

# Some Reflections on New Tools and Techniques

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So in summary your majesty, the failure to foresee the timing, extent and severity of the crisis ...was principally the failure of the collective imagination of many bright people to understand the risks to the systems as a whole. [\*Reply to the queen by the British Academy\*](#)

# The Great Illusion

- The “Invisible Hand” idea suggests that if individuals are left to their own devices the system will self organise into a socially satisfactory state.
- Only the Invisible Hand of Jupiter can interfere with this.
- Treating the economy as an **evolving complex adaptive system** and using **computational models** allows us to build models which generate **large sudden endogenous changes**
- **But this undermines the faith in the stable self-organisation of our economies.**
- **Focusing our attention on the results of the interaction between economic agents rather than on the “optimising” behaviour of the individuals would represent a paradigm shift in economics.**

# The Title of this Conference

- Mankiw made the distinction between **economic science** and **economic engineering** in a widely cited article in the Journal of Economic Perspectives.
- The title of this conference suggests that we are focusing on the second of these activities.
- Whenever one suggests that economics has not taken account of this or that feature the almost inevitable answer is « we have adapted our models to include that and they are better and more general as a result ».
- Why then all the calls from Trichet, Bernanke, Romer and others criticising what they see as a failure to provide useful analysis of the evolution of the economy?

# Why we should look elsewhere: Mankiw

- « The fact that modern macroeconomic research is not widely used in practical policymaking is prima facie evidence that it is of little use for this purpose. The research may have been successful as a matter of science, but it has not contributed significantly to macroeconomic engineering. »
- N. Gregory Mankiw, 2006. "[The Macroeconomist as Scientist and Engineer](#)," [Journal of Economic Perspectives](#), American Economic Association, vol. 20(4), pages 29-46, Fall.

# Where does the difficulty come from?

- The economy is made up of individuals who interact directly.
- Such systems do not have aggregate behaviour which can be characterised as the average behaviour of the individuals
- The Gap between micro and macro is real!

# Microfoundations

- The effort to adhere rigidly to microfoundations is as Blanchard has pointed out not helpful for policy makers, they need to incorporate knowledge of higher level interactions and the aggregate behaviour that they generate.
- This is not just a return to the past but is needed if we are not to face the impossibility of understanding what is happening at the macro level. This is important if our theory is not to be at odds with what has been learned from other disciplines.



Presentation at NAEC conference on Averting Systemic Collapse  
September 17th-18th 2019



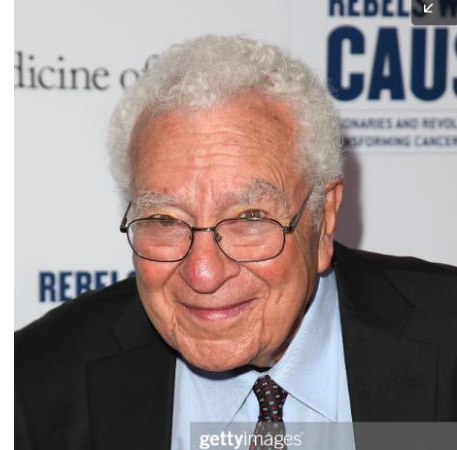


# More is Different

“The ability to reduce everything to simple fundamental laws does not imply the ability to start from those laws and reconstruct the universe.

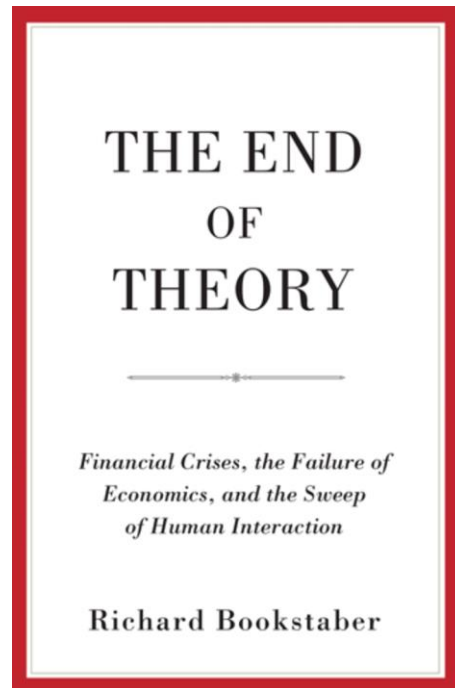
- In fact the more the elementary particle physicists tell us about the nature of the fundamental laws, the less relevance they seem to have to the very real problems of the rest of science much less to those of society...
- Instead, at each level of complexity entirely new properties appear and the understanding of the new behaviours requires research which I think is as fundamental in its nature as any other.”
- *Phil Anderson “More is Different”, Science 1972*

# The role of mathematics



- “In much of today’s research on complex adaptive systems, mathematics play a very significant role, but in most cases it is not the kind of mathematics that has traditionally predominated in scientific theory [...] The kind of mathematics that is often used in the simulation of complex adaptive systems resembles the discrete mathematics used on a digital computer to approximate continuous differential equations, but now the discrete mathematics is used for its own sake and not just as an approximation.
- Murray Gell-Mann

# Economics' Mathematical Pretensions



- This book published by Princeton University Press in 2018, shows just how unsound from a logical and philosophical point of view is the undertaking to model the economy mathematically as we have done in the past.
- Non-ergodicity, emergence and the relation between macro and micro.

# Rick Bookstaber



- Chief risk officer to the \$120 billion pension, endowment, and working capital fund of the University of California
- Co-author of the Volcker Rule.
- He has developed ABM for the U.S. Treasury

# Is the World Ergodic?

- Paul Samuelson [1969] wrote that if economists hope to move economics from “the realm of history” into “the realm of science” they must impose the “ergodic hypothesis”
- Yet recently the Geneva Association of Insurers argued that the industry could not maintain the ergodic hypothesis. Tomorrow will not look like yesterday.
- Keynes, of course, did not have the ergodic view.

# How can we bring science and engineering closer?

# ABM and Neuroeconomics

- ABM allow us to model heterogeneity and both natural and induced heterogeneity are of fundamental importance in analysing macrobehaviour.
- Why, if we are not to stick to microfoundations should we be interested in neuro science? Precisely because we have to people our models with individuals and specify the way in which the interplay of their decisions generates aggregate behaviour.
- Herb Simon argued that the formation of expectations should be also a matter for empirical enquiry not as in rational expectations an abstract theoretical concept.

# A more modest view

- Ben Bernanke,  
« I just think it is not realistic to think that human beings can fully anticipate all possible interactions and complex developments. The best approach for dealing with this uncertainty is to make sure that the system is fundamentally resilient and that we have as many fail-safes and back-up arrangements as possible »

Interview with the IHT May 17th 2010



# Frank Hahn (1925-2013)



- “In this respect, the signs are that the subject will return to its Marshallian affinities to biology. Evolutionary theories are beginning to flourish, and they are not the sort of theories we have had hitherto. In particular, biologists have always known that, say, the giraffe was not inevitable. There are many routes evolution could have taken even in stationary environments. **But wildly complex systems need simulating.** Interestingly enough, ideas from evolution are being applied to the learning (and behaviour) of the individual agent. There has been much interest in evolutionary algorithms which are designed for the computer. There are convergence theorems and there no doubt will be more and better ones. But while there will be work for the computer scientist, **I very much doubt that economists will be able to establish general propositions in any but very special examples.** Again, I do not judge - **simulation, especially when based on good data, is a perfectly respectable and probably fruitful activity.**”
- *Frank Hahn The Next Hundred Years (1991)*

# Where are people working on this?

- [LSE EMK Complexity Group](#)
- [NYU Agent Based Modelling Lab School of Public Health](#)
- [Oxford University INET group ABM and Complexity](#)
- [Santa Fe Institute Complexity Research](#)
- [UCL Institute for Innovation & Public Purpose.](#)
- [Institut pour la Complexité Paris](#)
- [Max Planck Institute for the Physics of Complex Systems Dresden](#)
- [Institute for Complex Systems and Mathematical Biology \(ICSMB Aberdeen\)](#)
- [Department of Complex Systems Science | NAGOYA UNIVERSITY](#)
- [National Institute of Science and Technology for Complex Systems Tokyo](#)

# Where are people working on this?

- [Bank of England](#)
- [European Central Bank](#)
- [Bundesbank](#)
- [U.S. Treasury](#)
- [U.K Treasury](#)
- [Finance Canada](#)
- [Federal Reserve Board and Federal Reserve Banks of Saint Louis New York and San Francisco agent based models.](#)
- [ABBA: An Agent-Based Model of the Banking System – IMF](#)
- [An Agent-Based Modeling Approach, World Bank Group](#)

# Let a Thousand Flowers Bloom!



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