Historical roots of complex-system reasoning in economics

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Some things about economics

- Economics studies the production and distribution of useful goods and services
- Goods or services produced as private property and distributed through exchange are commodities
- Families, communities, tribes, also produce and distribute
Commodity production

- The usefulness of a commodity to its owner is its ability to exchange for other commodities—its *exchange value*.
- Exchange value is expressed abstractly as *money price*.
- Money is historically inherent in commodity production.
Origins of political economy

- The proto-nation states of the early modern period noticed that military success arose from material resources
- This led to theories of the source of the “wealth of nations”
- The physiocrats of the 17th-18th centuries identified national wealth with productive land
Classical political economy

- The classical political economists, Adam Smith, Thomas Malthus, and David Ricardo saw the wealth of a nation as its organized productive labor.
- How does a commodity system organize production without central rules or control?
In the simplest case where each worker has means of production, in conditions of “perfect freedom” workers can produce any commodity.

If the price of a commodity in relation to the time required to produce it is higher than average, workers will move into that line of production.
The movement of labor will prevent the ratio of the price of a commodity to the labor time required to produce it from moving very far from average.

This labor theory of value explains both the decentralized allocation of labor as a resource and the dynamics of commodity prices.
Market and natural price

- Market prices in this theory will fluctuate or “gravitate” around natural prices proportional to required labor times
- The fluctuating allocation of labor and prices of commodities constitute a self-organizing complex system
Capital and the rate of profit

- When workers do not own the means of production they become *capital*
- The owners will shift capital (carrying workers along) into lines of production with a higher profit rate
- Actual commodity profit rates will fluctuate around an *average rate of profit*
Smith makes the extraordinary claim that this type of self-organized complex system is superior to centralized top-down systems in creating wealth.

The *unintended consequence* of each worker and capitalist’s pursuit of self-interest is social progress.
The division of labor

- Smith argues that commodity production can sustain a wider division of labor than other forms of production.
- Because of the inherent productive advantages of the division of labor, the spread of the commodity form increases social wealth.
- A virtuous spiral ensues.
Money

- Commodity circulation requires a counter-circulation of money
- Money is either a particular money-commodity (gold, for example) or its representative as a token or credible promise to pay
- Government can regulate money but does not control or create it
The value of commodity exchange per unit time that can be sustained by a given quantity of money depends on how many transactions on average the money mediates, its velocity.

Credit transactions can raise the average velocity of money and sustain a larger commodity circulation.
U.S. Velocity of Money
The vision of self-regulation

- This abstract theory creates a vision of a self-regulating commodity system
- Once government has secured the rules of the game, property rights and monetary system, the system is supposed to take care of itself
- This is not how things actually work out
Neoclassical economics elaborates the classical view in several respects.

- The maximization of profit or utility requires the equalization of marginal cost and marginal revenue or marginal utility and price.
- *Attained equilibrium* takes the place of gravitation.
Equilibrium vs complexity

- Neoclassical theory replaces the complex, adaptive system of commodity production with attained equilibrium
- This is a (somewhat distorted) version of thermodynamic equilibrium
- In particular the neoclassical view is path-independent or ergodic
Friedrich Hayek, who is an important complexity theorist in his own right, emphasizes the informational aspect of commodity production. Each worker or entrepreneur has only a sliver of the knowledge required for a coherent social allocation; the market forces them to reveal information.
Pitfalls of econophysics 1

- There are many aspects of economic interactions that look like the types of systems physicists excel at analyzing.
- Economic systems have a mixture of positive and negative feedback, complex dynamics and statistical self-organization.
It is tempting to apply the powerful analytical methods of physics to economic institutions and dynamics. Physicists have an advantage conceptually in some aspects of economics. Price is similar to thermodynamic phenomena like pressure.
Monetary and financial institutions, however, are subtle, not widely understood technically, and difficult to grasp.

For example, in any transaction money is conserved: what someone pays someone else gets.
Pitfalls of econophysics 4

- From this simple observation it is tempting to conclude that money is conserved over the whole economy.
- The development of sophisticated credit transactions, however, creates money substitutes that are not conserved.
Pitfalls of econophysics 5

- Credit transactions affect both sides of the balance sheet: the credit is an asset and a liability
- In highly developed capitalist economies credit fluctuations can be quantitative huge on a short time scale
- Foreign exchange transactions exceeded $3 trillion a day in 2007
Pitfalls of econophysics 6

- The New York clearing houses clear $300 million payments a day, less than 5% settled in cash.
- In a virtual sense each transaction is balanced in money terms, but rapid changes in the volume of outstanding credit make the abstract assumption of conservation of money irrelevant.
Some dynamic assumptions that are compelling in physical systems are quite off the mark for economies.

In physical systems, for example, it is plausible to assume symmetry in the interchange of energy among molecules.
In economic systems, however, there is very little symmetry in money payments.

Because of the division of labor most households specialize in the sale of specialized labor services to a small group of buyers.
The same division of labor dictates that household spending is directed to a wide range of goods and services providers. Similar asymmetries are pervasive in firm transactions; suppliers are rarely customers.
The application of powerful physical analytical methods to economic and financial problems requires a thorough understanding of the economic institutions.

This often has the creative effect of spurring the development of new methods adapted to economics.