Empirical Validation Issues for Agent-Based Computational Economics

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Outline

- Redux: Three strands of ACE Research
- For which strand(s) is empirical validation appropriate?
- Does one approach work for all?
- Summary of arguments and open issues from Fagiolo, Windrum, and Moneta (2006)
- Other important issues related to the empirical validation of ACE models
Three Strands of ACE Research

- **Qualitative Insight/Theory Generation**  
  (e.g. coordination in decentralized markets,...)

- **Empirical Understanding**  
  (e.g. possible reasons for empirical regularities,...)

- **Normative Understanding**  
  (e.g. institutional design,...)
Illustrative Issue: What are the performance capabilities of decentralized markets? (Adam Smith, F. Hayek, ...)

ACE Approach:
- Construct an *agent-based world* qualitatively capturing key aspects of decentralized market economies (firms, consumers, limited information, ...)
- *Introduce traders with endowments, needs, wants,*.... Let the world evolve. Observe the degree of coordination that results.

EXAMPLES: Decentralized exchange economies without a Walrasian Auctioneer, ZI agent double-auction markets,...
ACE and Empirical Regularities

**Key Issue:** Is there a causal explanation for *persistently* observed empirical regularities?

**ACE Approach:**

- Construct an *agent-based world* capturing salient aspects of the empirical situation.
- Investigate whether the empirical regularities can be *reliably generated* as outcomes in this world.

**Example:** ACE financial market research seeking explanation of several “stylized facts” in combination

[https://www2.econ.iastate.edu/tesfatsi/finance.htm](https://www2.econ.iastate.edu/tesfatsi/finance.htm)
ACE and Institutional Design

Key Issue: Does an institutional design ensure efficient, fair, and orderly social outcomes over time despite possible attempts by participants to “game” the design for their own personal advantage?

ACE Approach:

- Construct an agent-based world capturing salient aspects of the institutional design.
- Introduce agents with endowments, needs, goals, beliefs, etc. Let the world evolve. Observe and evaluate resulting social outcomes.

EXAMPLES: Design of matching mechanisms, unemployment benefit programs, electricity markets
Key Distinctions in Approaches to the Empirical Validation of ACE Models

- **Descriptive output validation**, i.e., matching computationally generated output against already-acquired real-world system data.

- **Predictive output validation**, i.e., matching computationally generated output against yet-to-be-acquired real-world system data.

- **Input validation**, i.e., ensuring that the structural conditions, institutional arrangements, behavioral dispositions, & processes incorporated into a model capture the salient aspects of a real-world system under study.
Joining together with industry stakeholders and researchers from multiple disciplines in a repeated looping through 4 stages of analysis:

- Field work and data collection;
- Scenario discussion/role-playing games;
- Agent-based model development;
- Intensive computational experiments.

NOTE: See Barreteau et al. (JASSS, 6-1, 2003)
How can researchers provide **summary reports** of model findings to other researchers and to intended model users (e.g. policy makers) in an accurate, compelling, and clear manner?

For example, it might be necessary to report **outcome distributions** rather than simple outcome point predictions.

Or it might be necessary to report how **network interaction patterns** vary systematically in response to policy changes.
How can researchers ensure the robustness of their model findings?

For example, how to be sure that model findings indeed arise from modeled attributes of a real-world system under study rather than from spurious aspects of the software/hardware platform implementation?

How can researchers ensure the accumulation of empirically supported findings?