# AGENT-BASED MODELING IN ECONOMICS AND BUSINESS
## COURSE OUTLINE WINTER 2019 / 2020
Prof. Michael Roos / Benjamin Bonakdar / Matthias Reccius

## CONTENT

This module is an introduction to agent-based modeling and simulation. Agent-based modeling recently has become more and more popular both in research and practical applications in business and policy. This method can be applied to a large variety of practical and academic questions both in business and in economics. It has been used to study problems in marketing, organizational research, human research, but also in financial economics, industrial economics and macroeconomics.

The module covers technical aspects of agent-based modeling and simulation such as how to set up a model, how it can be analyzed and how it can be implemented on a computer. After finishing the course, you will be able to program your own small model for a research project or the bachelor thesis.

## MODULE OBJECTIVES

- You understand potential and limitations of agent-based modeling and simulation.
- You learn how to work with ABM and how to interpret their results.
- You acquire basic knowledge to implement your own agent-based models.
- You will learn how to use the ABM programming platform NetLogo.

## PREREQUISITES

You will need very good skills in written and spoken English. Some affinity to computer programming would be helpful.

**For programming purposes, you have to bring your own laptop to the class. Please make sure to install the newest version of NetLogo (v6.1.0) before the beginning of the course.**

## ORGANIZATION

The module consists of a combined lecture and tutorial.

We will discuss 3 different models during the class to give you an introduction to agent-based modelling. Afterwards, we will develop an own, fourth, model, in which we focus on investments within an economy.

Within each session, we will discuss how to further extend the model. Here, you have to implement the proposed extension from class into NetLogo before(!) the next session – in total 3 times. You will have 3 weeks to solve these exercises on your own. In the subsequent class, we will then discuss one possible solution.

Out of these 3 assignments, you have to pass at least 2. These account for the "Studienleistung". Note that you have to submit your material incl. code latest at the beginning of the next session.

The term paper should show that you understood the basic concepts of agent-based modeling. Here, we expect you to write a report, which describes your modelling ideas, your coding process and your way of approaching the different problem sets.

At the end of the semester, you need to present your report in a colloquium. Depending on the number of participants, you either work on your own or in a team of two.

**NOTE:** Attendance is obligatory! If you get sick, you need to bring a confirmation from your doctor. In other cases, you need to have a proper reason to not attend. In total, you can be absent max. 2 times. If you miss class more often, you cannot continue with the course.

**Deadline for seminar paper**: 28.02.2020

| **Participants:** | 20 |
| --- | --- |
| | - 15 Students from study program Management and Economics |
| | - 5 Students from study program Applied Computer Science |

| **Assessment**: | Term paper (Hausarbeit): 70% |
| --- | --- |
| | Oral presentation at colloquium: 30% |

| **Time and place:** | Lecture/Seminar Thursday, 14-16 h, c.t., GD 03/158 |
| --- | --- |
| **Start:** | Thursday, 17.10.2019 |

## REGISTRATION

**Students enrolled in the Management and Economics program:**
It is necessary to register for this module in FlexNow **and at the chair**, because the number of places is limited to 15.

**Students enrolled in the Applied Computer Science:**
It is necessary to contact the "Zentrum für ökonomische Bildung" (ZfÖB) as early as possible for the registration. Also you need to **register at the chair**, since the number of places is limited to 5.

The **registration procedure at the chair** consists of two steps:
1. You have to sign in to the Moodle course by 15.00h on October 16, 2019.
2. You have to show up at the first lecture (17.10.).

If there are more than 20 applications, we will choose participants randomly.
If there are free places available, you can join the course after the first round of registrations.

The **registration phase in FlexNow** is: 28.10.2019 – 10.11.2019.

## MOODLE

There is a Moodle course for this module. No password is required for the registration. Study materials such as lecture slides and exercises will be provided on Moodle.

## SCHEDULE

| Lecture | Topic | Lecturers |
|---|---|---|
| **17.10.** | Introduction *(together with Master students)* | Roos |
| **24.10.** | NetLogo and starting agent-based modeling | Bonakdar |
| **31.10.** | Agents' movements, interactions with the environment and other agents | Bonakdar |
| **07.11.** | The Sugarscape model | Reccius |
| **14.11.** | A simple market model | Reccius |
| **21.11.** | Basic investment model *(Ex.1: first extension)* | Bonakdar / Reccius |
| **12.12.** | First extension of investment model: model dynamics with some heterogeneity *(Ex.2)* | Bonakdar / Reccius |
| **23.12.-06.01.** | Christmas Break | |
| **09.01.** | Further extension of the investment model with different levels of heterogeneity *(Ex.3)* | Bonakdar / Reccius |
| **30.01.** | Seminar Colloquium | Bonakdar / Reccius |
| **28.02.** | Report Deadline | Students |

This schedule is preliminary and subject to change. Potential changes will be announced via Moodle.

## READING

The following literature helps for a better understanding and give a good introduction to ABM. It's recommended to read and work with these publications.

**Books:**
'Agent-Based Modelling in Economics' by Lynne Hamill and Nigel Gilbert
(ISBN: 978-1-118-45607-1)
'Agent-Based and Individual-Based Modeling' by Steven F. Railsback and Volker Grimm
(ISBN: 978-0-691-13673-8)

**Short papers:**
Bonabeau, E. (2002). Predicting the Unpredictable. Harvard Business Review 80(3), 109 – 116.

Tesfatsion, L. (2003). Agent-based computational economics: Modeling economies as complex adaptive systems. Information Sciences 149(4), 263 – 269.

Twomey, P. and R. Cadman (2002). Agent-based modelling of customer behaviour in the telecoms and media markets. info 4(1), 56 – 63.