed description of topics*

Cognitive and intellectual skills: *see detailed description of topics*

Key transferable skills: *see detailed description of topics*

Practical skills: *see detailed description of topics*

Pre-requisites, background knowledge and skills

The course assumes students have familiarity at masters' level of mathematics for economists, microeconomics, and econometrics and are able to work with a spreadsheet (e.g. Excel) or their preferred statistical software. *Participants will specifically use R for the lab exercises in this course.* Instructions on how to install R and materials about basic operations will be made available prior to the course. In addition, we will provide the links to courses freely available that fit best our requirements (EdX, Data Camp, etc.)

Overall assessment criteria and methods

Being practically oriented, assessment will be based on active participation in all lecture and lab sessions. All participants will receive a University of Pretoria certificate of attendance. PhD students requiring credits can request for formal evaluation, which will involve delivering a short scientific research paper where the student will be required to demonstrate competence in applying the tools covered in the course to solving a practical problem using own data for example.

Thematic topics

Topic	Time (in Hours)				Independent Study	Total
	Theory	Seminar	Practical / Tutorial	Sub-Total		
1. Introduction to R					30	30
2. Analysing Discrete Choices in Economics: an introduction	4		2	6	5	11
3. Stated Choice Experiment: From research question to data analysis	5		8	14	10	24
3. Experimental Economics	3		1	4	10	14
4. CE and/or EE for student projects			5	5	10	15
5. Student evaluation & feedbacks			1	1	0	1
Total	**12**		**18**	**30**	**65**	**95**

Detailed Description of Topics

Topic 1: Introduction to R basics

Topic objectives

At the end of Topic 1, the students should be able to:

- Install R and R Studio on their own laptop.
- Install R packages to be used later in the course.
- Know the most common data structures R uses to store and manipulate data.
- Create R data structures (with special emphasis on importing data from Excel data sets).
- Manipulate and perform basic calculations on such data structures (in particular generate summary information).

Mode of delivery

The students will be required to follow an online course on R basics made available through a UP platform and to follow existing resources on the internet. Links to resources will be given to students one month before the start of the course, to give them ample time to develop R skills prior to attending in-class courses at UP Pretoria Campus.

Topic 2: Analysing Discrete Choices in Economics: an introduction

Topic objectives

At the end of this topic the students should be able to:

- Formulate the different representations of choice in economics
- Understand the influence of peers and group rules on preferences and choices
- Understand how choices can be used to extract economic values under non-market settings

Topic 2.1. Individual preferences and choices

- Preferences and choices; the different frameworks to represent discrete choices: Random Utility Model (RUM), Lexicographic Utility, EBA, etc.
- Approaches to elicit preferences: an overview of revealed vs. stated preference methods

Topic 2.2. Choices influenced by Peers and Group Choices

- Individual Choices influenced by Peers
- Social Choice Framework (related to EE)
- EE methods to elicit preferences and choices under different social settings.

Topic 2.3. Choices and Preferences: What for?

- Choices and values: the connection with WTP and WTA and its use in valuation of non-market goods
- Influence of institutions upon the individual choices

Mode of delivery

Regarding **individual choices**, this topic will initially introduce the "individual" preferences notion using a lab session during which students will respond to a Choice Experiment. We will then ask students to analyse how they responded to the choice questions as individuals. We will follow the practical session with a lecture describing the different choice frameworks that they could use to

represent individual choices, and a lecture reminding students about the connection between individual choices and important welfare concepts such as WTP.

Regarding **collective choices**, we will initially introduce key concepts underlying decisions within a group using a serious game "Wat-a-Game", which allows students to reflect on decisions made within groups. A debriefing of the game results will follow, to include a discussion about group decision-making.

Topic 2.1.

- Activity (1hr): Ask students to respond to a CE followed by a debriefing session: How did students make their choices? What information did they use? How did they use it?
- Lecture (1hr): From Individual Preferences to Individual Choices: the different frameworks (behavioural choice rules) for representing choices (RUM, Lexicographic, EBA, etc.) and the derived choice models

Topic 2.2.

- Activity (2hr): Introduction to Choices in Groups through a serious Game Wat-a-Game
- Lecture (1hr): Debriefing of results and discussion about group choices and individual choices (as influenced by others)

Topic 2.3.

- Lecture (1h): From Choices to Value under the RUM framework (including a rapid reminder of welfare economics concepts WTA/WTP and why they need to be evaluated (public good); a brief introduction of revealed vs. stated preference methods.

Readings

- Hensher, D. A., Rose, J. M., Greene, W. H., 2015. Applied choice analysis. Cambridge University Press, Cambridge, U.K. (2nd Edition). (Chapters 2 & 3)

Topic 3: Valuing Non-market goods using Stated Preference Techniques

After the general introduction to choice analysis and modelling (topic 2), the focus will shift to stated preference methods (with particular emphasis on discrete choice experiments) and how they can be used to analyse individual choices and infer individual values for non-market goods.

Topic Objectives

At the end of Topic 3 the students should be able to:

- Develop a stated preferences survey (research question, construct a questionnaire and an experimental design, and capture the information in an adequate format)
- Use standard models to analyse CE date (conditional logit, mixed logit and latent class)
- Estimate WTP and conduct posterior analysis using these models

Topic 3.1. Survey Development and Implementation

- Purpose of the Survey
- Population, sample, survey methods
- Attribute vs. Non-attribute approach
- Building blocks of a Choice Experiment: Alternatives / Attributes / Levels
- Experimental Design: Orthogonal, Efficient Designs
- Designing a CE questionnaire: Good practices
- Pre-testing and conducting the survey

- Data collection and formatting

Topic 3.2. Models for data analysis and valuation of resources

- Introduction to estimation in R
- Conditional logit, mixed-logit, latent class models. Model estimation, WTP and posterior analysis.

Topics 3.3. Advanced topics

- Other Heuristics (ANA, EBA)
- Hybrid Choice Models

Mode of delivery

Topic 3.1.

- Lecture (1hr): Refine your research Question; Develop a sampling strategy; Decide whether you want to go for attribute or non-attribute approach
- Lecture (1hr): The Building blocks of a Choice Experiment
- Lab (1hr): Groups are assigned research questions and will have to define a plausible CVM question, and plausible Alternatives/Attributes/Levels
- Lecture (1h): Experimental Design
- Lab (1h): Experimental Design. Using R, students will develop a full factorial-, followed by an orthogonal design. A Demonstration of the Ngene software will be provided to show students how to develop an efficient design (with a discussion on how to obtain priors).
- Lab (1h): R & Data formatting. This is will be based on an excel sheet with the survey data students developed during the first lab. Students will key-in in the response they gave during the first lab.

Topic 3.2.

- Lecture (1hr): The conditional logit model and a first inference about WTP
- Lab (1hr): Using R, format data and develop a conditional logit model. Calculate WTP for the different attributes.
- Lecture (1hr): The mixed logit and WTP inferences.
- Lab (1hr): Using R, develop a conditional logit model and calculate WTP
- Lecture (1hr): The latent class approach and WTP inferences.
- Lab (1hr): Using R, develop a latent class model and calculate WTP

Topic 3.3.

- Lecture (1hr): Some alternative heuristics and how they are treated: 2 examples: attribute non-attendance and choice set formation
- Lab (1hr): Demonstration of an inferred ANA model using R
- Lecture (.5hr): How attitudes and perceptions influence choices: Hybrid Model Approach
- Lab (.5hr): Demonstration of an hybrid model

Readings

- Experimental Design
  - Rose, J., Bliemer, M., 2009. NGENE User Manual & Reference guide. Choice Metrics, Sydney, Australia. (Provided) (Chapters xx)
- Models and model estimations

- Train, K. (2009): Discrete Choice Methods with Simulation. Cambridge: Cambridge University Press (2nd Edition) (made available by the author as pdf files at: https://eml.berkeley.edu/books/choice2.html)
- Hensher, D. A., Rose, J. M., Greene, W. H., 2015. *Applied choice analysis*. Cambridge University Press, Cambridge, U.K. (2nd Edition). (Chapters 4 & 5)

- Specialized models
  - Taye, F. A., Vedel, S. E., Jacobsen, J. B., 2018. Accounting for environmental attitude to explain variations in willingness to pay for forest ecosystem services using the new environmental paradigm, Journal of Environmental Economics and Policy, 1-21. (Example of Hybrid Choice Model)
  - Scarpa, R., Zanoli, R., Bruschi, V., Naspetti, S., 2013. Inferred and Stated Attribute Non-attendance in Food Choice Experiments, Am. J. Agric. Econ. 95 (1), 165-180. (ANA)

Topic 4: Analysing economic choices through Controlled Experiments

After reflecting on the serious game in which the behavior of economic agents' given the presence of strategic issues and institutions under controlled experiments was analyzed (topic 2.2), students will be exposed to basic concepts and methods of experimental economics through lectures and practical experiments. Particular focus will be given to using simple experimental tools in the field, and in a developing/emerging country context.

At the end of topic 3, the students should be able to:

- Know the basic features of an economic experiment
- Know pros & cons of experimental economics
- Design the main steps of an economic experiment protocol
- Adapt an experimental protocol to a research question in their field

Topic 4.1. Concepts and methods in experimental economics

General introduction to the concepts and methods of experimental economics. Is economics an experimental science? Why and when it is useful and wise to adopt the experimental methods in economics. Critics and endorsements of the method. Lab experiments, economic field experiments. Overview of the main characteristics of an economic experiment (sample, protocol, recruitment and payment of subjects, treatments, data collection and processing, etc.). Some basis of experimetrics (econometrics for economic experiments).

Topic 4.2. Experimental Economics in the Field

How to conduct economic experiments for policymaking and in developing and emerging countries.

Mode of delivery

Lecture (1hr): back to the results of the serious game and discussion on how a controlled game can be used to understand strategic and group behaviour.

Lecture (2 hr): concepts and methods in experimental economics.

Moblab (1 hr): Individual choices and social interactions.

Lecture (1 hr): Labs in the field.

Readings

- Charness, G., & Viceisza, A. (2016). Three Risk-elicitation Methods in the Field: Evidence from Rural Senegal. Review of Behavioral Economics, 3(2), 145-171. doi: 10.1561/105.00000046
- Falk, A., & Heckman, J. J. (2009). Lab Experiments Are a Major Source of Knowledge in the Social Sciences. Science, 326(5952), 535-538. doi: 10.1126/science.1168244
- Farolfi, S., Dubois, D., Morardet, S., Nouichi, I., & Marlet, S. (2018). Information provision and willingness to pay irrigation water in Tunisian local associations for agricultural development. An experimental economics study. Cahiers Agricultures, 27(2). doi: Artn 2500110.1051/Cagri/2018007
- Gintis, H. (2000). Beyond Homo economicus: evidence from experimental economics. Ecological Economics, 35(3), 311-322. doi: Doi 10.1016/S0921-8009(00)00216-0
- Janssen, M. A., Anderies, J. M., & Cardenas, J. C. (2011). Head-enders as stationary bandits in asymmetric commons: Comparing irrigation experiments in the laboratory and the field. Ecological Economics, 70(9), 1590-1598.
- Levitt, S. D., & List, J. A. (2007). What do laboratory experiments measuring social preferences reveal about the real world? Journal of Economic Perspectives, 21(2), 153-174. doi: Doi 10.1257/Jep.21.2.153
- Ostrom, E. (2010). Revising theory in light of experimental findings. Journal of Economic Behavior & Organization, 73(1), 68-72. doi: 10.1016/j.jebo.2008.11.008
- Viceisza, A. C. G. (2016). Creating a Lab in the Field: Economics Experiments for Policymaking. Journal of Economic Surveys, 30(5), 835-854. doi: 10.1111/joes.12118

Topic 5: Wrapping-up: Putting it all together.

Following the theory and econometrics of individual and collecting decision-making, and its connection to the economic valuation of non-market goods and services (topics 1-4), students will be invited to either refine their current research questions, or to consider new research questions they could develop based on the newly acquired tools.

At the end of Topic 5, students should be able to present an outline of a relevant scientific project that can be empirically implemented going forward.

Topics 5.1. : Specificities of African Cases (1h)

Brief introduction to the topic (15 min), followed by an open-discussion with students about the specificities of the students case studies that would require special attention

Topic 5.2. : Students projects (Group Work and restitution)

Table 1: Alternative calendar

	Monday	Tuesday	Wednesday	Thursday	Friday
8 :30	Introduction				
9 :00	Serious game: WAT-A-GAME	Lab : CE response + debrief with students	Course + Lab : Conditional Logit Model	Course: Mixed Logit Model	Course: Hybrid Model
					Lab: Hybrid Model Demo
10 :00		Course: Building Blocks of CE	Course: Concepts & methods in EE	Lab: Mixed Logit Model	Students Working Groups (EE + CE projects)
11 :00	Course : Controlled games to understand strategic and group behavior	Lab: Group work Alter. / Attr. / Levels		Course: Latent Class Model	
12 :00	*LUNCH BREAK*	*LUNCH BREAK*	*LUNCH BREAK*	*LUNCH BREAK*	*LUNCH BREAK*
13 :00	Course : From Pref to Choices	Course: Experimental Design	MobLab: Individual choices and social interactions	Lab: Latent Class Model	Students Working Groups (Presentations + Discussions)
14 :00	Course : From Choices to Value	Lab: Exp. Design with R	Course: Labs in the field	Course: ANA + Choice Set Formation	
15 :00	Course : From RQ to Strategy	Lab: R & Data Formatting	African Specific Issues	ANA Demo	Evaluation
			Lab: Students Groups		
16 :00					