

# Doctoral Program in Economics



Academic year 2020/21

## EVOLUTIONARY GAME THEORY

### Period:

Third term: from April 26<sup>th</sup> to June 4<sup>th</sup>

### Course hours:

20

### Teachers:

Leonardo Bargigli (10 h)

Leonardo Boncinelli (10 h) – course coordinator

### Exam methods:

Writing of a critical essay on the relevant literature, including a computational application.

### Prerequisites:

Elements of game theory and dynamic systems

## MODULE 1: Theoretical Tools for Evolutionary Game Theory (Boncinelli)

### Program

- Evolutionary stability, ecological dynamics, replicator dynamics
- Learning processes: reinforcement learning, imitation, myopic best response
- Long-run equilibria: errors and transitions between equilibria
- Applications to coordination and cooperation problems

### Educational objectives

Learn the methods and techniques of the evolutionary approach economics and social sciences, and the ability to apply them to the understanding of social phenomena.

### Bibliographical references

Suggested readings:

- Samuelson L., "Evolutionary Games and Equilibrium Selection", MIT Press, 1997
- Weibull L.W., "Evolutionary Game Theory", MIT Press, 1995
- Young, P.H., "Individual Strategy and Social Structure", Princeton University Press, 1998
- Begon, M., J.L. Harper, and C.R. Townsend, "Ecology: Individuals, Populations, and Communities", Blackwell Science Ltd., 1996

## **MODULE 2: Introduction to Scientific computation with application to Evolutionary Game Theory (Bargigli)**

### **Program**

- Introduction to scientific computing with Python
- Applications to basic evolutionary game theory models

### **Educational objectives**

Learn the basics of scientific programming and be able to design and program a simple simulation code.

### **Bibliographical references**

Suggested readings:

- [Python Programming for Economics and Finance — Python Programming for Economics and Finance](#)
- A. Isaac, Simulating Evolutionary Games: A Python Based Introduction, JASSS, 2008.
- [https://python.quantecon.org/index\\_multi\\_agent\\_models.html](https://python.quantecon.org/index_multi_agent_models.html).