RUHR UNIVERSITÄT BOCHUM

COMPLEXITY ECONOMICS AND AGENT-BASED MODELING
COURSE OUTLINE WINTER SEMESTER 2018-2019
Prof. Dr. Michael Roos and Tom Bauermann

CONTENT

In the recent years, the interest in agent-based computational economics (ACE) as a tool for investigating macroeconomic issues has grown significantly (Richiardi 2017). In contrast to standard economic approaches, this approach models agents (e.g. households and firms) as heterogeneous, boundedly rational, interacting individuals. Macroeconomic features, like boom-and-bust-cycles, emerge from these constant interactions. Thus, this approach yields a direct micro to macro link and allows for an explicit representation and analysis of the interaction among individual agents as well as between agents and the economic environment.

The course will provide a broad introduction to the concepts of complexity, heterogeneity and interaction in economic models, and special attention is devoted to the study of macroeconomic agent-based models (ABM). In this course, we will focus especially on consumption behaviour of agents. A step-by-step introduction of essential ABM building blocks and a versatile, open access programming platform will be presented in order to enable students to gain the basic knowledge to construct their own models and perform simulations.

OBJECTIVES

- Learn about agent-based models, what they are used for and in which aspects they differ from mainstream analytical models
- Learn about complexity and behavioral Economics, and why it matters for macroeconomics
- Learn how to design and implement an agent-based model using NetLogo
- Learn how to analyse agent-based models via R-Studio

REQUIREMENTS

- Prior knowledge in Macroeconomics I & II is strongly recommended
- Prior programming experience is helpful but not required
- Very good English skills

ORGANIZATION

Participants: Maximum 25. Further details on the selection process will be provided during the first lecture.

Lecture: The module consists of lectures and tutorial sessions. Both are relevant for the exam. The lecture provides you with theoretical aspects of complexity and behavioral Economics. The tutorial sessions will focus on the computational aspects of agent-based modelling and deepen the knowledge from the lecture.

Please note: In the first tutorial we will start to use NetLogo. Please bring your notebook to every tutorial and please download NetLogo in the respective version[1]. For output analysis, we will use R-Studio. Please, also download R **and** R-Studio in the respective version[2].

Assessment: 30% final written exam

70% term paper

Further details on the exam will be provided during the lecture and on Moodle in due course.

Exam: Registration for the exam: **29th October to 11th November 2018**

Registrations and deregistrations **cannot** take place after 11th November.

Exam date: **22nd February 2019**

Time and Room: Lecture: Friday, 14h-16h, GBCF 04/411
Tutorial: Wednesday, 12h-14h, GC 02/120

Begin: 19th October 2018

SELF STUDY

This module contains 120 hours of self-study. You are expected to prepare the lecture by reading the relevant literature.

READING LIST

Further literature (weekly readings) and information will be provided on Moodle (<https://moodle.ruhr-uni-bochum.de/m/enrol/index.php?id=17356>).

Axelrod, R. (2005) ***Agent-based modeling as a bridge between disciplines***, in: Kenneth L. Judd and Leigh Tesfatsion (Eds.), Handbook of Computational Economics, Vol. 2: Agent-Based Computational Economics, Handbooks in Economics Series, North- Holland, pp. 1-21.

Chen, S-H. and Wang, S-G. (2010) ***Emergent Complexity in Agent-based Computational Economics***, Journal of Economic Surveys, Vol. 25, No. 3, pp. 527–546.

[1] Please, have a look at: https://ccl.northwestern.edu/netlogo/download.shtml
[2] Please, have a look at: https://cran.r-project.org/ and https://www.rstudio.com/products/rstudio/download/

Fagiolo, Giorgio and Paul Windrum and Alessio Moneta (2007) **A Critical Guide to Empirical Validation of Agent-Based Models in Economics: Methodologies, Procedures, and Open Problems**, Computational Economics (30), pp. 195-226.

Gilbert, Nigel and Lynne Hamill (2015), ***Agent-Based Modelling in Economics***, Wiley.

Grimm, Volker and Steven F. Railsback (2011) ***Agent-Based and Individual-Based Modeling: A Practical Introduction***, Princeton University Press, 2011.

Kirman, A. (2012) ***Can artificial economies help us understanding real economies?*** Revue de l'OFCE / Debates and policies, pp. 15-41.

Richiardi, Matteo G. (2017) ***The Future of Agent-Based Modeling***. Eastern Economic Journal (43/2), pp. 271–287.

Tesfatsion, L. (2006) ***Agent-based computational economics: a constructive approach to economic theory***, in: L. Tesfatsion and K. L. Judd (editors), Handbook of Computational Economics, Volume 2: Agent-Based Computational Economics, Handbooks in Economics Series, North-Holland, pp. 831-880.

SCHEDULE AND OUTLINE OF THE COURSE

The following schedule is preliminary and subject to changes. Any change will be announced on Moodle in due course.

Date	Type	Content
19 October	Lecture	Introduction to the course, Example (Lengnick model)
24 October	Tutorial	Introduction to NetLogo
26 October	Lecture	Introduction to ABM
2 November	Online-Lecture	Complexity
7 November	Tutorial	Introduction to Netlogo
9 November	Lecture	Modelling Consumption
14 November	Tutorial	Consumption Model I (Hand-to-mouth consumption)
21 November	Tutorial	Consumption Model II (Keynesian Consumption)
23 November	Lecture	Modelling Consumption
28 November	Tutorial	Consumption Model III (Buffer Stock Saving)

30 November	Lecture	Modelling Consumption
5 December	Tutorial	Consumption Model IV (Values and Consumption (Relative Income Hypothesis))
7 December	Lecture	Values, attitudes and behavior
12 December	Tutorial	Consumption Model IV (Values and Consumption (Relative Income Hypothesis))
14 December	Lecture	Values, attitudes and behavior
19 December	Tutorial	Consumption Model V (Rational Consumption)
9 January	Tutorial	Mixing up Consumption Models
11 January	Lecture	Validation and Calibration
16 January	Tutorial	Validation and Calibration of Models
18 January	Lecture	Analysis
23 January	Tutorial	Analysis
25 January	Lecture	Analysis
30 January	Tutorial	tba.