

Austrian Economic Principles and the Use of Agent Based Modeling for Policy Insight

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The field of Complex Adaptive Systems (CAS) research or Complexity Science is very fast growing. It is an interdisciplinary field which affects research in every area including molecular biology, ecology, physics, psychology, artificial life, earthquake prediction and economics. Although John Von Neumann and later John Holland deserve credit for the computational and mathematical actualization of the major concepts, arguably Hayek is the founder of the field.

Building on the Austrian School methodology, Hayek considered the market a complex system, when he described order in market systems as spontaneous (or emergent). He also recognized that the complexity approach was not only applicable to economics, and he worked in several other fields, including cybernetics, an early precursor to today's CAS.

A complex adaptive system is a dynamic network or system composed of many agents (cells, individuals, species, firms, nations, etc) acting simultaneously and reacting to what the other agents are doing. Individual agents have behavioral responses and make choices, but the system as a whole is an emergent property which arises from competition and cooperation among the agents.

Modeling in CAS research therefore must assume only micro-level behaviors, allow for heterogeneity and evolutionary adaptation or learning, allow for interaction among agents over time, and not assume any return to a preconceived equilibrium state. These assumptions are perfectly in line with what Austrian economists have argued is necessary in the field of economics.

Mises argued that there are certain axioms of human behavior which are known a priori – these are micro-level behavioral assumptions which are necessary to predict the economic system as a whole. He argued that with those axioms alone the whole of the discipline can be deduced. CAS would only add to this that the emergent phenomena and evolutionary behavior will be difficult to predict using deductive reasoning alone. Computational models can do a better job.

Hayek argued that modeling complex phenomena produces pattern predictions but that no precise predictions can be made. This echoes Mises' assertion in *Human Action* that qualitative but not quantitative predictions can be made using praxeological methods. Modeling in CAS is descriptive and insightful, but may not produce quantitative predictions about economic reality.

Mises argues that this is because human preferences are not quantitatively ordered (cardinal) and are also constantly in a state of dynamic flux. So, while we can model something that represents reality on the system level scale, we cannot pretend to know the precise relationships between the various preferred actions or the way they change in time. Hence it is an accurate general representation, but

should not be taken as a precise predictor. One should not measure relationships between specific components of the system, but rather gain insight into the reaction of the system to various shocks and shifts within it or applied to it.

Because the market is a complex system, these general insights are extremely important. Every economic policy decision must be considered on the basis of how it will affect the dynamics of the system. While precise measurements would be helpful, a model that could predict even a general response would be extremely useful. Arguably the conventional economic approach which assumes a return to a static equilibrium state, and is based on aggregates rather than micro-level behavior, cannot do even that.

A CAS model of the economy based on Austrian behavioral assumptions can therefore not only illustrate Austrian principles and provide insight to economists, but it could also provide important broad policy insight. As a supplement to conventional tools, the CAS model could act as a system level check to ensure that the static equilibrium models have not left out critical dynamic responses. A CAS model representing the economy as a whole, based on Austrian micro-level behavioral assumptions, would therefore be a very useful policy tool.