Agent-based Computational Economics
Reading List

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April 19, 2016

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1 Course description

Economics is a social science that tries to explain how individual decision-making and individual actions generate macroscopic social and economic phenomena. Nowadays, in many of the social sciences (sociology, political science, economics) there is a lively debate about using computation and simulation to model the behavior of economic and social actors.

This course will give an overview of the current developments in computational modelling in various fields of research. These models can be in micro or macro, from small toy models to large integrated simulations of entire artificial economies.

We start with cellular automata models (Conway’s Game of Life, Schelling’s Residential Tipping Model).

We then look at the Sugarscape model of Epstein and Axtell which combines a CA environment with agents connected through social networks.

Next, we study the work done by Epstein and Axtell together with anthropologists and archeologists on the Replication of Anasazi population in Long House Valley, as an example of successful generative social science. The artificial society they create is able to replicate (or retrodict, or explain) the settlement and movement of the real Anasazi population over a period of 300 years.

After these introductory examples we turn to agent-based macroeconomics: to a model we have developed in our group, which is called the EURACE@Unibi model.

Artificial Financial Markets: Noise traders versus fundamentalists on financial markets (LeBaron, Day and Huang, Brock and Hommes).

We also look at agent-based models of real economic markets. The Fruit and Vegetables market in Marseille with local interaction and bargaining.

Finally, we consider important work being done in the field of experimental economics on expectation formation. We look at results on laboratory experiments and models that try to match how human subjects form price expectations. We give an overview of expectations formation experiments performed in Amsterdam (Brock and Hommes).

All the articles for this course you will find in the Reading List. PDFs of the articles are available online from my website, in compressed files:

http://www.wiwi.uni-bielefeld.de/lehrbereiche/vwl/etace/team/Sander_van_der_Hoog

Browse to Teaching Material → Course on Agent-based Computational Economics.
2 Resources

2.1 Literature in the Library

Books are in the library in the Semesterapparat S van der Hoog II.


2.2 Further Reading

Epstein, Generative Social Science: Studies in Agent-Based Computational Modeling.


Gilbert, Nigel and Klaus Troitzsch, Simulation for the Social Scientist. Ch. 7-9 on Multi-agent models.


2.3 Supplementary material on the Web

Use a search engine (DuckDuckGo, Startpage, ...) to find these:


TEDxRotterdam, Igor Nikolic, Complex adaptive systems

Miles Parker: Why Model Reality?

Miles Parker: Why Agent-Based Modeling? Part I

Lee Smolin: Physics Envy and Economic Theory

SIMSOC: Recommendations for ABM videos
3 Reading list per lecture

All starred entries are mandatory readings. These are recommended for further understanding of the material covered in class.

PRE-AMBLE: GENERAL EQUILIBRIUM THEORY – WHAT’S WRONG?


Buiter, W., 2009, The unfortunate uselessness of most ’state of the art’ academic monetary economics, Financial Times, Blog FT.com/Maverecon.


Supplementary material on the Web

Joseph Stiglitz – An Agenda for Reforming Economic Theory
https://www.youtube.com/watch?v=L9KAd_nqINY

3.1 Bounded Rationality


Bibliography of Robert Axtell:

http://scholar.google.com/citations?user=K822uYQAAAAJ&hl=en

Selected articles:


THEORY OF AGENT-BASED MODELLING

See also: http://www2.econ.iastate.edu/tesfatsi/ace.htm#Intro, Section: Introductory Materials

3.2 Intro: What are Agent-based Models?


* North, Macal: Ch. 3 Agents Up Close and Ch. 4 The roots of ABMS


Further reading:


Epstein, 1999, Agent-Based Computational Models and Generative Social Science, Complexity 4(5), 41-60.


3.3 Finite State Automata Models: The Iterated Prisoners’ Dilemma


Further reading:


3.4 Cellular Automata Models: Schelling’s Model of Segregation

* Gilbert, N. and Troitzsch, K., Simulation for the Social Scientist. Ch. 7 on Cellular Automata, pp. 159-177.


Further reading:


3.5 Exploitation vs. Exploration: The Sugarscape Model

Sugarscape model:


NetLogo implementation: http://ccl.northwestern.edu/netlogo/models/community/Sugarscape

Java implementation: http://sugarscape.sourceforge.net/sugarscape.html

AGENT-BASED MODELS: APPLICATIONS

3.6 Agent-based Macroeconomics I: The Research Program

See also: http://www2.econ.iastate.edu/tesfatsi/amulmark.htm


Further reading: See also: http://www2.econ.iastate.edu/tesfatsi/afinance.htm, Section 1: Rethinking Economic Methodology in the Wake of the Subprime Financial Crisis


Kirman, Whom or What does the Representative Agent represent?

3.7 Agent-based Macroeconomics II: Models

Eurace@Unibi Group: Download PDFs here:
http://www.wiwi.uni-bielefeld.de/lehrbereiche/vwl/etace/Eurace_Unibi/Model_Documentation
and here:
http://www.wiwi.uni-bielefeld.de/lehrbereiche/vwl/etace/Eurace_Unibi/Research_Papers_using_the_Eurace_Unibi_Model


EURACE Group:


Pisa Group:


Ancona/Milan Group:

Delli Gatti, D. Desiderio, S., Gaffeo, E., Cirillo, P. and Gallegati, M., Ch. 1 Macroeconomics from the bottom-up. pp.1-30.

3.8 Agent-based Macroeconomics III: Policy analysis

3.8.1 Fiscal policy models


3.8.2 Credit regulation: Basel II and III


3.8.3 Models of the interbank market


3.8.4 Labour market policy models


3.9 Artificial Financial Markets

See also: http://www2.econ.iastate.edu/tesfatsi/afinance.htm, Section 2: Agent-Based Financial Economics: Introductory Readings.


* LeBaron, Blake, 2006, Agent-based Computational Finance, Ch. 24 in Handbook of Computational Economics 2, Tesfatsion and Judd (Eds.), Elsevier, North-Holland: Amsterdam.


Further reading:


Hai-Chuan Xu, Wei Zhang, Xiong Xiong, and Wei-Xing Zhou, 2014, An agent-based computational model for China’s stock market and stock index futures market
URL: http://d.repec.org/n?u=RePEc:arx:papers:1404.1052&r=cmp

URL: http://d.repec.org/n?u=RePEc:arx:papers:1404.0243&r=cmp

THE REAL WORLD

3.10 Laboratory Experiments and Expectation Formation Mechanisms


3.11 Bargaining in real markets


THE COMPUTER SCIENCE OF AGENT-BASED MODELLING

3.12 How to build Agent-based Models


* Gilbert, N. and Troitzsch, K., Simulation for the Social Scientist. Ch. 8 on Multi-agent models, pp.159-177.
Frameworks for building ABMs: FLAME

Download PDFs here:
http://www.wivi.uni-bielefeld.de/vpl1/research/eurace-unibi.html


The Model Development Cycle

Railsback and Grimm: Individual-based Modelling

Ch. 1, Part I: On the process of modelling

North and Macal, 2007, Managing Business Complexity

* Ch. 5: The Role of ABMS
  Compares ABMS to other modelling approaches. Important figure: 5.1 on p.61.

* Ch. 6: Discovering Agents and Agent Behaviors
  Important: State Machine Diagrams and Activity diagrams.

Ch. 7: Office ABMS
Small-scale ABMs, on agent modelling environments

Ch. 14: ABMS Project Management
Tables on model design, Task tables.


3.13 Verification and validation of simulation models

* North and Macal, Ch.11: ABMS Verification and Validation


Galán, Izquierdo, Izquierdo, Santos, del Olmo, López-Paredes and Edmonds, 2009: Errors and Artefacts in Agent-Based Modelling, Journal of Artificial Societies and Social Simulation vol. 12, no. 1 1 (http://jasss.soc.surrey.ac.uk/12/1/1.html)

3.14 Computation, complexity and economics


Further reading:


