



# UNIVERSITÀ DI PISA

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## COMPUTATIONAL ECONOMICS

**GIORGIO FAGIOLO**

Anno accademico 2023/24  
CdS ECONOMICS  
Codice 433PP  
CFU 6

Moduli COMPUTATIONAL ECONOMICS	Settore/i SECS-P/01	Tipo LEZIONI	Ore 42	Docente/i GIORGIO FAGIOLO ANDREA ROVENTINI
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Obiettivi di apprendimento

### *Conoscenze*

- Agent-based computational economics (ACE)
- Agent-based models (ABMs)
- Why ACE?
- Coding of ABMs
- Economic applications of ACE

### *Modalità di verifica delle conoscenze*

- Essay on selected topics

### *Capacità*

- Coding
- Building blocks of economic models

### *Modalità di verifica delle capacità*

- Essay on selected topics

### *Comportamenti*

N/A

### *Modalità di verifica dei comportamenti*

N/A

Prerequisiti (conoscenze iniziali)

- Basic knowledge of neoclassical micro and macro economic models

Corequisiti

N/A

Prerequisiti per studi successivi

N/A

Indicazioni metodologiche



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N/A

### Programma (contenuti dell'insegnamento)

This course is intended to serve as a broad introduction to the huge literature using agent-based computational approaches to the study of economic dynamics. It is organized in 2 parts. The first one is taught by Prof. Giorgio Fagiolo (Scuola Superiore Sant'Anna) and the second one by Prof. Andrea Roventini (Scuola Superiore Sant'Anna)

The first part (Fagiolo, 21 hours, 14 meetings) covers three themes. The first one ("Why?") will discuss the roots of the critiques to the mainstream paradigm from a methodological, empirical and experimental perspective. We shall briefly review the building blocks of mainstream models (rationality, equilibrium, interactions, etc.) and shortly present some of the evidence coming from cognitive psychology and experimental economics, network theory and empirical studies, supporting the idea that bounded rationality, non-trivial interactions, non-equilibrium dynamics, heterogeneity, etc. are irreducible features of modern economies. In the second part ("What?") we shall discuss what ACE is and what are its main tools of analysis. We will define an ABM and present many examples of classes of ABMS, from the simplest (cellular automata, evolutionary games) to the most complicated ones (micro-founded macro models). The third part ("How?") aims at understanding how ABMs can be designed, implemented and statistically analyzed. We shall briefly present the basics of programming, by both discussing the pros and cons of using simulation platforms (Matlab, NetLogo, Swarm, LSD, etc.) vs. computer languages (Python) and providing some simple "hands-on" applications to cellular automata. Finally, we will see how the outputs of ABMs simulation should be treated from a statistical point of view (e.g., Montecarlo techniques) and we will discuss two hot topics in ABM research: empirical validation and policy analysis.

The second part (Roventini) is dedicated to agent-based macroeconomics. First, the main differences between DSGE and ABMs will be discussed making the case for the adoption of agent-based models for macroeconomic policy analyses. Then, different macro ABMs accounting for endogenous growth and business cycles will be presented taking into account the main implications for innovation, monetary, and fiscal policies.

### Bibliografia e materiale didattico

See <https://sites.google.com/view/giorgiofagiolo/home>

### Indicazioni per non frequentanti

N/A

### Modalità d'esame

Essay on selected topics.

### Stage e tirocini

N/A

### Pagina web del corso

<https://elearning.ec.unipi.it/course/view.php?id=192>

### Altri riferimenti web

<https://sites.google.com/view/giorgiofagiolo/home>

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