DYNAMICAL SYSTEMS AND FINANCIAL INSTABILITY - NEW MODELLING INSIGHTS AND EMPIRICAL VALIDATION

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Abstract

The 2007-08 financial crisis was a wake-up call to mathematicians working in the area of quantitative finance. Because the financial instruments that relied on sophisticated mathematics collateralized debt obligations (CDOs) and other structured products were at the very centre of the crisis, many started to look for general models that likewise would put finance at the core of economic activity. It came as somewhat of a surprise that mainstream macroeconomic models, for example the Dynamic Stochastic General Equilibrium (DSGE) models routinely adopted by central banks around the world, had no fundamental role for banks, or financial markets for that matter, other than that of passive intermediaries. The exceptions were the models used by heterodox economists such as Steve Keen following earlier work by, among others, Hyman Minsky and Wyne Godley in the context of stock-flow consistency. In these lectures I will analyze the systems of equations obtained in this way using the tools of modern dynamical systems theory, including bifurcations, global estimates, and topological properties. They include the classical Goodwin model and its many extensions and modifications, which I consider in the context of data for OECD countries, all the way to very recent models using mean field approximations for the microeconomic interactions governing the short-time scale of the systems. This innovative way of macroeconomic modelling is still in its infancy but has the potential to be a paradigm shifting development that, together with complementary work on incomplete knowledge, radical uncertainty, network theory, and agent-based models, can redefine the role of mathematics in economic theory.