

Title: Discussion on the Relation of Macro to Micro Economics

Date: May 03, 2009 09:00 AM

URL: <http://pirsa.org/09050046>

Abstract: TBA

Is a transdisciplinary perspective on economic complexity possible?

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Alfred Marshall's Problem

- “When demand and supply are in stable equilibrium, if any accident should move the scale of production from its equilibrium position, there will be instantly brought into play forces tending to push it back to that position, just as if a stone hanging by a string is displaced from its equilibrium position...”
- But in real life such oscillations are seldom as rhythmical as those of a stone hanging freely from a string; the comparison would be more exact if the string were allowed to hang in the troubled waters of a mill-race, whose stream was at one time allowed to flow freely and at another partially cut off. Nor are these complexities sufficient to illustrate all the disturbances with which the economists and the merchant alike are forced to concern themselves.
- If the person holding the string swings hand with movements partly rhythmical and partly arbitrary, the illustration will not outrun the difficulties of some very real and practical problems of value.”
- Alfred Marshall, *Principles of Economics*, 8th edn., 1920, p. 346.
- Marshall's problem is that he drew on both physics and biology to understand economics, calling biology the “Mecca” of economics, while mostly using existing models from physics to formalize his theory, derisively labeled as “neoclassical” by Thorstein Veblen for its over-reliance on physics models rather than Darwinian evolutionary theory favored by Veblen. Can both approaches be used integrally?

What is a “transdisciplinary” approach?

- The term “transdisciplinary” is used by ecological economists to describe their discipline (Richard Norgaard).
- “Multidisciplinary” is an older term, popular in the 1950s and 1960s, referring to people in separate disciplines conversing with each other while maintaining fully their mutual disciplines.”
- “Interdisciplinary” is a later term, more popular in the 1970s and 1980s, referring to the establishment of specialized niche disciplines that take a few ideas from one discipline and a few ideas from another to create this specialized niche discipline, such as “water economist,” who draws on ideas from hydrology to combine with some ideas from economics.
- “Transdisciplinary” ideally implies a broader linking and integration across the disciplines at a deeper level, although critics suggest that this may be ultimately a delusion.
- Recent examples relevant to our discussion include “econophysics” and “econobiology,” with ecological economics arguably a sub-variety of the latter.

A Collection of Complexities

- Three levels of complexity:
- 1) “small tent” heterogeneous agents complexity (Santa Fe Institute)
- 2) “large tent” dynamic complexity, Rosser
- 3) “meta-complexity,” including the “45 varieties” identified by Seth Lloyd.
- “Computational complexity” is a rising rival to “dynamic complexity” in studying economic complexity (Velupillai, Axtell).

Econophysics as transdisciplinary perspective?

- “multidisciplinary field...that denotes the activities of physicists who are working on economic problems to test a variety of new conceptual approaches to deriving from the physical sciences” (Mantegna and Stanley, 2000, viii-ix).
- Strong view says it should replace standard economics because the latter lacks invariance principles, with students taking statistics and physics courses rather than Principles of Economics (McCauley, 2004).
- Applications include financial economics (Bouchaud and Cont, 2002; Farmer and Joshi, 2002; Sornette, 2003), income and wealth distribution (Levy and Solomon, 1997; Dragulescu and Yakovenko, 2001; Chatterjee et al, 2005), size distribution of cities (Gabaix, 1999), size distribution of firms (Axtell, 2001), and others (Rosser, 2006), including distributions of research discoveries and growth paths of economies.
- Major theme of much econophysics is analysis of “power law” distributions (showing straight line when log of variable is mapped to log of another variable). Such distributions exhibit kurtosis, positive fourth moments, or “fat tails” widely observed in financial market returns and other phenomena. Contrasts with Gaussian normal (or lognormal) that can be characterized by mean and variance alone.

Controversies over Econophysics

- Heterodox economists Gallegati, Keen, Lux, and Ormerod counterattack (Physica A, 2006) with four points.
- 1) excessive claims of originality
- 2) insufficiently rigorous statistical tests
- 3) excessive claims of universality
- 4) poor quality of theory
- Lux (2009) shows econophysicists getting into problems when adopt standard economic theory uncritically.

Complicated History of Econophysics

- While econophysicists emphasize importance of power laws, they were first introduced by economist-sociologist, Vilfredo Pareto (1897).
- Physicist Osborne (1959) introduced random walk into financial economics, which became standard (Mandelbrot began urging reintroduction of power laws starting in 1963), but random walk first proposed by mathematician, Bachelier in 1900 to study stock market dynamics, prior to Einstein's 1905 work.
- Geographers (Zipf, 1941) preserved idea of power laws in studying city size distributions.
- First to apply statistical mechanics (most common tool of econophysics) to economics was an economist, Hans Föllmer (1974).

Econobiology as a transdisciplinary perspective?

- “Econobiology” mostly still a derisive term (McCauley, 2004). But several sub-varieties exist with their own names, including the fairly broad term, “ecological economics,” already noted.
- Bioeconomics (Colin Clark, 1976) used to study fishery dynamics and more general mathematical models of interactions between species populations and humans, some of which exhibit complex dynamics.
- Complex predator-prey dynamics in forests.
- Chaotic climatic-economic interactions may be truly integrative models of economics, physics, and biology.

Econobiology controversies

- Policy issues in managing common property biological resources
- The question of “emergence” and relation to critique of dynamic complexity concept by computational complexity advocates. Does “emergence” imply unscientific ideas of “holism” and “organicism”?

Does complexity explain anything about market dynamics?

- Better models of what has happened in financial markets and the current crisis.
- Example of model of period of financial distress before market crash using heterogeneous agent-based modeling (Gallegati, Palestrini, Rosser, 2008).

Conclusion

Marshall's problem not fully resolved, given ongoing controversies between econophysicists and econobiologists, as well as competing views of complexity.

Possible integration might occur within studies of climate change.

Another possibility (not discussed in paper, but some speculations here) may involve neuroscience and neuroeconomics, especially in studying interactions between different parts of brain and consciousness and complexity of actual human decisionmaking. Neuroscientists must understand biology, physics, as well as psychology, and neuroeconomists must also deal with transdiscipline of economic psychology.