

CLE

Complexity Lab
in Economics



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Complexity Lab in Economics - CLE

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Why complexity?

Since the onset of the Global Financial Crisis in 2007, economists (and economics) have been criticized for being unable to timely predict the occurrence of the crisis and of the ensuing Great Recession and to provide adequate remedies. The economic profession has therefore engaged in a process of soul searching which is still ongoing.

In some quarters, a profound revision and adaptation of the prevailing scientific paradigm is called for; in others the need for an entirely new paradigm is deeply felt. In both cases, new methodologies and a new or deeply revised research agenda are deemed necessary.

By and large, economists have failed in understanding and mastering the growing complexity of the economic system. Complexity means, first and foremost, that any aggregate (macroeconomic) outcome is more than the sum of the microeconomic decisions taken by agents acting in isolation: decentralized interactions are crucial, as they create collective arrangements that emerge endogenously and cannot be directly traced back to the individual decisions.

New methodologies and a new research agenda are necessary

unable to timely predict the occurrence

In a nutshell, market economies are *complex adaptive systems*. Understanding complex and far reaching interactions is the main goal of the science of complexity, an eminently *interdisciplinary* field which distills and encompasses insights from physics, biology and computer science.

What can complexity contribute to economics?

Economics can benefit from adopting concepts and tools pioneered in the *science of complexity*. An example may suffice. A new stream of macroeconomic computational literature is growing in recent years: *Agent Based (or heterogeneous agents) Models (ABM)*. ABMs are based on the assumption that agents are inherently and persistently heterogeneous and that the macro-economy *self organizes around emergent macroeconomic configurations*. These models generally feature complex *network structures* due to direct and indirect interactions among heterogeneous agents, as these elements are essential in realistic models of the macro-economy.

Market economies are complex adaptive systems... Economics can benefit from adopting concepts and tools pioneered in the science of complexity

Being extremely disaggregated and inherently non-linear, ABMs are not analytically tractable. Therefore, an intensive use of specialized software and computer power is necessary. Agent-based modeling is basically a *computational methodology* to solve models of complex adaptive systems.

Why a Complexity Lab in Economics?

The "Complexity Lab in Economics" (CLE) was established in December 2014 to encourage research on the applications of complexity to economic modeling, with special emphasis on ABMs, networks, experiments. Its main research areas are:

- **Macro-financial Agent-Based Models:** we aim at building and exploring the properties of macroeconomic models with heterogeneous and interacting agents to study aggregate economic fluctuations and crises.
- **Financial Networks:** we aim at building and exploring the properties of networks of borrowing/lending relationships, e.g. among financial institutions or among banks and firms/households. These networks are vehicles for the diffusion of financial contagion and systemic risk.

- **Behavioral macroeconomics:** we aim at building and testing macroeconomic models in which agents' information set and cognitive abilities are limited, emphasizing the role of heterogeneity in expectation formation mechanisms.
- **Laboratory experiments:** These models can then be tested by means of laboratory experiments with human subjects. Macroeconomic experiments are an exciting new branch of experimental economics.

The "Complexity Lab in Economics" encourages research on the applications of complexity to economic modeling

America's best idea

