Models for Applied Environmental Economics

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EPFL

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Agent based models

- investigation into the collective behavior of agents
  - dynamically interacting rule-based agents
  - real-world-like diversity and complexity?
  - simulating/re-creating complex social phenomena
- complex adaptive system
  - self-organization in dynamic networks of interaction
  - understanding of individual behavior does not automatically convey a perfect understanding of the system's behavior
  - result: equilibria, emerging patterns, or no dominant pattern

    -> search for causal regularities; robust system behaviour?

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Agents' behavior

- behavioral rules
  - bounded rationality (Herbert Simon)
    - limited tractability of the decision problem
    - cognitive limitations of the mind
    - limited time available to make the decision

    -> search for satisfaction, not optimality
  - heuristics
  - often: some degree of randomness
- learning and change of behavior

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Inductive modeling and emergence

- higher-level system properties emerge from micro-scale behavior

  -> the whole is greater than the sum of its parts

- inductive approach to modeling
  - choose assumptions
  - then watch how phenomena emerge from the agents' interactions

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Some elements of ABMs

- population
  - many and different types of agents
  - typically arranged in a (spatial) grid where they might be allowed to move about
- decision-making heuristics
- learning rules or adaptive processes
- interaction patterns
- environment

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Agent based models: applications

- multi-/interdisciplinary applications
  - (social) psychology, sociology, political science, biology, economics, management, ...
- examples of applications
  - population dynamics and migration
  - self-organizing networks
  - social dilemmas
  - traffic jams
  - epidemics
  - diffusion of innovations

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Agent based models: pros & cons

- robustness compromised
- ad hoc assumptions?
- new empirical challenges
- temptation to hand over theory building to machines

- flexible approach
- network-based
- experiments with different behavioral assumptions
- emerging field

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