

# Econophysics

Introduction to the NAEC Ecole Polytechnique Econophysics meeting

Alan Kirman

Chief Adviser to the NAEC initiative

# A long historical relationship

- Walras was convinced that we were on the road to becoming a discipline like physics.
- Many other economists agreed
- Jevons (1905) said that economics resembles physics in that
  - "The equations employed do not differ in general character from those which are really treated in many branches of physical science".
- Another contemporary, Cairnes (1875) was even more explicit. He asserted that
  - "Political Economy is as well entitled to be considered a 'positive science' as any of those physical sciences to which this name is commonly applied".
- He went on to argue that the principles of economics have identical features to those
  - "Of the physical principles, which are deduced from the laws of gravitation and motion".

# A long historical relationship

- Pareto himself, made the remark that, when examining the equations which have to be solved to determine an economic equilibrium, someone well versed in mathematics or physics would say,
- *“ These equations do not seem new to me, they are old friends. They are the equations of rational mechanics. ”*
- But Schumpeter went as far as to say,
- « So far as pure theory is concerned, Walras is in my opinion the greatest of all economists. This system of economic equilibrium, uniting, as it does, the quality of « revolutionary » creativeness with the quality of classic synthesis, is the only work by an economist that will stand comparison with the achievements of theoretical physics» Schumpeter (1954), p.827

# Interaction

- "Changes in consumers' preferences would be a much less important source of uncertainty if in fact such changes occurred for different consumers independently of each other. The law of large numbers would, in that case, reduce the variability in the distribution of aggregate demand at constant prices over the various commodities. It is through waves of imitation... that interacting preferences become an important source of uncertainty."
- *Koopmans (1957), quoted in Föllmer (1974).*



# 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*

Looking at equilibrium states rather than the path through different states.

- It is of little interest to look at the world when it is 4 degrees warmer because it will not stay like that

# Complex Collapse



# Complex collapse

- The Western Antarctic Ice Sheet is now subsiding into the sea more rapidly than previously. Furthermore, this process is now irreversible, according to two articles in Science (Ian Joughin et al. 2014) and Geophysical Research Letters (Rignot et al. 2014). This will lead to a « short term » rise in sea level of over one metre and a longer term rise of much greater magnitude.
- Anthropogenic causes are an important part of the explanation



# Complex collapse

- In fact the mechanism is more indirect. Stronger winds have pushed warmer water which rises naturally towards the Antarctic region. These are caused, it is claimed, by global warming.
- This coupled with the increased Ozone hole, due in part to the emission of aerosol gases has led to the change in the ice sheet's stability.
- **BUT AND HERE IS THE IMPORTANT POINT**
- « **There is no stabilising mechanism** » as one of the authors said.
- Changing the things which we can control will not help now to prevent the phenomenon but could slow it.
- **The system has self organised into an unstable state.**

# Conclusion

- We left physics just when we needed it most
- We will be obliged to come back to it
- The presentations that follow may help you to understand why.