Complex economics: toward a new paradigm

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> A new scientific paradigm does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die.
>
> Max Planck

The mainstream approach (DSGE) shows that stability and efficiency exist if markets extend infinitely far into the future.

Since these markets clearly do not exist, we might ask ourselves what assurance we have of the stability and efficiency of the capitalist system.

The answer is simple and wrong: the market acts *as if* there were an invisible hand.

According to Friedman (1953), the goal of a positive science is to develop hypotheses that yield “valid and meaningful” *predictions* about actual phenomena.

This approach bears several contradictions:

(i) if a system is complex, dynamics is unpredictable (a HIM is complex);

(ii) if a micro-model has to predict the macro-behaviour, the opposite has to be true also, this is possible *if* reductionism is true and it implies, via the non-contradiction principle, that micro and macro models have to predict the empirical evidence (which is negated by the *as if* assumption).

Determinism, mechanicism and reductionism qualify the classical mechanics approach, but, once translated into economics, produce some non-trivial consequences.

Reductionism denies any difference between microeconomics and macroeconomics.

The RA framework allows for a scaling of the individual behaviour to aggregate entities.

A not-innocuous side effect of it is that coordination problems are ruled out.

A second effect is that there is no room for any interaction among agents.

Chaos theory taught us that if there are non linearities (and interaction generates nonlinearities), small shocks might cause large effects.

The attempt to apply the physicist methodology to economics is well represented in the attempt to reduce the agents' behaviour to the single atom character.

Perfect rationality

(i) has to be assumed in order to have the agents behaving like an atom.

(ii) it is a necessary but insufficient condition.

If information is not complete, other agents' behaviour changes the environment making it impossible for a less than perfectly informed, to optimize his behaviour.

Interaction generates emergence.

Since Lakatos, a framework in order to be sound has to be coherent in a twofold way:

(i) internally, there has to be congruence between axioms and proposition;

(ii) externally, i.e. there should be empirical coherence.

Mainstream economics focuses only on the internal coherence, on the idea that economics is not a replicable “science”.

Putting aside the empirical evidence problem, the economic literature focused on deriving theorems from axioms.

Economists rely on what they call "equilibrium theory".

Market price fluctuations are the response to shocks, external influences, which affect a stable system.

Beyond these forces, markets have no real internal dynamics of their own, nor is a state change contemplated.

Some economists acknowledge it, focusing their study on the deviations of the empirical evidence from equilibrium.

Some scholars have actually tried to build new foundations and move beyond the restrictions of equilibrium thinking.

Agent-based modelers or computational economists build computer models that try to mimic markets or the entire economy by simulating the behavior of individuals.

These "agent-based" models do not assume equilibrium from the outset, but instead let market behavior emerge naturally from the actions of interacting participants.

Up to now, only a small minority of economists has embraced this approach.

Complex systems with many interacting components are increasingly studied by most scientists in very different disciplines.

Instead of utilizing the power of computer simulations to gain insights into the working of the economic system, most economists seem to be fond of any work that is based on strict mathematical proof, so that axioms and theorems are the core-structure of any theoretical economic paper.

The reductionist vision is closely linked to the idea of characteristic scales.

The complexity vision can be seen as complementary to reductionism, which is based on the analysis of the behavior of the elementary elements.

Statistical physics taught us that one can use a reductionist approach if interactions between elements are linear, which is not the case when information is unfairly distributed.

If one wants to take Lucas' critique seriously, it should be realized that we need a change in our attitude, abandoning the standard methodology.

Complexity opens a challenge to the mainstream approach, proposing to understand the working of a system by analyzing its components in a holistic approach.

According to me, the main innovation produced by the non-linear systems literature is its emphasis on the properties of the behavior of the whole as a result of the interactions between parts, rather than being properties of the parts themselves.

Moreover, since these interactions-based properties disappear when the parts are studied independently, one needs a new forma mentis, a new methodological approach able to study different hierarchical levels, as well as each single level.

If, to quote an abused expression, “the whole is more than the sum of its parts”, we need to ask ourselves how to study such a processes?

The solution we propose is the bottom-up modeling: start from the analysis of the behaviour of the constitutive elements, with (possibly) local interaction at the single agents level (simple behavioural rules), possibly changing the interaction nodes and the individual rule (adaptation).

At the next meso-level some statistical regularities emerge: they cannot be inferred from the individual behaviour (self emerging regularities).

This emergent behaviour feeds back to the individual level (downward causation) but also produces aggregate (the next hierarchical level) regularities.

This approach allows each and every proposition to be falsified at micro, meso and macro levels and opposes the mainstream axiomatic theory of economics.

On the contrary, bottom-up modeling is based on the gathering of interacting components.

Instead of modeling the global dynamics of the system (“top-down method”) by assuming the relationships of different aggregate quantities, in the bottom-up approach one models the components to study the emerging regularities.

Bottom-up modeling is based on the analysis of the gathering of interacting agents, where their acting is aimed at satisfying its needs and attaining its objectives.

If agents interact in a non-linear way usually they generate complex entities, which are not directly related to the properties of the individual entities.

Aggregate entities' "laws" depends in some way on the individual behavior, but their properties cannot be deduced from the individual characteristics.

According to this approach, nature, and economics, are organized in a hierarchical way, from the bottom-up, so that a collective behavior may emerge once we pass from a hierarchical level to another.

Each level may have its fundamental laws, but the different aggregation levels have new and different properties compared to the individual elements.

These properties emerge from individual elements when they interact.

There are no absolute fundamental laws which, starting from the smallest scale permit the derivation of all the other properties at all the other scales.

There are different levels and fundamental laws for each of them which permit the step to the next level.

This is recognized to be true for all the, hard and soft, sciences, except for mainstream economics.

Complexity is not a new discipline; rather it represents and requires a change in the scientific attitude of each scholar.

Rather than investigating the properties of the fundamental bricks, we aim at studying the emerging behavior of economics as a complex system by focusing on the nature of the interconnections.

A modest step which we believe to be a most promising direction indicated by the series of the WEHIA conferences.

Welcome to WEHIA 2009.