Complexity and agent-based models in economics, finance and sustainability

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This presentation introduces Agent-Based Modeling (ABM) as a modern and flexible computational approach for analyzing complex economic and social systems. ABM differs from traditional modeling by focusing on individual agents—autonomous entities with their own characteristics, decision rules, and behaviors—whose interactions generate emergent system-wide outcomes. The presentation outlines the fundamental properties of agents, such as autonomy, social ability, responsiveness, proactiveness, adaptability, and bounded rationality, showing how these features allow ABM to better reflect real-world economic behavior. A methodological overview describes the main stages of developing an agent-based model: defining agents and their environment, establishing behavioral rules, implementing models using platforms such as NetLogo, and conducting simulations to observe dynamic patterns. Through this process, ABM enables experimentation with scenarios that are difficult to capture using conventional analytical tools. Several practical examples demonstrate ABM's versatility, including applications in transportation (railway capacity, airplane boarding), evacuation and safety modeling, warehouse logistics, and financial decision-making. These cases highlight ABM's capacity to test strategies, evaluate policies, and uncover non-linear effects arising from agent interactions. Overall, the presentation emphasizes the value of ABM for researchers and policymakers seeking to understand systems where heterogeneity, interaction, and emergent behavior play a central role.