Modelling vs. intuition

—by Shankar Vedantam

Last year, as the financial meltdown was getting underway, a scientist named Yaneer Bar-Yam developed a computer model of the economy. The model used virtual actors, which allowed Bar-Yam to do what regulators cannot do in real life—change the way the actors had behaved and then study how those changes rippled through the system.

The fundamental principle behind the model was simple. Human beings regularly solve problems by imagining how particular behaviors can lead to specific outcomes. Regulators, managers, and leaders try to do the same thing on a bigger scale. But in a system as complex as the economy, where feedback loops of rumor, fear, and misinformation regularly trigger panic and herd behavior, the ability of individuals to forecast outcomes can diminish rapidly. The normal rules of human intuition break down: A positive intervention—the federal government announcing it is going to pump trillions of dollars into the economy—can be greeted by a plunge in the stock market. Trivial things can get amplified and assume gigantic proportions.

Bar-Yam wanted to understand why the economy was so unstable. Commentators were focused on the housing crisis, but Bar-Yam was not sure whether the bursting of the real estate bubble was upstream or downstream of the instability in the economy. It seems intuitively obvious to say the housing crash destabilized the economy, but isn't it possible that some underlying instability in the economy preceded the housing crash—and amplified its effects? If you take away one of the supports of a house built on stilts and a storm knocks the house down, the problem is not the storm but the missing support. If you rebuild the house on its shaky base—but put in expensive new storm windows—you are unlikely to fare better when the next storm rolls around.

Bar-Yam's model suggested a different explanation for the instability in the economy: In July 2007, the Bush administration eliminated a 69-year-old regulation known as the uptick rule. It had been put in place by Joseph Kennedy, the first commissioner of the Securities and Exchange Commission, who had himself profited from the wild economic gyrations of the previous decade. (Kennedy's appointment as SEC chief was tantamount to installing a fox to guard the henhouse, or, as President Franklin D. Roosevelt would say, "it takes a crook to catch a crook.)

The uptick rule was designed to prevent bear raids: If a powerful investor suddenly sells a large number of shares in a company, he or she can temporarily create a situation in which the supply of shares far outstrips the demand. The fall in the share price can be greatly amplified by feedback loops of rumor and misinformation. Once the stock's value is in the toilet, the crooked investor can swoop in and buy the shares back at an artificially discounted price.

Before eliminating the uptick rule in 2007, the SEC conducted a real-life test of its utility. It eliminated it for one-third of the stocks that make up the Russell 3000 index and, upon analysis, it decided that the rule could be struck without causing much harm. Bar-Yam's model, however, suggested that the elimination of the uptick rule had created instability in much the same way as removing one of the supports of a house. The housing crisis was the storm that happened to knock the house down. Mary Schapiro, the incoming head of the SEC in the Obama administration, has promised to revisit the uptick rule.

Several caveats are in order when it comes to the computational analysis, which was conducted at Bar-Yam's New England Complex Systems Institute. Computer models are not oracles; they cannot tell you with certainty that a change in a system causes a particular outcome. In other words, Bar-Yam and his co-author Dion Harmon might be wrong about the uptick rule. Also, intuition may have preceded them, as Jim Cramer and other commentators of the TV show "Mad Money" had called for the elimination of the uptick rule months before the computer analysis came out.

The virtue of computational models is that when you are confronted by a dizzying array of potential problems, they can tell you where to focus your attention. If market regulators have dozens of options, a model can tell them which are more likely to work. When it comes to houses, stilts, and storms, it is easy to see that the missing stilt is the problem and not the storm windows. In dealing with a complex economy such as ours, it is not always clear which problems precede others, because everything in the system is interconnected.

In recent years, computational models have been applied in social contexts as diverse as battlefield situations, air traffic control, and public health programs. The common theme is that leaders in every case are asked to make decisions in situations with uncertain outcomes.

At the University of Maryland, for example, a computational model was built to predict how different situations amplify the likelihood of violence in the Middle East. One conclusion of the model is that the militant group Hezbollah is more likely to lob rockets into Israel when elections are held in Lebanon; presumably, the attacks are meant to impress a domestic audience. The conclusion is not necessarily counter-intuitive. A skilled political watcher could have told you the same thing. But if pundits intuitively know how 100 different issues might influence outcomes, computational models can tell you the relative importance of each variable.

Another model by the Maryland group shows that infant mortality levels predict the likelihood of political instability in a country better than any other single measure. Again, this is not a shocker. Anyone can guess that countries with poor public health are on less secure footing. What the model does is tell us to pay preferential attention to infant mortality over, say, hunger or poverty or religious strife.

Our culture celebrates intuitive leaders who make brilliant calls—even when we suspect their success was largely luck. Computational models, which speak the language of scientific doubt, are less sexy, but they can tell a president who takes empirical evidence seriously where public health dollars, battlefield troops, and financial interventions can have the greatest impact. [*The Washington Post*, February 16, 2009]