

## Economists' Grail: A Post-Crash Model

By MARK WHITEHOUSE

Physicist Doyne Farmer thinks we should analyze the economy the way we do epidemics and traffic.

Psychoanalyst David Tuckett believes the key to markets' gyrations can be found in the works of Sigmund Freud.

Economist Roman Frydman thinks we can never forecast the economy with any accuracy.

Disparate as their ideas may seem, all three are grappling with a riddle that they hope will catalyze a revolution in economics: How can we understand a world that has proven far more complex than the most advanced

economic models assumed?

The question is far from academic. For decades, most economists, including the world's most powerful central bankers, have supposed that people are rational enough, and the working of markets smooth enough, that the whole economy can be reduced to a handful of equations. They assemble the equations into mathematical models that attempt to mimic the behavior of the economy. From Washington to Frankfurt to Tokyo, the models inform crucial decisions about everything from the right level of interest rates to how to regulate banks.

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## Researchers' Grail: Finding a Post-Crash Economic Model

In the wake of a financial crisis and punishing recession that the models failed to capture, a growing number of economists are beginning to question the intellectual foundations on which the models are built. Researchers, some of whom spent years on the academic margins, are offering up a barrage of ideas that they hope could form the building blocks of a new paradigm.

"We're in the 'let a thousand flowers bloom' stage," says Robert Johnson, president of the Institute for New Economic Thinking, launched last year with \$50 million from financier George Soros, a big donor to liberal causes who has long been a vocal critic of mainstream economics. The institute so far has approved funding for more than 27 projects, including efforts by Messrs. Farmer and Tuckett aimed at developing new ways to model the economy.

Some of academia's most authoritative figures say the new ideas are out of the mainstream for a good reason: They're still very far from producing a model that demonstrably improves on the status quo.

"I guess I'll wait until I see these models and what they can and cannot do," says Robert Lucas, an economist at the University of Chicago who won the Nobel Prize for his work on "rational expectations," the concept at the very heart of modern orthodoxy.

New York University's Mark Gertler, who with now-Federal Reserve Chairman Ben Bernanke did ground-breaking work in the 1980s on how financial troubles can trip up the economy, says economists already have many of the tools they need to fix the current models.

"It strikes me as not productive to say that all we have done is a complete waste," he says. "The profession is extremely competitive. If you have a better idea, it's going to win out."

Today's models emerged from a revolution of their own. In the 1970s, economists were struggling to figure out how policy moves, such as raising taxes or cutting interest rates, could change how people behave. They were also eager to subject their own reasoning to the unforgiving judge of mathematical logic.

So they populated their models with rational people who can calculate the value of various possible moves and choose the optimal path. A person deciding whether to buy a car, for example, would take into account the potential return on investing the money, the probability that car prices will rise, and the chances that an increase in tax rates will cut into her disposable income.

By translating peoples' preferences into equations, and finding the point at which they meet those of firms and other players, the models forecast an exact trajectory for the economy. That feature makes them very attractive to economists, who can plug in a change in interest rates and see precisely how the move might affect an entire country's output for the next few years.

The problem, says Mr. Farmer, is that the models bear too little relation to reality. People aren't quite as rational as models assume, he says. Advocates of traditional economics acknowledge that not all decisions are driven

### Decoding the Model

Economic models, including those used at the world's most powerful central banks, seek to reduce the entire economy to a handful of mathematical equations. Here, for example, is an equation describing consumer behavior from a European Central Bank model.

At any given time, people's CONSUMPTION will depend largely on how much they think they'll be able to CONSUME IN THE FUTURE. If, for example, they think taxes will rise, they'll save more now so they won't have to cut back as much on spending later.

Higher INTEREST RATES will encourage people to save more and spend less.

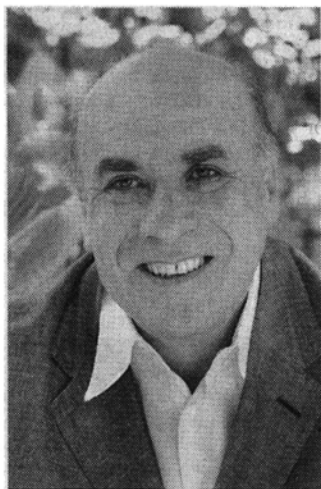
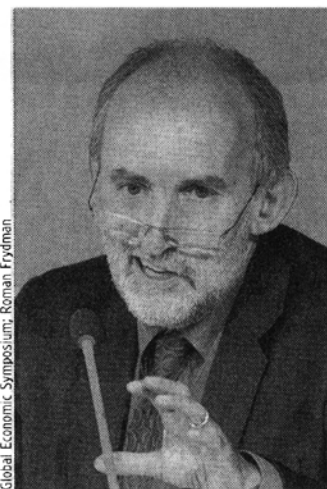
$$\hat{C}_t = \frac{h}{1+h} \hat{C}_{t-1} + \frac{1}{1+h} \hat{C}_{t+1} - \frac{1-h}{(1+h)\sigma_c} (\hat{R}_t - \hat{\pi}_{t+1}) + \frac{1-h}{(1+h)\sigma_c} (\hat{\epsilon}_t^b - \hat{\epsilon}_{t+1}^b)$$

The effect of interest rates will depend on people's WILLINGNESS TO CHANGE their spending patterns and their expectations of FUTURE INFLATION.

VARIOUS FACTORS NOT INCLUDED IN THE MODEL, such as consumers' moods, can encourage them to spend now rather than later.

People's HABITS can also influence how much they react to changes in their expectations, to changes in interest rates, and to other factors.

Source: WSJ research



David Tuckett, left, and Roman Frydman are working on new models.

by pure reason. Mr. Farmer sees a perhaps greater flaw in the models' mathematical structure. A typical "dynamic stochastic general equilibrium" model—so called for its efforts to incorporate time and random change—consists of anywhere from a few to dozens of interlinked equations, which must agree before the model can spit out a solution. If the equations get too complex, or if there are too many elements, the models have a hard time finding the point at which all the players' preferences meet.

To keep things simple, economists leave out large chunks of reality. Before the crisis, most models didn't have banks, defaults or capital markets, a fact that proved problematic when the financial crisis hit. They tend to include only households, firms, central banks and the government. They also commonly use a single equation to represent each player, impairing the models' ability to explain the unexpected outcomes that can emerge when millions of different people interact.

"You are limited by what you can solve," says Mr. Farmer. "It puts the whole enterprise in a straitjacket."

His proposal: Create a richly complex, computer-based simulation of the economy like those scientists use to model weather patterns, epidemics and traffic.

Given enough computing power, such "agent-based" models can include millions of individual players, who don't have to be rational or agree with one another. Instead of equations that must be solved, the players have open-ended rules of behavior, such as, "If I've just turned 55 and I'm feeling blue, I'll buy a sports car."

A leading expert on complex systems at the Santa Fe Institute, a nonprofit think tank, the 58-year-old Mr. Farmer has spent much of his life trying to figure out how to predict the future.

In the 1970s, he and a group of graduate students from the University of California at Santa Cruz managed to outsmart Las Vegas casinos, developing software and portable computers that clocked the velocity of the ball and rotor on roulette wheels. Later, he made a small fortune as a partner in Prediction Company, which applied some of what he learned at the roulette table to financial markets and was ultimately sold to the Swiss bank UBS AG.

Some policy makers believe the agent-based approach to modeling the economy has promise. "I think the whole profession is much more open to these new approaches than it has been at any time in the past 20 years," says Simon Potter, director of economic research at the Federal Reserve Bank of New York.

The tough part is coming up with rules that bear some relation to reality. To that end, Mr. Farmer and three economists—Robert Axtell of George Mason University, John Geanakoplos of Yale University and Peter Howitt of Brown University—are hoping to involve dozens of experts on the behavior of consumers, investors and firms in a massive model-building project. Inputs could include everything from historical data to interviews.

"It's going to be a very hard job that will require a lot of time and persistence," says Mr. Farmer. He estimates that a proper agent-based model could take many years to build, but would cost a tiny fraction of the \$1 billion a year the government spends on the National Weather Service. "This is not something you can do in your kitchen."

Writing better rules for human behavior will require researchers to dig deeper into the human psyche, says Mr. Tuckett, a professor at University College London. Specifically, he's looking into how unconscious needs and fears can cause big swings in financial markets.

The field of economics has already borrowed from psychology to help explain the sometimes irrational behavior of people and markets. Psychologist Daniel Kahneman shared a Nobel Prize in 2002 for his work identifying the ways in which humans systematically overestimate or underestimate risk.

Mr. Tuckett goes one leap further. Extensive interviews with money managers have led him to posit that because certain financial instruments are so volatile and hard to value, they trigger humans' tendency to fantasize. Borrowing language from Sigmund Freud, he calls such financial assets "phantastic objects," which people see alternately as capable of fulfilling their dreams of wealth and power or utterly worthless and repulsive.

Economic models, argues Mr. Tuckett, need to account for the way peoples' behavior changes with the psychological context. When they're in fantasy mode,

they'll place astronomical values on anything from Dutch tulips to dot-com stocks to complex mortgage securities. When they realize the folly of their ways, they'll focus only on the flaws. He hopes to create a survey of investors' state of mind, which could be used as an input for an agent-based model such as the one Mr. Farmer is developing.

The 63-year-old psychoanalyst, who is working with Manchester Business School finance professor Richard Taffler to develop a new field of "emotional finance," says it could be a long time before his ideas reach the mainstream.

"Economists have been terrified of psychology," says Mr. Tuckett. "They believe that if they take it on board, they'll have to go interviewing people and will never be able to make generalizations."

Mr. Frydman, a professor at New York University, is accustomed to the role of an outsider. The 62-year-old economist says that even as a graduate student in the 1970s at Columbia University, he didn't buy into the concept of rational expectations—a stance that has left him to pursue a career on the academic margins for more than three decades.

The main flaw in the dominant models, he says, is the same feature that makes them so attractive to policy makers: Their ability to make precise predictions. To generate their predictions, the models assume that people, firms and other players always make decisions in the same way. The players must also share the same beliefs about the exact probabilities of various outcomes, such as a rise in car prices or tax rates.

"It's like socialist planning," says Mr. Frydman. "If we really knew that much, we could have Communism and God knows what." Capitalism works better than other systems, he says, because it lets people disagree about the future and profit from their insights—rational behavior that models don't accommodate.

Mr. Frydman doesn't offer a better way to make predictions. Rather, he believes economists

and policy makers must come to terms with the limits of their knowledge.

Consider the housing market. If prices far exceed historical averages, as they did in 2006, we can know there's an elevated risk of a crash. What we can't know, says Mr. Frydman, is when that crash will occur, how exactly consumers will respond, or how much a given decrease in interest rates might help.

In Mr. Frydman's view, the best that policy makers can do is try to limit extreme swings. A central bank might, for example, set indicative parameters for the prices of assets such as stocks, bonds and houses. If prices exceed those parameters, potential buyers will be forewarned that they're taking on added risk of a big loss—and might even think twice about doing so.

Developed with economist Michael Goldberg of the University of New Hampshire, Mr. Frydman's concept of "imperfect knowledge economics" has some influential admirers, including Nobel Prize-winning economist Edmund Phelps of Columbia University.

The ideas of Messrs. Farmer, Tuckett and Frydman are just a few of the myriad being hatched around the globe.

Many economists think the next big idea will more likely come from the ranks of younger Ph.D. candidates, who are producing reams of work examining the financial crisis. Established academics—such as Mr. Gertler, Nobuhiro Kiyotaki of Princeton, Marcus Brunnermeier of Princeton, Michael Woodford of Columbia and Robert Hall of Stanford—are making progress on including banks, financial markets and even a bit of irrationality in traditional models.

Mr. Farmer says he thinks the traditional models will always be useful for certain types of analysis, but isn't optimistic they'll provide the whole solution. "Economic forecasts have never been very good, and it's not clear that if we stick with the methods we're pursuing we'll do any better," he says. "We need to try something new."