Efficiency through evolution: Comparing Darwinian and comprehensive approaches in agent-based economic forecast modeling

Topic: Input-output Analysis for Policy Making (1)
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This presentation explores two innovative approaches to agent-based modeling (ABM) in economics: the Darwinian deployment method developed by Jaraiz et al. [1] and the comprehensive simulation approach by Poledna et al. [2]. While both methods successfully model real economies, they represent different philosophies in handling agent populations and computational resources, with significant implications for practical applications.

At the heart of this comparison lies a fundamental question about the relationship between model complexity and predictive power. The Darwinian approach demonstrates that a small population of agents, guided by evolutionary principles, can reproduce macroeconomic patterns accurately. Similarly, the comprehensive approach simulates entire populations with intricate behaviors, offering granular insights into economic interactions.

The technical implementation of these approaches reveals their unique characteristics. The Darwinian method employs a selection mechanism where agents compete and evolve, maintaining representative economic actors. This solution requires only four agents per sector per million active population, allowing the simulation to run on standard hardware. The comprehensive approach models each individual agent, tracking their decisions and balance sheets, utilizing advanced computing resources and multiple Monte Carlo simulations for stable results.

These methodological approaches showcase different paths to economic analysis and forecasting. Both methods successfully integrate national accounts data and input-output tables, achieving comparable accuracy in predicting GDP components and sectoral interactions. Their resource requirements differ, offering flexibility in implementation: the Darwinian approach completes its analysis in a single run on a laptop computer, while the comprehensive method leverages high-performance computing clusters for detailed analysis.

The implications for policy analysis reveal complementary strengths. The Darwinian approach suits rapid assessment and forecasting, making economic modeling more accessible. The comprehensive approach offers insights into agent behaviors and aggregate effects for deeper analysis.

Looking forward, these approaches suggest enriching paths for the evolution of economic modeling. The Darwinian method points toward elegant, efficient solutions that capture essential economic dynamics. The comprehensive approach demonstrates the power of full-scale simulation. Together, they expand our understanding of how to balance model complexity with practical utility in economic analysis.

This research carries broader implications for complex systems modeling beyond economics. The success of the Darwinian approach offers new insights about representing complex systems while maintaining predictive accuracy. The comprehensive approach provides valuable understanding of the full complexity of economic interactions. Both methods contribute unique perspectives to our modeling toolkit.

For the academic and policy-making communities, this exploration offers valuable insights into the future of economic modeling. The presentation will examine how these approaches might be

combined or adapted for different contexts, from regional economic analysis to global financial systems. Understanding their respective strengths will help researchers and practitioners choose the most appropriate tools for their specific needs.

The technical achievements of both approaches illustrate the richness of modern economic modeling. The Darwinian method's ability to achieve accurate results with minimal computational resources represents an innovation in efficient modeling, while the comprehensive approach's detailed agent-level simulations provide deep insights into economic interactions. This exploration illuminates the possibilities inherent in economic modeling and suggests new directions for research and application.

In conclusion, besides presenting recent progress in the development of the DEPLOYERS framework, this report will demonstrate how different approaches to agent-based modeling can achieve similar goals through complementary means. By understanding these approaches and their implications, we can better appreciate the diverse tools available for economic analysis and potentially develop new hybrid methods that combine their respective strengths. This knowledge is crucial for advancing the field of economic modeling and its practical applications in policymaking and forecasting.

[1] Jaraiz, M. et al. â€œDEPLOYERS: An agent-based modeling tool for multi-country real-world dataâ€•, 30th Conference of the International Input-Output Association, Santiago de Chile, July 2024.
[2] Poledna, S. et al. â€œEconomic forecasting with an agent-based modelâ€•, European Economic Review, Volume 151, January 2023, 104306.