VNIVERSITAT DE VALÈNCIA

Course Guide
44949 Agent-based Economics

COURSE DATA

Data Subject	
Code	44949
Name	Agent-based Economics
Cycle	Master's degree
ECTS Credits	5.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
2242 - M.D. in Economics	Faculty of Economics	1	First term

Subject-matter

Degree	Subject-matter	Character
2242 - M.D. in Economics	6 - Agent-based economics	Optional

Coordination

Name	Department
CABALLERO SANZ, FRANCISCO	10 - Economic Analysis
ROCHINA BARRACHINA, MARIA ENGRACIA	132 - Economic Structure

SUMMARY

This course is aimed at introducing Agent Based Modelling (ABM) as a computational methodology for the analysis of complex economic systems, with a focus on macroeconomics. The course analyzes the economy as a complex system in which macroeconomic properties emerge from the (decentralized) interaction among heterogeneous (boundedly rational) agents. The basics of ABM and some more advanced tools will be provided during the course by means of both theoretical and practical lectures. The theoretical part of the course introduces the concept of complexity in economics and proposes a critical perspective on mainstream (e.g. neoclassical) and heterodox (e.g. post-Keynesian and evolutionary) macroeconomics, according to a pluralist and multidisciplinary approach. During practical lectures, students will actively learn coding and computer simulation (by using free programming software like Netlogo, R, Python or Julia), based on a step-by-step strategy (namely, starting from simple models and enlarging the basic framework by including more advanced features). Macroeconomic accounting will be studied based on a Stock-Flow Consistent (SFC) approach. In particular, the course will focus on macro topics like business cycles and growth, inequality, financial fragility and capitalist crises. The course prepares students for academic research in this area.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

No previous knowledge other than that implied by the criteria of admission to the program will be assumed.

OUTCOMES

2242 - M.D. in Economics

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- Develop a critical capacity, show a research concern and interest in the field of economy, specialise in the use of bibliographical materials, in the use of economic databases and econometric, mathematical and statistical software. Also, learn to adequately disseminate research findings through scientific articles and presentations in congresses.
- Gain the capacities of abstraction and logical reasoning that are essential for the creation of economic models: ability to express oneself using formal, graphic and symbolic languages, to apply analytical and mathematical methods to economics, and to relate and manipulate concepts according to a purpose.
- Acquire linguistic and technological skills: ability to use English in the scientific field of economics and to use ICT in the field of economic study and research.

LEARNING OUTCOMES

At the end of the course, the student should be able to:

• Know the bibliographic bases needed for a critical understanding of complex economic systems

• Critically evaluate the content of scientific papers (though not always covering all analytical details), reports of international institutions, central banks, governments, as well as divulgative articles, etc., recognizing the main elements of the different theoretical and methodological approaches

• Build and simulate a small-scale agent-based model of a macroeconomy, or of a sub-system of it, and understand the results of counterfactual simulations as well as of policy experiments

• Understand macroeconomic accounting based on the Stock-Flow Consistent approach

• Understand the (algorithmic) structure of middle-to-large scale Agent-Based Stock-Flow Consistent (AB-SFC) macroeconomic models and their potential to describe the evolution of the capitalist system and its tendency towards the crisis

DESCRIPTION OF CONTENTS

1. Agent-Based Economics: An Introduction

1.1. Critics to mainstream macroeconomics
1.2. The economy as an adaptive complex system
1.3. What is an Agent Based Model (ABM)
1.4. Agent Based Modelling (ABM) as a computational laboratory
1.5. A first example of an ABM (Schellings segregation model)

2. Agent-Based Economics: What, Why, When

2.1. Main features of ABM
2.2. On the way to ABM: Evolutionary roots, the Santa Fe perspective and microsimulation
2.3. Why (heterogeneous interacting) agents?
2.4. ABM as a complement or a substitute to analytical models
2.5. An ABM example on wealth distribution (Epstein and Axtells Sugarscape)

3. From Mainstream to Agent Based Macroeconomics: Optimality vs. Adaptation

3.1. A Dixit-Stiglitz benchmark with perfect information
3.2. Price/quantity decisions when demand is unknown
3.3. The ABM approach to price/quantity decisions

4. Agent Based Macro Models

4.1. Main features of macro ABMs
4.2. Typical steps in building a macro ABM
4.3. An agent-based macro framework with decentralised matching
4.4. Monte Carlo simulations
4.5. Extensions: Financialisation, financial regulation, inequality

5. Implementing and Simulating a Simple ABM in R

5.1. A toy model
5.2. Programming in R
5.3. Simulating the model
5.4. Some variations
5.5. Multiple simulations

6. Going Further: Implementing an ABM on Business Fluctuations and Financial Networks in R

6.1. Beyond the toy model
6.2. A simplified ABM with a network-based financial accelerator
6.3. Programming in R
6.4. Simulating the model

7. Toward an improved macro ABM framework

7.1. Extensions of the simplified ABM model
7.2. A complete macro ABM
7.3. Stock-flow consistency (SFC)
7.4. ABM meeting SFC

8. ABM-SFC I: Inequality and Finance in a Rent Economy

8.1. The inequality-finance nexus
8.2. Shadow banking and securitisation
8.3. A hybrid ABM-SFC macro model
8.4. An extension: the macro effects of financial complexity

9. ABM-SFC II: Does Inequality Hamper Innovation and Growth?

9.1. The inequality-growth nexus
9.2. A medium-to-large scale ABM-SFC macro model
9.3. Policy experiments: tax progressiveness and wages downward rigidity

10. ABM-SFC III: Back to the Basics

10.1. A simple SFC model
10.2. The ABM version of the simple SFC model
10.3. R implementation

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	40,00	100
Classroom practices	10,00	100
Study and independent work	75,00	0
TOTAL	**125,00**	

TEACHING METHODOLOGY

The course consists of both theoretical and practical lectures. Theoretical lectures are aimed at critically understanding various approaches to macroeconomic modelling and introducing the main features of complex economic systems composed of a multitude of heterogeneous interacting agents. Relevant articles will be discussed in class and critical abilities will be stimulated by organizing reading groups to debate about contrasting views in the literature and encourage students to propose their own view on complex issues. Practical lectures are aimed at acquiring the basic skills of programming and computer simulation to implement and simulate a simple agent-based model of business cycle fluctuations. A step-by-step approach will be followed in building the simulation model, so to allow students to understand both the building blocks of a typical model and the relationships among different parts of the model; in the meanwhile, students acquire the computational skills and accounting rules needed for the implementation of a simulated (artificial) macroeconomy. Computational and policy experiments will be performed in class in collaboration with students to stimulate an active learning of theories, modelling and simulation techniques.

EVALUATION

The evaluation will consist of an assignment (like a short paper) on topics suggested during the course, which is worth the 50% of the final mark, and a final exam carrying the remaining 50% of the final mark.

REFERENCES

Basic

-

- Delli Gatti D., Fagiolo G., Gallegati M., Richiardi M., Russo A. (2017), Agent-Based Models in Economics: A Toolkit. Cambridge University Press.

- Caiani A., Russo A., Palestrini A., Gallegati M. (2016), Economics with Heterogeneous Interacting Agents: A practical guide to Agent Based Modelling, Springer.

Additional

- Godley W., Lavoie M. (2012), Monetary Economics: An Integrated Approach to Credit, Money, Income, Production and Wealth. Palgrave Macmillan UK.