

Making Sense of Chaos
A Better Economics for a Better World
by J. Doyne Farmer

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- The book of an *honnête homme* (Renaissance man).
- Quasi-encyclopedic knowledge.
- A pleasure to read.

- My summary (besides all the great stories, anecdotes, historical developments, applications):
  - × The (economic, social) world is complex.
  - × One needs models with a similar level of complexity ("*digital twins*").
  - × Once models are complex enough, outcomes are complex too, and fit better the data.
  - × There are ways to numerically deal with that complexity that "standard economics" cannot use.

- My impressions
  - × "*This book is not about criticizing economics*" (page 3): ✓.
  - × "*Standard economics*" is sometimes used as a straw man: fair enough.
  - × The book raises some deep epistemological issues that made me think, and I can only reflect on them as a practitioner.
  - × I will not discuss the sociology of the profession (why Professor P cannot publish research R in journal J or get grant G?), although it matters.
  - × I see much more continuity between Doyne's and standard approach than many on both sides.
  - × This is because standard theory is very plastic.

- I will react as a "standard" macroeconomist, but like to think I am open-minded (but not so open that my brains fall out)
- I have been working on approaches which are somewhat closer to Doyne's approach than most of the "standard macroeconomists".
- For that reason, I am sometimes invited to play the bad cop $\rightsquigarrow$ not really interesting.

- Some thoughts/comments on
  1. Models.
  2. Equilibrium.
  3. Utility.
  4. Bottom-up Approach.
  5. Representative Agent *versus* Symmetric Allocations
  6. Exogenous *versus* Endogenous Fluctuations.
  7. Identification in Macro.
- Nothing here that Doyne does not know nor understand.
- My comments are more methodological than applied to the specific problems addressed in two last parts of the book (financial markets and climate change).

The way I was taught to think of models

The way I was taught to think of models



1. Models

- A model is not the reality.
- All models are wrong (George Box (1976)).
- Occam's razor reigns.
- Joan Robinson (1962): " *A model which took account of all the variegation of reality would be of no more use than a map at the scale of one to one.*"
- Models can be used as laboratories for experiments, but they stay models in the sense of a scale model cars.
- Therefore, calibration looks at aggregate outcomes as much as microdata.

Doyne's view of models

Doyne's view of models



1. Models

- Models should be reality *digital twins*.
- Study the world "as is" and not "as if".
- Example: a model should be populated by two billions households because there are two billions households in the world.
- Super ambitious!
- Principle of *verisimilitude*: Models should fit the facts and their assumptions should be plausible.

1. Models

- Very refreshing perspective: "Yes we can!".
- Doyne: We can because we don't need to solve for complicated fixed points problem (derived from rational expectations) with ABMs. $\rightsquigarrow$ Good point that makes me think.
- Ben Moll's 2024 Economic Journal lecture at the Royal Economic Society meeting shares a somewhat similar view

Heterogeneous Agent Macroeconomics
Eight Lessons and a Challenge

Benjamin Moll
London School of Economics

First part based on joint work with:
Felipe Alves, Greg Kaplan, David Laibson, Peter Maxted, Gianluca Violante

Economic Journal Lecture, RES

In HA models, rational expectations about equilibrium prices make no sense

- Very refreshing perspective: "Yes we can!".
- Can we?
- Is that desirable?
  - × A model builder analogy to chaotic dynamics:
  - × Complex models with slightly different assumptions (or parameters values, etc...) can be super close on past data (or for short horizon forecast), but be arbitrarily different at some point (further horizon, policy experiments, etc...).

1. Models

- Principle of *verisimilitude*: Models should fit the facts and their assumptions should be plausible.
- I could not agree more.
- But fit and plausible are vague enough to make the principle of little use in practice to discriminate between many models.

2. Equilibrium

- At some points, the book could have been more clear about what is an equilibrium.
- In dynamical systems, equilibrium means rest point.
- In dynamical economic models, equilibrium does not mean rest point (steady state).
- Since Hicks 1939 "Value and Capital", there are notions of temporary equilibrium (in period t, given expectations) and intertemporal equilibrium (conditional on an expectation function - that needs not to be rational).
- Equilibrium does not mean supply = demand. This is Walrasian equilibrium, but there are concepts of Non-Walrasian equilibria.

2. Equilibrium

- Equilibrium: (my own definition) "*allocations derived from decentralised decisions such that transactions are made compatible by some mechanisms*".
- Competitive market is one of such mechanism, rationing and waiting lines is another one.
- With that language, ABMs spit out an equilibrium path (an equilibrium of that particular model).
- This is what standard economics means by equilibrium (as far as I understand).

3. Utility

- I think there is too much emphasis on the fact that not using a utility (or objective) function makes ABMs very different.
- If there is learning, revisions are done in order to maximise something (accuracy for example).
- If there is imitation, evolution and genetic selection of heuristics, this is done according to some objective (like fitness, consumption level, etc...)
- Not so different from maximising utility:
  - × Utility is a device to predict choices (which are observable) (Samuelson's revealed preferences).
  - × Max utility is not synonymous of selfishness: one can care about the others.
  - × Max utility is not synonymous of hyper-optimization: one can have cognitive or informational limitations (rational inattention).

4. Bottom-up Approach

- I find particularly confusing and not useful the idea that ABMs are bottom-up and standard econ models are not.
- Take the worst possible example for some: Walrasian General Equilibrium:
  - × Given prices, agents take decisions to max objective under budget constraints.
  - × Prices are such that demand = supply on all markets (here comes centralization, but one can have other stories - concept of core convergence)
- How can something be more bottom-up?
- Even if one assumes a representative agent, that assumption is done *after* decisions are taken.
- Representative agent = as many as you want identical agents, not just one.

5. Representative Agent *versus* Symmetric Allocations

- One can see the macroeconomy as a large game, with the equilibrium concept being Nash Equilibrium.
- One can assume that agent are identical and restrict to symmetric equilibria.
- Equilibrium allocations properties will be very different from a model with only one agent.

6. Exogenous *versus* Endogenous Fluctuations

- Let ε be the shock and Y the endogenous variable.

$$\mathcal{R} = \frac{\sigma_Y^2}{\sigma_\varepsilon^2}$$

- $\mathcal{R} = \infty$: endogenous fluctuations.
- $\mathcal{R} = 1$: the model explains nothing.
- $\mathcal{R}$ large and $< \infty$: perhaps good enough to learn something.

7. Identification in Macro

- Not discussed in the book.
- In macro, we cannot do Randomized Controlled Trials.
- It is also hard to find quasi-experimental evidence.
- Therefore, observing causal links is very hard.
- It is hard for standard economics, and it seems to me that it is as hard for ABMs.

To Conclude

- A lot to learn from the book.
- I was already (partially) convinced .
- It will make me think more.

