What economic researchers do

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Economics is a tool for recognizing patterns in data and interpreting them in ways that distinguish cause from coincidence.

To explain research in physics, Richard Feynman used a chess metaphor. An astrophysicist is in the position of someone who does not know a game called chess and who observes people who happen to be playing chess. From incomplete observations of the players' activities, the observer's job is to discover the players' purposes and the rules of chess. For Feynman, "rules of the game of chess" stand in for laws of physics.

Feynman's metaphor is a literal description of what scientific economists do. Like astrophysicists, we acquire non experimental data generated by processes we want to understand. John

von Neumann defined a *game* as (1) a list of players, (2) a list actions available to each player; (3) a list of how payoffs accruing to each player depend on the actions of all players; and (4) a timing protocol that tells who chooses what when. A *strategy* is a rule that tells you what to do in different situations that you might face. John Nash gave us a powerful definition: a collection of strategies, one for each player, is an *equilibrium* of a game if no player wants to change his strategy.

Like Feynman's metaphorical physicist, our task as economists is to infer a "game" from observed data. But then we want to do something that physicists don't: to think about how different "games" might produce improved outcomes.

In physics, according to Laplace, the past causes the future.

> We may regard the present state of the universe as the effect of its past and the cause of its future. *Marquis de Laplace*

Things are different in economics.

What we *expect* other people to do *later* causes what we do *now*.

We typically have personal theories about what other people *want* that we use to forecast what they do. When we have good personal "models of other people", then what other people are likely actually to do will determine what we expect them to do. This line of reasoning delivers a sense in which "the future causes the present" in economic systems. An arrow of time points backwards in economics.

Here are some examples.

- Bank runs: I will run on a bank if I expect that other people want to run, and *vice versa*. Without deposit insurance, depositors have incentives to avoid banks vulnerable to runs. With deposit insurance, depositors don't care and won't run.

- Deposit insurance: if governments insure bank deposits, their owners want banks to become as big as possible and as risky as possible, while depositors don't care.

- Unemployment and disability insurance. There are trade-offs between insuring people against bad luck and providing

adverse incentives for them to provide for themselves.

- Central government bailouts of subordinate governments. Insurance versus adverse incentives.

- Reputation of public and private actors. My reputation is what others expect me to do. I face choices about whether to confirm or disappoint their expectations. Those choices have consequences. Janet Yellen and other central bankers think a lot about that.

How we learn

Like physicists, we use models and data to learn. We don't learn new things until we appreciate that our old models were defective.

This explains how we have learned so many things from past depressions and financial crises and are learning more from current ones, by constructing new models in light of how old ones have failed.

I want to close by sharing with you some quotes about science that I like.

> "I hope it will not shock experimental physicists too much if I say that we do not accept their observations unless they are confirmed by theory." *Sir Arthur Eddington, Sept. 1933*

> "The course of a scientific discipline gets shaped in different ways depending on whether theories lead data or data lead theories. A theory tells what to look for, and you either find it or you don't. If you find it, you move on to the next open question. If you have no theory, you'll start collecting as much data as you can and hope that patterns emerge. But until you arrive at an overview, you're mostly poking around in the dark." *Death by Black Hole, by Neil de Grasse Tyson*

> "It's the best possible time to be alive, when almost everything you knew is wrong." *Tom Stoppard, Arcadia, Act I, scence 4*

"No progress without paradox." *John Wheeler*

"The universe cannot be read until we have learned the language and become familiar with the characters in which it is written, which is a mathematical language." "Without these, one is wandering in a dark labyrinth." *Galileo, quoted in Alice Hoffman's "The Marriage of Opposites," p. 112.*