Responses to Professor Yu Chen

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Question 1

Could you please provide one or two examples of how large-scale scientific computing has been successfully employed to address a particular challenge in the fields of economics or finance?

Disclaimer: economists never "successfully" overcome challenges

Example. Economic theory $\Longrightarrow$ tax firms that generate negative externalities

Studies have shown that carbon taxes reduce greenhouse emissions

But Australia has no carbon tax

- carbon taxes reduce profits at powerful corporations
- carbon taxes raise electricity prices — political resistance

Economists can only point out implications

- If you choose action A, you will probably get outcome B

A useful large-scale computational study

Chetty et al. Nature, 608 (7921): 108-121, 2022

A study of

- 71 million facebook users
- 21 billion friendship connections

This data correlated with measures of economic mobility

Key finding: cross-class friendships are a stronger predictor than

- school quality
- family structure
- racial composition of neighborhoods

One outcome: founding of Opportunity Insights

- identify barriers to economic opportunity
- develop solutions that improve mobility

Partnerships with

- Govt agencies
- Schools
- Colleges

Using insights to develop effective policy

Q2

Is it possible that incorporating a more realistic representation of human expectations could push the Cobweb model into a chaotic regime?

Given that chaotic systems are highly sensitive to initial and boundary conditions, would this make long-term predictions using economic models less reliable?

What is a realistic representation of human expectations?

- changing over time
- will be increasingly AI driven
- hard to measure and even harder to model

Regarding chaotic regimes, it is possible.

- Chiarella (1988)
- Matsumoto (1996)
- Brock and Hommes (1997), etc.

Also important: more realistic models of

- learning through interacting with a system
- learning through interacting with peers
- social effects
- herding behavior

All of these can lead to complex dynamics

Does this make long term predictions less reliable?

- Answer: yes and no

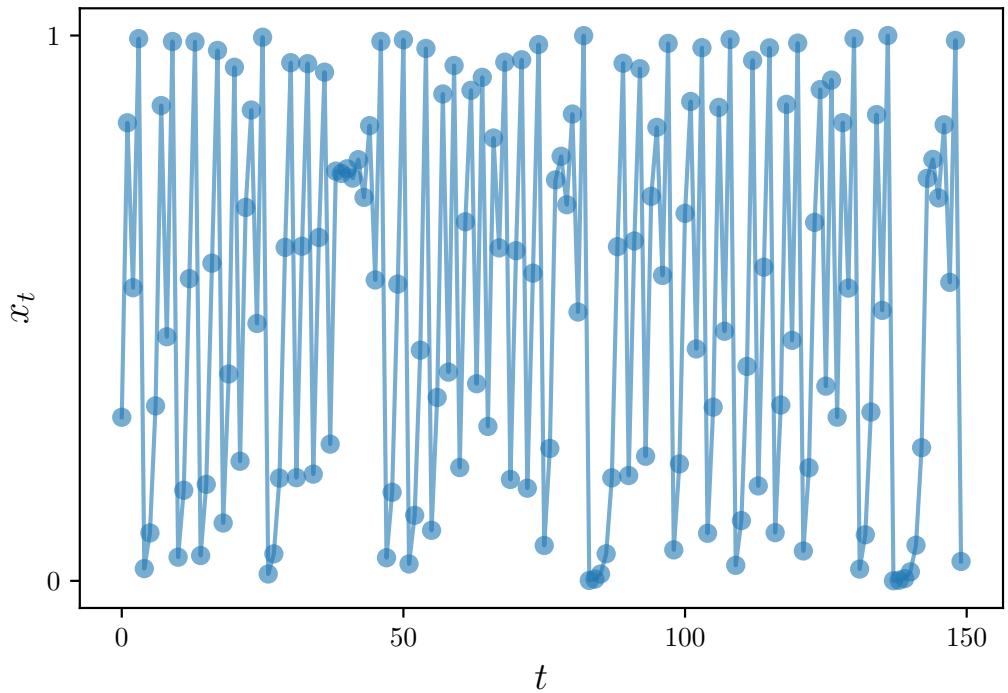
Economists cannot forecast individual entities (traders, firms, etc.)

But they can potentially predict distributional quantities

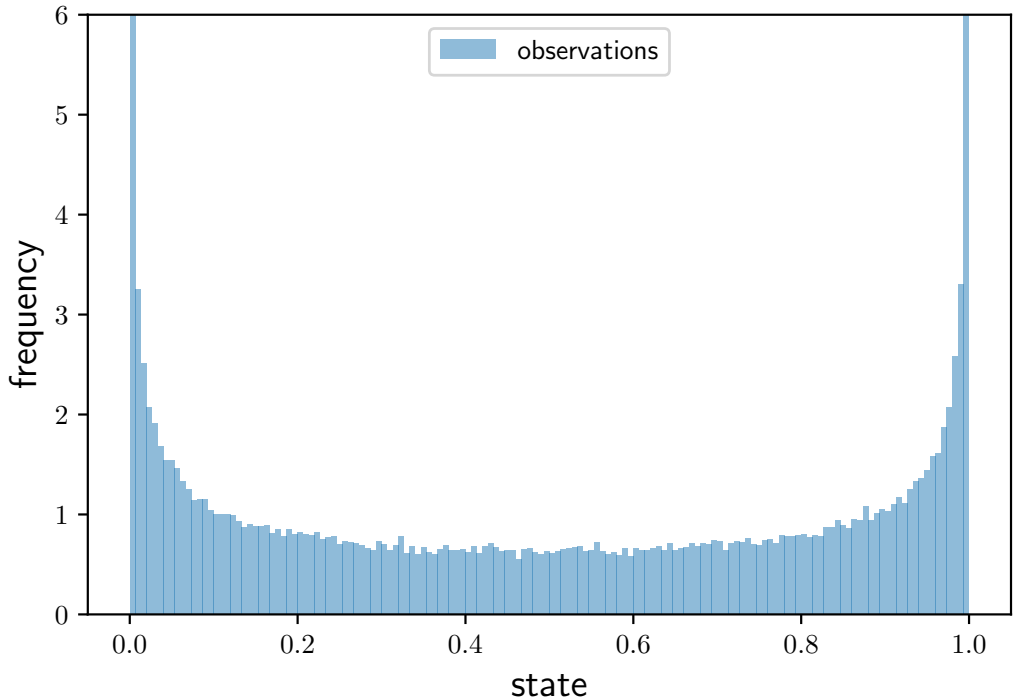
- cross-sectional averages, dispersion, etc.

Even in chaotic models, we often have stability in cross-sections (fixed points of Perron–Frobenius operators)

Example. Quadratic map, time series



Example. Histogram



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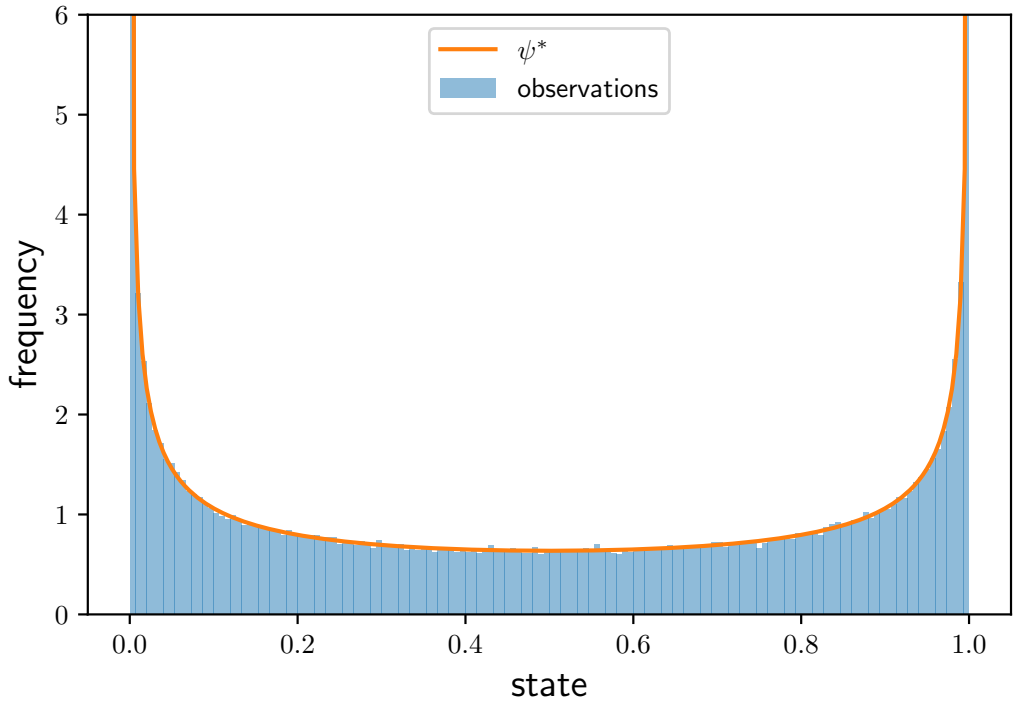

Q3

In computational fluid dynamics, emerging research is exploring the replacement of robust computations with surrogate AI solvers.

Can we anticipate that AI might provide answers to complex economic problems if we forego understanding the mechanisms of economic phenomena?

Yes, and this can be valuable!

Example. Chinco, Clark-Joseph, Ye, Journal of Finance, 2020

- Rolling 1 minute ahead return forecasts using lagged cross-section of returns
- Machine learning methods based on sparsity / shrinkage
- Significantly improved out-of-sample fit

The model is too complex for simple interpretations

But it suggests that good predictors are correlated with news about fundamentals