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Best Guess

Economists explore betting markets as prediction tools

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During a highly charged week in Washington, D.C., last July, a research project sponsored by the Department of Defense sparked a furious outcry from prominent politicians and was then hastily axed by the Pentagon. The project, known as the Policy Analysis Market (PAM), was to have been a market in which participants could wager on Middle East events, say, the gross domestic product of Syria in coming years or the political instability of Iran. The project's developers, however, had made a public relations faux pas. On their Web site, they invited participants to suggest additional topics for markets and speculated that those suggestions might include terrorist attacks and political assassinations. Critics labeled the project a "terrorism futures market" and denounced it as morally repugnant and grotesque.

Within the week, John Poindexter, the official heading the office sponsoring the project, had announced his resignation, and the department had cut off funds not just for the PAM project, but also for all of its research into markets as prediction tools.

On the face of it, having people bet on disasters sounds downright appalling. However, the core idea of the project rests on solid scientific foundations. Studies over a 20-year period have amassed a wealth of evidence that under the right circumstances, carefully designed markets can be among the most effective prediction tools.

Economists have found, for instance, that orange juice futures predict the weather in Florida better than conventional weather forecasts do. And on the day the space shuttle Challenger exploded in 1986, Wall Street traders correctly guessed within minutes of first hearing the news which of the four main suppliers had provided the faulty part, whereas a blue-ribbon panel of experts took months to come to the same conclusion.

Markets, such as the New York Stock Exchange, distill the collective wisdom of millions of individuals into a single statistic, and they do so with amazing efficiency. In contrast to other information-gathering institutions, such as committees and polls, markets require participants to put hard dollars behind their opinions. What's more, markets reward the people who are right, not those who lie convincingly or are loudest or most aggressive or who have the longest string of titles after their name.

"In a market environment, people who don't know anything will lose on average and will take the hint and go away," says Robin Hanson, an economist at George Mason University in Fairfax, Va. and a consultant for Net Exchange, the San Diego company that was to have run PAM.

Some markets have been engineered for the express purpose of providing forecasts on matters beyond the price of commodities. The Hollywood Stock Exchange, a Web-based virtual market that makes predictions about Hollywood stars and movies, correctly guessed

35 of last year's 40 Oscar nominees in the main categories. For more than a decade, an academic project called the Iowa Electronic Markets has predicted the outcomes of presidential races better than 75 percent of the polls do. And in a recent trial, a market specially designed to predict sales of Hewlett-Packard products performed better than the company's internal sales forecasts did.

Some economists hold that such markets could be used to assess potential consequences of policy decisions by a government, corporation, or other institution. "Different people know different things about the consequences of social policies, and to make good decisions, we have to pull all that information together," Hanson says. "The market technology has enormous potential to help us address the most important questions we think about."

Market wind tunnels

To get a sense of how future-predicting markets operate, consider the Iowa Electronic Markets, which is based at the University of Iowa in Iowa City. Suppose two candidates, A and B, are facing off. Anyone can enter the market by putting some money into the pool; for each dollar an investor puts in, he or she receives two contracts, one of which will pay $1 if candidate A wins, and one of which will pay $1 if candidate B wins.

Once contracts are in circulation, participants can buy and sell them to each other at a trading Web site. If the going rate for a candidate A contract is 53 cents, for instance, then the market as a whole thinks candidate A has a 53 percent chance of winning. Once the election results come out, participants cash in their winning contracts from the pool—the more contracts of the winner they have, the more money they make.

In addition to these winner-take-all markets, the Iowa project runs markets in which participants can bet on what share of the vote each candidate will receive.

The research that led to future-predicting markets stems from the 1960s and 1970s, when Vernon Smith and Charles Plott, now of George Mason University and the California Institute of Technology in Pasadena, respectively, began using laboratory experiments to study different market designs. In the early 1980s, Plott and Shyam Sunder, now of Yale University, tested how well markets aggregate information by designing a set of virtual markets in which they carefully controlled what information each trader had.

In one experiment, Plott and Sunder permitted about a dozen study participants to trade a security, telling them only that it was worth one of three possible amounts—say, $1, $3, or $8—depending on which number was picked by chance. Plott and Sunder then gave two of the participants inside information by telling them which amount had been selected. Traders couldn't communicate with each other; they could only buy and sell on the market.

"The question was, Would the market as a whole learn what the informed people knew?" Plott says. "It turned out that it would happen lightning fast and very accurately. Everyone would watch the movements of the market price, and within seconds, everyone was acting as if they were insiders."

In another experiment, Plott and Sunder gave the inside traders less-complete information. For instance, if the outcome of the random pick were $3, they would tell some traders that it was not $1, and others that it was not $8. In these cases, the market sometimes failed to

figure out the true value of the security.

However, if Plott and Sunder created separate securities for each of the three possible outcomes of the random pick instead of using one security worth three possible amounts, the market in which some traders had incomplete tips succeeded in aggregating the information.

The studies established that, at least in these simple cases, markets indeed can pull together strands of information and that different setups affect how well they do so.

This type of experiment gave researchers a "wind tunnel" in which to test different market designs, says John Ledyard, a Caltech economist who chairs the board of Net Exchange. "With experiments, we're starting to zero in on what really works," he says.

Market logic

Armed with Plott and Sunder's insights, researchers in the late 1980s started designing real-world markets whose primary purpose was to aggregate information and predict the future. The Iowa Electronic Markets provided evidence that so-called idea-futures markets could provide a valuable service.

Why the Iowa markets worked so well was at first a mystery. "We know our traders are biased and mistake-prone, but somehow the markets manage to work," says Thomas Rietz, one of the University of Iowa professors who direct the market.

Market participants, recruited at a Web site and the University of Iowa's business school, are far from a representative sample of voters. By an overwhelming margin, they are young, well-educated, high-income, Republican males. What's more, they tend to be unreasonably optimistic about their preferred candidate's chances, and they trade accordingly.

On closer inspection, however, the Iowa team has found that traders fall into two categories. Most participants hold on to their shares, trading rarely and then tending to accept someone else's price. About 15 percent of traders, however, trade frequently and post offers rather than accept other people's offers. These "marginal" traders are less biased than the other traders are, the researchers report.

"The people who drive the markets—and therefore the predictions—are trading with their heads, not their hearts," says Robert Forsythe, another member of the Iowa team.

The other 85 percent of traders do perform an important function. To put it bluntly, they're the suckers willing to trade with the better-informed participants. "You need some amount of unintelligent money in the pool," says Justin Wolfers, an economist at Stanford University. "That's the honey that draws in intelligent traders."

The Iowa markets typically have hundreds or even thousands of traders. Economists generally expect these so-called thick markets to form better predictions than do thin markets, which have fewer traders. Their reasoning goes like this: The more traders there are, the more information is potentially available, and the more opportunities there are for trading.

However, Plott and Kay-Yut Chen of Hewlett-Packard Laboratories have demonstrated that under the right circumstances, even thin markets can make accurate predictions. In their experiments, markets consisting of about a dozen Hewlett-Packard employees predicted future sales better than the company's usual methods of market analysis did.

Plott and Chen made up for the small number of participants by the care with which they selected them. They chose people across a wide range of the company's departments, to maximize the different sources of information available to the market. They also included some uninformed speculators, both to provide liquidity to the market and to provide watchful eyes against illogical market behavior.

To illustrate that idea, consider the example of an election market with candidates A and B. Perhaps one informed trader believes candidate A has a 90 percent chance of winning, and so bids shares of A up to 90 cents. Meanwhile, another trader pushes B's shares up to 90 cents. This set of prices is illogical, because if one candidate's chances of winning are 90 percent, then the other's chances should be 10 percent. If A and B are both selling for 90 cents, speculators have a golden opportunity: They can buy a packet consisting of one share each of A and B from the pool for $1 and immediately sell the shares on the market for $1.80. Speculators will pounce and, in the process of trading, will push the prices down to a more reasonable level.

"It's useful to have people around noticing inconsistencies and making money by making the market consistent," Plott says.

Bubble-proof markets

Of course, one potential objection to idea markets is that markets have been known to make bad predictions, some of them whoppers. During the dot-com boom, for instance, the stock market drastically overestimated the immediate promise of the information-technology industry. Many economists view the Internet boom as a bubble, in which speculators buy stock not because they think it will be valuable in the long run but because they expect to sell it quickly for a profit.

"Maybe I buy Amazon stock at $100 because I think you'll buy it next week for $110, and then you buy it from me because you think you'll be able to sell it for $120, and so on," Wolfers says. "Eventually, the whole thing collapses."

Idea futures may be less prone to bubbles because they usually terminate on a specified date. "If the security is about whether the Raiders will win the Superbowl, we all know it will be resolved on a particular date," Wolfers says. "No one wants to be left holding the baby on that date."

Another potential objection to idea futures markets is that some participants might try to affect prices for reasons other than profit, such as to promote a particular candidate in an election market. However, the Iowa Electronic Markets suggest that this won't be a big problem. Attempts to manipulate those markets have failed miserably, Rietz says.

For instance, in the 2000 presidential market, several people opened accounts on the same day, and each invested $500—the maximum allowed—in Patrick Buchanan shares. Buchanan prices briefly spiked, but well-informed traders then seized the opportunity to

profit off the manipulative traders and by the end of the day, the effect of the investments had virtually vanished.

In an experiment in the same market, economists Koleman Strumpf of the University of North Carolina at Chapel Hill and Timothy Groseclose of Stanford University made random purchases. "The market would typically undo what we had done in a few hours," Strumpf says. "People weren't being fooled by our crazy investments."

The policy-analysis market

Many questions remain about idea markets. Hanson and Ledyard are tackling two of them: What types of predictions can a market make successfully? and Which market designs work best?

Hanson and Ledyard have come up with a new structure that, they say, performed better in studies with volunteer traders than previous designs did at squeezing the most information out of a small number of participants. The design incorporates two new elements.

With the first element, called conditional bidding, participants can bet on outcomes that emerge from complicated combinations of circumstances, such as, "What are George W. Bush's chances of being reelected if Howard Dean loses the Democratic primary?"

The other new element, called the market maker, provides an automated bidder that is always available to trade with anyone who comes to the market. That enables the market to remain liquid even when there are few participants. The tricky part, Hanson says, was ensuring that the automated market maker didn't lose tremendous amounts of money.

The next step would have been to test their market structure in a real-world application. Unfortunately, Hanson and Ledyard didn't do a good job of predicting the future themselves. Their proposed test bed was the ill-fated Policy Analysis Market.

Despite opponents' claims, PAM was never intended to predict terrorist attacks, Hanson says. For that role, it probably would be self-defeating because terrorists themselves could monitor such a market and switch their tactics accordingly. Rather, Hanson says, the original focus was to be on the social, economic, and political future of Middle Eastern countries.

Hanson, Ledyard, and the people at Net Exchange were aware that the project might spark controversy. Even so, they didn't expect what actually happened: Senators held a press conference denouncing the project, and the Defense Department, the very next day, summarily canceled all funding. "The science was irrelevant in the flap in Washington," Ledyard says.

The uproar turned all research on idea markets into political poison. The Defense Department canceled not only PAM but also projects using markets to predict how large a severe acute respiratory syndrome outbreak is likely to be next year and how soon engineers will reach certain technological milestones in building next-generation vehicles.

Researchers in the field are philosophical about the abrupt reversal of their fortunes. It is probable, they say, that private funding will pick up the slack, because many corporations

are interested in the potential of idea markets.

Perhaps the next market should focus on the question, "Do idea futures have a strong future?" According to the insiders, at least, the answer appears to be a resounding yes.

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References and Sources

References:

Chen, K.-Y., and C.R. Plott. Preprint. Information aggregation mechanisms: Concept, design and implementation for a sales forecasting problem. Available at http://www.hpl.hp.com/personal/Kay-Yut_Chen/paper/ms020408.pdf.

Hanson, R. 2003. Combinatorial information market design. *Information Systems Frontiers* 5(No. 1):110-119. Available at http://hanson.gmu.edu/combobet.pdf.

_____. 1999. Decision markets. *IEEE Intelligent Systems* 14(May/June):16-19. Available at http://hanson.gmu.edu/decisionmarkets.pdf.

Further Readings:

2002. The Bank of Sweden Prize in Economic Sciences in Memory of Alfred Nobel 2002. Nobel Foundation press release. Oct. 9. Available at http://www.nobel.se/economics/laureates/2002/press.html.

The Policy Analysis Market is featured at http://www.policyanalysismarket.com/. A glimpse of what the original market was like can be found at http://www.americanactionmarket.org/policyanalysismarket.org/pam_home.htm.

The Hollywood Stock Exchange has a Web site at http://www.hsx.com/.

Information about the Iowa Electronic Markets can be found at http://www.biz.uiowa.edu/iem/.

Sources:

Kay-Yut Chen
Web site: http://www.hpl.hp.com/personal/Kay-Yut_Chen/research.htm

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