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,…)

ACE and Qualitative Analysis

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/afinance.htm

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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

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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.

Input Validation via
Iterative Participatory Modeling

◆ 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)

Other Issues Related to the Empirical Validation of ACE Models

□ 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.

Other Issues...Continued

- 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?