Farmer, J. Doyne, "Making Sense of Chaos: A Better Economics for a Better World", Penguin, 2024*

J. Doyne Farmer's *Making Sense of Chaos* argues that traditional economic models, which rely on equilibrium-based theories and rational agents, are inadequate for understanding the complexities of modern economies. He proposes *complexity economics*, which applies insights from complex systems science to economic modeling. This approach acknowledges the non-linear, emergent nature of economic phenomena and seeks to improve predictions by using agent-based simulations.

The book begins by discussing the shortcomings of standard economic models in handling crises like the 2008 financial collapse and the COVID-19 pandemic. Traditional models assume rational decision-making and equilibrium, ignoring how economic shocks propagate. For example, the pandemic caused both supply and demand shocks, requiring high-resolution models to understand their ripple effects. Farmer's team successfully advised the UK government using a complexity-based approach, demonstrating the power of this methodology.

A core concept of complexity economics is *emergence*, where macroeconomic trends result from micro-level interactions. Traditional economics assumes rational agents optimizing utility, while complexity economics recognizes *bounded rationality*—people use heuristics and adapt over time. Complexity economics models individuals and firms as diverse, decision-making entities whose interactions shape the economy dynamically.

Farmer contrasts standard economic theories with agent-based models, which simulate economies from the bottom up. These models represent firms, households, and financial institutions as interacting agents, allowing for more realistic simulations. Unlike traditional models that assume equilibrium, agent-based models reveal how economic systems evolve unpredictably, sometimes leading to crises. This approach is especially useful for modeling business cycles, inequality, financial markets, and climate change.

The book also explores financial systems through a complexity lens, critiquing the *efficient market hypothesis*. Farmer argues that markets are often *self-referential*, meaning they generate their own momentum and crises rather than merely responding to external events. He shows that price movements often result from endogenous market dynamics rather than rational responses to news. His research highlights that market inefficiencies persist due to feedback loops, leverage cycles, and investor behavior.

Farmer applies complexity economics to broader societal issues, including climate change. Traditional models, such as William Nordhaus's work on the economic cost of climate mitigation, have underestimated the urgency of action. Complexity-based models, incorporating real-world interactions and feedback loops, provide more realistic assessments of economic and environmental risks.

The book concludes by advocating for more widespread adoption of complexity economics. Farmer calls for better data collection, improved computational models, and interdisciplinary collaboration to refine agent-based simulations. He envisions a future where complexity economics informs policy decisions on financial regulation, inequality, and sustainability, allowing societies to navigate economic turbulence with greater foresight.

Ultimately, *Making Sense of Chaos* is a call for a paradigm shift in economics—one that embraces uncertainty, adaptation, and emergent behavior to create models better suited for the real-world economy. Farmer argues that by integrating complexity science, economics can move beyond outdated assumptions and provide actionable insights for a more stable and just world.

Equilibrium – A state in which supply and demand are balanced, leading to stable prices and market conditions. In traditional economics, equilibrium is assumed to be the natural state of markets.

Emergence – A phenomenon where larger patterns or structures arise from the interactions of smaller, simpler components. In complexity economics, macroeconomic trends emerge from micro-level actions.

Bounded Rationality – A concept in decision-making that recognizes that humans have limited cognitive resources, information, and time, so they rely on heuristics and approximations rather than perfectly rational choices.

Heuristics – Simple, rule-of-thumb strategies or mental shortcuts that people use to make decisions and solve problems quickly, rather than through exhaustive logical analysis.

Agent-Based Models – Computational simulations where individual entities (agents), such as households or firms, interact according to predefined rules. These models help study complex systems and emergent economic behaviors.

Self-Referential – A system or process that refers to itself or is influenced by its own past behavior. In financial markets, this means that market trends can be driven by traders reacting to previous price movements rather than external economic factors.

Endogenous – Originating from within a system rather than being caused by external forces. In complexity economics, endogenous market dynamics drive trends and cycles without needing external shocks.

Feedback Loops – Processes where the output of a system feeds back into the system itself, influencing future behavior. Positive feedback loops reinforce trends (e.g., bubbles), while negative feedback loops stabilize systems.

Leverage Cycles – Economic cycles where borrowing and credit expansion amplify financial growth, followed by contractions when excessive debt leads to instability and crises.

Complex Systems Science – An interdisciplinary field that studies how interactions among components of a system give rise to collective behavior, often leading to unpredictable and emergent outcomes. It is applied to economics, biology, physics, and social sciences.

** ChatGPT 4o summary of my Kindle notes: the vocabulary selection and definitions also by ChatGPT, 30 January 2025*