Irrational Exuberance and Product Ecosystems

Using ABM to Understand the Surprising Complexity of Global Markets

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Emergent Structures
**Complex Systems**

- Massively parallel
- Absence of centralized control
- Local decision rules—not hierarchical
- Systems adapt, grow, change and learn
  - Even if individual agents do not
- Concern with “emergence”
What is ABM?

• SLIDE(S) FROM ISA 2011
ABM is useful when . . .

- Cause-effect relationships are nonlinear
- Large number of interaction effects
- Difficulties with gathering empirical data
- Scarcity of events
Four types of complexity

- Interaction
- Strategic
- Ecological
- Reflexive
Interaction Complexity

- *Defined*: The effect of a variable depends upon the value of one (or more) variables.
Interaction Complexity

B Disease gene network

Disorder class
- Bone
- Cancer
- Cardiovascular
- Connective tissue
- Dermatological
- Developmental
- Ear, nose, throat
- Endocrine
- Gastrointestinal
- Hematological
- Immunological
- Metabolic
- Muscular
- Neurological
- Nutritional
- Ophthalmological
- Psychiatric
- Renal
- Respiratory
- Skeletal
- Multiple
- Unclassified

University of Sydney, 6 July 2011
Strategic Complexity

- Collective Action
Strategic Complexity

- The Minority Game
Strategic Complexity
Ecological Complexity

- Defined: actors consciously change the environment and the payoffs they receive from it.
Strategic Complexity

- *Defined*: interdependent payoffs encourage actors to anticipate others’ actions
Ecological Complexity
Ecological Complexity

TeleGeography’s 2010 Global Internet Map
Reflexive Complexity

- Defined: Actors understand and react to shared knowledge about social behavior
Reflexive Complexity

- 2008 Crisis
How ABMs help

- Micro foundations: explanations “from the bottom up”
- How do systems (and models) learn?
  - Conservation
  - Selection
  - Innovation
Ant Optimization
A final thought

“Eventually artificial adaptation may repay its debt to nature by increasing researchers’ understanding of natural ecosystems and other complex adaptive systems.”

—John H. Holland

*Scientific American*, 1992
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