Toulouse School of Economics

Quantitative Techniques in Economics

Course title – Intitulé du cours	Quantitative Techniques in Economics
Level / Semester – Niveau /semestre	MRES / Fall semester
School – Composante	Ecole d'Economie de Toulouse
Teacher – Enseignant responsable	Fabrice Collard & Sumudu Kankanamge
Lecture Hours – Volume Horaire CM	30h
TA Hours – Volume horaire TD	-
TP Hours – Volume horaire TP	-
Course Language – Langue du cours	English
TA and/or TP Language – Langue des TD et/ou TP	-

Teaching staff contacts:

- email(s) address(es),
- office(s) number(s),
- office(s) hours/day(s) of the week when students can drop by
- preferred means of interaction (after the classes, by email, prior appointment,…)

- **Fabrice COLLARD**
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- Office hours: appointment
- Interaction: after the classes/ appointment

- **Sumudu KANKANAMGE**
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- Interaction: after the classes/ appointment

<u>Course Objectives:</u> newly acquired knowledge once the course completed should be well identified

In more detail :

- ideas, theories or methods that will be illustrated in class;
- methods that will be used and that students are expected to be proficient in;
- skills that will be developed during the course (type of problems to be resolved, ability to provide written and oral comments on an empirical analysis,…).

It is preferable to specifically list simple objectives with verbs, so that it is easy to evaluate whether these objectives are achieved at the end of the course or to identify the areas for improvement (for instance : for implementation goals - test hypotheses and draw correct inferences using test statistic; for conceptual goals - characterize first-degree, second-degree and third-degree price discrimination;…).

This class is designed to introduce students to standard computational techniques that are now a prerequisite in solving and evaluating modern quantitative economic models. The course will cover global solution techniques, and will show students how to deal with models featuring occasionally binding constraints. While a number of examples used in this course will be drawn from the field of macroeconomics, most techniques can also be used to solve, simulate and evaluate models from other fields.

Lectures will cover:

1. Applied dynamic programming:

Dynamic programming is a very powerful tool that allows to formulate and solve, in a relatively simple way, models featuring non-linearities, shocks, binding constraints, potential discontinuities, etc. This part of the class will introduce the student to these techniques and will also show under what conditions they can be used. We will cover value iteration techniques, policy functions iterations, endogenous grid methods, iteration on Euler equations, both in the deterministic and the stochastic case. In passing some attention will be given to non-linear solvers and numerical optimization techniques.

2. Incomplete markets/heterogeneous agents models:

The last part of the class will explore techniques that explicitly deals with heterogeneity. Starting from a seminal model with idiosyncratic heterogeneity, the techniques seen in the first part of the class will be extended to deal with distribution dynamics, transition dynamics, models with discrete-continuous choices and aggregate dynamics.

The class will be computer intensive and students are required to have a laptop or at least a laptop per two students. The computer language will mainly be Julia (no prior knowledge of the language is assumed nor requested). Necessary (free) software will be distributed in class.

By the end of this course, students should be able to

1. Set up a model,

2. Select and implement the relevant technique to obtain a numerical solution to the model,

3. Simulate the model, and hence generate relevant quantities for the question at stake.

Prerequisites :

- skills and competences needed/previously acquired
- or the title(s) of the compulsory course(s) which should have been taken before

Basic computer knowledge

Practical information about the sessions:

- please specify if laptops or tablets are accepted or not in the class,
- expectation on students' participation,
- how will be treated students that arrive to class late…..

Laptops and tablets are accepted.

The class is computer intensive: please have at least a laptop per two students.

Grading system :

- final exam or midterm exams
- Teaching Assistant grading
- weights of the weighted average main cours-TA (consistent with the voted examination "arrêté d'examen"),
- semester calendar,
- how to handle late homework…

The final grade for this part of the class will be a small home project. Additionally, there will be a few (non graded) weekly/bi-weekly assignments.

Bibliography/references :

- list of assigned readings and other course materials : books (chapters), internet links,…

- Numerical Methods in Economics, by Kenneth L. Judd (Pearson Addison Wesley, 2nd edition, 2008),
- Dynamic General Equilibrium Modeling, by Heer and Maussner (Springer, 2009),
- Recursive macroeconomic theory, by Ljungqvist and Sargent (MIT Press, 2004),
- Computational methods for the study of dynamic economies, by Marimon and Scott (OUP, 2001),
- Dynamic economics, by Adda and Cooper (MIT Press, 2003),

- Recursive methods in economic dynamics, by Stokey and Lucas (Harvard U. Press, 1989)

Session planning :

- presentation of the sessions, connection with the resources

TBA

Distance learning *:*

Distance learning can be provided when necessary by implementing, for example:

- Interactive virtual classrooms
- Recorded lectures (videos)
- MCQ tests and other online exercises / assignments
- Remote (online) tutorials (classes)
- Chatrooms

Remote (online) tutorials (classes)