
NOTE

PREDICTION MARKETS AND LAW: A SKEPTICAL ACCOUNT

Enthusiasm for “many minds” arguments has infected legal academia. Scholars now champion the virtues of groupthink, something once thought to have only vices.¹ It turns out that groups often outperform individuals in aggregating information, weighing alternatives, and making decisions. And although some of our legal institutions, such as Congress and juries, already harness the power of the crowd, others could be improved by multiplying the number of minds at work.² “Multiplying” implies a simple mathematical formula for improving decisionmaking; modern many minds arguments are more sophisticated than that. They use incentive analyses, game theory, and statistics to study how and under what circumstances groups make better choices than individuals do. The models propose to solve various information problems, such as determining guilt or innocence,³ deciding on a course of regulation,⁴ or estimating a value that is difficult to measure directly.⁵

Most ambitious, perhaps, has been the attempt to aggregate knowledge to predict the future. Uncertainty is a painful part of reality; it is only natural that the wisdom of the crowd would be summoned to bat-

¹ At the front of this movement is James Surowiecki, whose book, *The Wisdom of Crowds* (2004), popularized many minds arguments across disciplines.

² Simple multiplication is the mechanism behind the grandfather of many minds arguments: the Condorcet Jury Theorem. The theorem states:

[W]here there is a binary choice and a right answer exists, and where average competence exceeds .5 — that is, the average member of the group is more likely than not to choose correctly — then the likelihood that a majority vote of the group will produce the right answer approaches certainty as the group becomes larger or as average competence increases. Thus, the group’s average competence can quickly become higher than the competence even of an expert individual.

Adrian Vermeule, Essay, *Common Law Constitutionalism and the Limits of Reason*, 107 COLUM. L. REV. 1482, 1490 (2007) (footnote omitted); see also Paul H. Edelman, *On Legal Interpretations of the Condorcet Jury Theorem*, 31 J. LEGAL STUD. 327, 332–33 (2002); Christian List & Robert E. Goodin, *Epistemic Democracy: Generalizing the Condorcet Jury Theorem*, 9 J. POL. PHIL. 277 (2001). The idea has its roots in eighteenth-century mathematics. See MARQUIS DE CONDORCET, *ESSAY ON THE APPLICATION OF MATHEMATICS TO THE THEORY OF DECISION-MAKING* (1785), reprinted in CONDORCET: SELECTED WRITINGS 33, 48–49 (Keith M. Baker ed., 1976).

³ MICHAEL ABRAMOWICZ, *PREDICTOCRACY: MARKET MECHANISMS FOR PUBLIC AND PRIVATE DECISION MAKING* 253–54 (2007).

⁴ Matthew Einbinder, Note, *Information Markets: Using Market Predictions To Make Administrative Decisions*, 92 VA. L. REV. 149 (2006).

⁵ CASS R. SUNSTEIN, *INFOTOPIA: HOW MANY MINDS PRODUCE KNOWLEDGE* 42 (2006) (discussing a group’s ability to “know’ the number of beans in a jar, the weight of an animal, the likely winner of sports events, the outcome of future elections”).

tle it. The most popular model on that front has been the “information market” or “prediction market.”⁶ (The terms can be used interchangeably.) In particular, scholars have argued that such markets may alleviate uncertainty in legal and policy analysis.⁷ This Note argues that enthusiasm for prediction markets in law is misplaced. No one thinks prediction markets are perfect; even their proponents concede that they will fail under certain circumstances. But with their concessions they give up the game, at least as applied to legal problems: the circumstances in which prediction markets are inaccurate are precisely the circumstances in which law needs them most.

Part I surveys information markets — their success stories and their limitations. Part II begins by outlining the ambitions scholars have for information markets and law. Part II then develops the thesis of this Note: that the performance of prediction markets is inversely correlated with how valuable their predictions would be. This Part argues that if a future event is secret or knowledge about its likelihood is thin, if it depends on the idiosyncratic action of an individual, or if it is catastrophic but unlikely, a prediction market will probably not produce accurate information. Finally, Part III defines the niche, smaller than scholars imagine, in which prediction markets shine.

I. INFORMATION MARKETS

A. *How Information Markets Work and When They Work Well*

Information markets use the power of price to aggregate information into a single estimate of the likelihood of an occurrence.⁸ The market is a forum, typically online, in which participants place bets on

⁶ Some prominent prediction markets include Intrade, <http://www.intrade.com>; Iowa Electronic Markets (IEM), <http://www.biz.uiowa.edu/iem>; Hollywood Stock Exchange (HSX), <http://www.hsx.com>; and Foresight Exchange, <http://www.ideosphere.com>. For general information about prediction markets, see Bill Saporito, *Place Your Bets!*, TIME, Oct. 24, 2005, at 76; AEI Reg-Markets Center, Policy Markets, <http://www.aei-brookings.org/pages/index.php?id=37#> active (last visited Jan. 10, 2009); and Chris F. Masse, Real-Money Prediction Exchanges, http://www.chrisfmasse.com/3/3/exchanges/#Real-Money_Prediction_Exchanges (last visited Jan. 10, 2009).

⁷ See, e.g., ABRAMOWICZ, *supra* note 3, *passim*; SUNSTEIN, *supra* note 5, at 132–33; Miriam A. Cherry & Robert L. Rogers, *Tiresias and the Justices: Using Information Markets To Predict Supreme Court Decisions*, 100 NW. U. L. REV. 1141 (2006); Lior Jacob Strahilevitz, “How’s My Driving?” For Everyone (And Everything?), 81 N.Y.U. L. REV. 1699, 1702 (2006) (“This Article takes the next step in the aggregation of dispersed information literature. Namely, it explores the use of information aggregation technologies to deter, detect, and punish citizen misconduct.”); Einbinder, *supra* note 4.

⁸ Robert W. Hahn & Robert E. Litan, *Preface* to INFORMATION MARKETS, at xi, xi (Robert W. Hahn & Paul C. Tetlock eds., 2006) (“Information markets are markets for contracts that yield payments based on the outcome of an uncertain future event.”).

the outcome of events.⁹ Each participant owns a set of contracts, or shares (to use a stock market analogy), that promises to pay out if an event occurs. The payout can be defined in a variety of ways depending on the design of the particular market,¹⁰ but in any case the owner of a contract stands to gain money from the fruition of his bet. A participant can trade contracts with other participants, and so he can make money either by receiving a payout or by selling the share at a price that exceeds his purchase price.¹¹

The information that an information market produces is the price of the traded contract.¹² For example, if shares of “*Revolutionary Road* wins Best Picture” are selling at \$0.45, and that contract promises to pay its owner \$1 if the prediction comes true, then the price reflects a belief that *Revolutionary Road* is 45% likely to take home the award. But this trading price is more useful, that is, more *reliable*, than an individual film critic announcing his belief that *Revolutionary Road* is 45% likely to take home the Oscar, for two reasons. First, the price the critic paid for the share may be more reliable than his stated prediction because as a self-interested market participant, his interest in making money should counteract any bias that he has. This bias may come from his personal enjoyment of the film or from the fact that he wrote a positive review of it, and so will be validated if the Academy agrees with him. But by purchasing a share, the critic is forced to “put his money where his mouth is.”¹³

⁹ See, e.g., sources cited *supra* note 6.

¹⁰ IEM’s different models illustrate some payout design options. In its “winner-takes-all” market, shares for a candidate pay \$1 if the candidate is elected and nothing if he is not. Joyce E. Berg & Thomas A. Reitz, *The Iowa Electronic Markets: Stylized Facts and Open Issues*, in INFORMATION MARKETS, *supra* note 8, at 142, 143. In its “vote-share” market, each contract promises to pay one penny for each percentage point that a candidate gets. *Id.* Pari-mutuel wagering, discussed further in section I.B, *infra*, divides the pool of bets on a race among those who correctly predicted the winner. ABRAMOWICZ, *supra* note 3, at 15–16.

¹¹ Trading is essential to efficient pricing, and so to accurate predictions. See Robert W. Hahn & Paul C. Tetlock, *Introduction to Information Markets*, in INFORMATION MARKETS, *supra* note 8, at 1, 2 (“By allowing experts to trade with one another, markets help to aggregate disparate pieces of information.”).

¹² The notion that market prices have informational value is frequently traced to Professor Friedrich Hayek. See F.A. Hayek, *The Use of Knowledge in Society*, 35 AM. ECON. REV. 519, 526 (1945) (“[I]n a system where the knowledge of the relevant facts is dispersed among many people, prices can act to coordinate the separate actions of different people . . . [T]he price system [is] a mechanism for communicating information . . .”). The modern prediction market exploits Professor Hayek’s observation. See Justin Wolfers & Eric Zitzewitz, *Interpreting Prediction Market Prices As Probabilities* (Inst. for the Study of Labor, Discussion Paper No. 2092, 2006), available at <http://ssrn.com/abstract=898597>.

¹³ This phrase is often used to describe the incentive mechanism that drives the accuracy of prediction markets. E.g., SUNSTEIN, *supra* note 5, at 121 (“When people are willing to put their money where their mouth is, there is an increased likelihood that they will be right.”); Emile Servan-Schreiber et al., *Prediction Markets: Does Money Matter?*, 14 ELECTRONIC MARKETS 243,

The second reason why price may be more reliable than an expert's individual assessment is that price reflects the aggregation of a number of different beliefs about the film.¹⁴ Maybe the film critic is willing to spend \$0.45 because his belief is strong, but if the share is trading at \$0.25, he will purchase at or slightly above that price. The more he is willing to wager (or the more shares he is willing to buy), the more his purchase will nudge the price upwards. And so the price will change to reflect his genuine belief in the likelihood of the event. In other words, a share's trading price is right because "traders can profit from information suggesting that the market price is wrong, yet at any given time they have not done so."¹⁵

Thus, twin mechanisms — the "putting your money where your mouth is" incentive and the aggregation of information — conspire to yield an accurate prediction. People with bad information buy contracts for prices that do not reflect their actual value; when their predictions do not come true, they lose out and are discouraged from investing further. People with good information make accurate predictions, win payouts, and have incentives to participate more — as heavily as their risk tolerance and capital permits.¹⁶ Price is "an astonishingly concise and accurate coordinating and signaling device" that converges on an otherwise elusive truth.¹⁷

Prediction markets can be surprisingly accurate when compared to other methods of information aggregation. The Iowa Electronic Markets (IEM), created by professors at the University of Iowa's business school, is proof that prediction markets can work.¹⁸ In the week before presidential elections from 1988 to 2000, the IEM predictions were within 1.5 percentage points of the actual vote, an improvement upon the polls, which rely on self-reported plans to vote for a candidate and which have an error rate of over 1.9 percentage points.¹⁹ And the IEM is not only accurate at the eleventh hour. "IEM prices also ap-

244 (2004); Robin D. Hanson, *Decision Markets*, IEEE INTELLIGENT SYSTEMS, May/June 1999, at 16, 17, available at <http://hanson.gmu.edu/decisionmarkets.pdf>.

¹⁴ It solves the problem that Professor Hayek identified when he said that "[t]he economic problem of society is . . . a problem of the utilization of knowledge not given to anyone in its totality." Hayek, *supra* note 12, at 519–20.

¹⁵ ABRAMOWICZ, *supra* note 3, at 15. "The claim that prediction markets can efficiently aggregate information is based on the Efficient Market Hypothesis." Justin Wolfers & Eric Zitzewitz, *Prediction Markets in Theory and Practice 2* (Nat'l Bureau of Econ. Research, Working Paper No. 12083, 2006), available at <http://www.nber.org/papers/w12083>.

¹⁶ SUNSTEIN, *supra* note 5, at 105–06 ("Those without information will not participate; those with a lot of information will participate a great deal.").

¹⁷ *Id.* at 120.

¹⁸ Berg & Reitz, *supra* note 10, at 142 ("IEM prices respond quickly to information, are accurate in both a relative and absolute sense immediately before the event and well in advance, and appear to exhibit little bias.").

¹⁹ *Id.* at 150.

pear to outperform polls in advance of the election. . . . IEM prices were more stable than polls, respond[ed] less to transient events than polls, and were closer to election outcomes than the average poll when the election was more than one week away.”²⁰

Also particularly successful are internal markets conducted at high-tech companies such as Yahoo!, Google, and Hewlett-Packard. In the same way that the IEM counters the self-report bias of polls, these markets counter analysts’ overly optimistic projections of company performance. Hewlett-Packard ran a prediction market hoping to improve on its official forecasts of sales figures, figures it estimated by deliberation. The company sold securities that paid out if a particular range of sales was achieved;²¹ three quarters of the time, these information markets outpredicted the official forecasts.²² Google designed a larger scale market for its employees in 2005. Over a thousand participants bet on more than 150 questions. According to the project’s manager, the trading prices reflected accurate assessments of probability: “If we look at all events that we said were 80% likely, 80% of them should come true and 20% should fail. . . . This correlation is roughly what we’ve seen actually happening.”²³

B. When Information Markets Go Wrong

The picture of information markets’ performance is not all rosy. Trading prices in May 2003 reflected nearly an 80% chance of the United States finding weapons of mass destruction in Iraq by September of that year.²⁴ Hours before the nomination of then-Judge John Roberts to the Supreme Court, TradeSports was selling shares for Judge Edith Clement for 80 cents on the dollar.²⁵ Indeed, “[u]ntil roughly two hours before the official announcement, the market was more or less completely ignorant of the existence of John Roberts, the actual nominee.”²⁶

Scholars have also identified systematic biases present in most information markets, most notably the favorite-longshot bias.²⁷ This phenomenon is illustrated in racetrack betting, itself a kind of informa-

²⁰ *Id.*

²¹ Kay-Yut Chen & Charles R. Plott, *Information Aggregation Mechanisms: Concept, Design and Implementation for a Sales Forecasting Problem* 6–7 (Cal. Inst. of Tech., Working Paper No. 1131, 2002), available at <http://www.hss.caltech.edu/SSPapers/wp1131.pdf>.

²² *Id.* at 12–14.

²³ SUNSTEIN, *supra* note 5, at 115 (internal quotation marks omitted).

²⁴ ABRAMOWICZ, *supra* note 3, at 22–23.

²⁵ SUNSTEIN, *supra* note 5, at 135.

²⁶ *Id.* at 134.

²⁷ ABRAMOWICZ, *supra* note 3, at 16–17; SUNSTEIN, *supra* note 5, at 138–40. For a more sophisticated examination of the phenomenon, see Bruno Jullien & Bernard Salanié, *Estimating Preferences Under Risk: The Case of Racetrack Bettors*, 108 J. POL. ECON. 503 (2000).

tion market that uses the power of price to predict the outcome of races. Racetrack markets employ “pari-mutuel wagering,” a pool system whereby the sum of all bets is divided among those participants who correctly predicted the winner.²⁸ Pari-mutuel wagering has revealed an anomaly that may be endemic to all information markets: “[F]avorites tend to produce better payoffs than long shots, controlling for the fact that more money will be wagered on favorites than on long shots.”²⁹ Gamblers tend to undervalue wagering on a sure thing, perhaps because it is more exciting to gamble on a longshot.

Another weakness is that information markets, no less than the stock market, may be vulnerable to bubbles and information cascades.³⁰ The Judge Clement misprediction is an example of an information cascade that began with the media reporting that she was the likely nominee: “Many people were saying that the president would select Judge Clement, not because they knew, but because other people were saying that the president would select Judge Clement.”³¹ In a market where securities can be freely traded, the price that a participant is willing to pay reflects not only that person’s belief in the fruition of the event, but also a guess about how other participants estimate the occurrence. This feature makes information markets valuable, but also susceptible to bubbles. If one participant believes that the other participants believe Judge Clement has an 80% chance of being nominated, then that participant has an incentive to buy a share at 79 cents or lower, regardless of his subjective estimation of the chances. His purchase drives Judge Clement’s price up, and thus inflates the bubble.

Prediction markets are vulnerable to manipulation, although scholars do not agree on how serious the problem is.³² Information market traders can gain from manipulations in two ways. First, they could

²⁸ ABRAMOWICZ, *supra* note 3, at 15–16.

²⁹ *Id.* at 16.

³⁰ An information cascade occurs when “individuals rationally allow the presumed information of others to swamp their private judgments.” Adrian Vermeule, *Many-Minds Arguments in Legal Theory*, 1 J. LEGAL ANALYSIS (forthcoming 2009) (manuscript at 21), available at <http://ssrn.com/abstract=1087017>; see also *id.* at 23–24.

³¹ SUNSTEIN, *supra* note 5, at 135.

³² *E.g.*, Justin Wolfers & Eric Zitzewitz, *Prediction Markets*, 18 J. ECON. PERSP. 107, 119–20 (2004). Some even argue that because manipulation attempts ultimately fail, they increase the liquidity of the market, and so its accuracy. See Robin Hanson & Ryan Oprea, *Manipulators Increase Information Market Accuracy* (July 2004) (unpublished manuscript, available at <http://dimacs.rutgers.edu/Workshops/Markets/hanson.pdf>); see also SUNSTEIN, *supra* note 5, at 137–38; Saul Levmore, *Simply Efficient Markets and the Role of Regulation: Lessons from the Iowa Electronic Markets and the Hollywood Stock Exchange*, 28 J. CORP. L. 589, 601 (2003) (“Manipulation attempts can, to be sure, be offset by arbitrage and by players who seek to make money in a market by profiting from the fact that the manipulator has moved the market the wrong way.”); *id.* (“The flip side of this argument is that much as there is money to be made in manipulation, there is money to be made in counter-manipulation.”); *id.* at 603.

profit by artificially lowering the trading price temporarily and purchasing shares to be sold at a higher price when the market returns to “normal.”³³ Second, they could try to affect the informational value of the market.³⁴ For example, a candidate’s supporter could purchase his shares at an inflated value, raising the perceived odds that he would win the election, and (hopefully) getting more voters to jump on the putative bandwagon.³⁵ At least in the short term, manipulators have succeeded in artificially inflating or deflating the prices of securities in information markets. In 2004, TradeSports’s election prediction market fell victim to two “sustained attempts” at manipulation, which resulted in “large price changes that do not appear to have been based on any information.”³⁶

Finally, a failure of information markets is that they may react more than they predict. This is not a failure in the same sense that manipulations, bubbles, and biases create misinformation, but rather it is a criticism of the value of the information produced by an information market. Professor Orin Kerr suggests that when traders’ information is based on publicly available information, the market will just restate common knowledge rather than predict future events.³⁷ Professor Michael Abramowicz sums up the ubiquitous criticism this way: “[P]rediction markets . . . do not seem to tell participants much more than they could figure out themselves by considering the underlying materials.”³⁸ He does not entirely concede Kerr’s point, maintaining that at least *if* private reliable information existed, it would be reflected in the market, while without the market that private information would likely never be shared. But he also has a retreat position, suggesting that even if “[t]he primary purpose of the market is assessment aggregation, . . . that can be important.”³⁹

³³ Inversely, one could artificially raise the price and sell before the market settles back down. For an explanation of the theoretical possibility of price manipulation, see ABRAMOWICZ, *supra* note 3, at 29.

³⁴ Paul W. Rhode & Koleman S. Strumpf, *Manipulating Political Stock Markets: A Field Experiment and a Century of Observational Data 2* (Jan. 2007) (unpublished manuscript, available at <http://www.unc.edu/~cigar/papers/ManipNBER.pdf>) (“Parties with an interest in the outcome have an incentive, whenever possible, to move the odds prices in their preferred direction.”).

³⁵ Such manipulation probably explains the October 2004 blip in John Kerry shares on the IEM. ABRAMOWICZ, *supra* note 3, at 25, 29.

³⁶ *Id.* at 29 (footnote omitted).

³⁷ Posting of Orin Kerr to *The Volokh Conspiracy*, <http://volokh.com/posts/1121797428.shtml> (July 19, 2005, 14:23) (“[T]he people who are placing bets presumably are outsiders who are getting their predictions from newspaper articles, blogs, horoscopes, etc., and then placing bets. As a result, a site like TradeSports would seem to just mirror the collective common wisdom of newspapers and blogs on a question like this. Am I missing something?”).

³⁸ ABRAMOWICZ, *supra* note 3, at 38.

³⁹ *Id.*

Professor Cass Sunstein's relatively modest claim for markets, that "they do an excellent job in aggregating privately held information,"⁴⁰ hints at a concession that information markets' primary use is in aggregation, not prediction. And although the price system creates an incentive to be *right*, all a share price can reflect is that participant's *confidence* that he is right.⁴¹ Confidence may or may not be epistemologically justified. To be sure, the value of sorting strongly held beliefs from weak ones is significant because confidence is likely to be correlated with accuracy.⁴² But in situations where the two are less likely to be correlated, an information market will parrot conventional wisdom instead of eliciting the wisdom of the crowd.

II. PREDICTION MARKETS AND LAW

A. Ambitions for Prediction Markets in Law

Despite these failings, scholars have high ambitions for prediction markets and law. At first, the fit seems to work: good law is highly dependent on accurate information. Many legal rules, from due process to the statute of frauds, have at their heart a concern about informational accuracy.⁴³ Less obviously, liberal legal theory itself poses an informational puzzle: if we are to have the rule of law, then we need to know what that law is.⁴⁴ Even democracy itself can be thought of as an answer to an epistemological question: how should governmental power be used? And because the law operates with limited resources, all this legally relevant information should be acquired efficiently.

A facile objection to using information markets in law is to say that legal epistemological puzzles go beyond the factual to the normative. In the post-legal realist age, no one thinks that judges merely discover facts about what the law is, as a scientist discovers facts about nature's law. These decisions involve questions of what is right, not just what is true.⁴⁵ But this critique overlooks the fact that normative decisions

⁴⁰ SUNSTEIN, *supra* note 5, at 104.

⁴¹ Professor Sunstein explains the correlation between wagering and confidence: To see why [the betting] method might work, consider the familiar informal challenge when people disagree on some question: "Want to bet?" The point of the challenge is to suggest that the speaker is really confident of her judgment, enough so as to ask the person with whom she disagrees to back her conviction with money.

Id. at 103; *see also* ABRAMOWICZ, *supra* note 3, at ix-x.

⁴² *See* ABRAMOWICZ, *supra* note 3, at 49.

⁴³ *See* Louis Kaplow, *The Value of Accuracy in Adjudication: An Economic Analysis*, 23 J. LEGAL STUD. 307 (1994).

⁴⁴ *Cf.* Michael Abramowicz, *The Law-and-Markets Movement*, 49 AM. U. L. REV. 327, 415-17 (1999).

⁴⁵ Professor Abramowicz thinks prediction markets can predict even normative decisions. A "normative prediction market" would aggregate beliefs about what a hypothetical decisionmaker

involve factual inputs.⁴⁶ Whether a judge decides that a plaintiff complaining of secondhand smoke is *right* to do so depends on whether he thinks the causal link between secondhand smoke and cancer is *true*. A low-cost means of gathering accurate information, especially about an uncertain future, could improve legal decisions — whether legislative (how can we stop global warming?), judicial (will this defendant recidivate?), or executive (who are the most dangerous drug lords?).

Naturally, ambitions for prediction markets in law abound, but in truth even fact-oriented information markets may offer little help to legal decisionmakers. This is because the circumstances in which information markets are particularly likely to fail, as acknowledged by their most vocal proponents, are precisely those circumstances in which the law faces a costly information problem. The law must regulate individual, idiosyncratic behavior; it must make policy decisions based on an uncertain future; and it must take into account very unlikely, but catastrophic events. For each of these epistemological puzzles, an information market has been proposed; yet for each of these puzzles, information markets are particularly unhelpful.

B. Challenges for the Use of Prediction Markets in the Law

1. *Information Is Thin or Secret.* — The outcomes that judges would most like to predict are naturally those about which little is already known. In the legal context, thinness of information often results from secrecy. In theory, prediction markets are equipped to induce the sharing of secret information, but in practice, they perform poorly when asked to aggregate closely guarded secret information.

(a) *The Informational Problem of Terrorism.* — Terrorism is a paradigmatic modern information problem. When a judge makes a rule regarding terrorism, he must make a judgment about the costs and benefits of the rule.⁴⁷ Thus, he must calculate the expected loss

would decide about a normative dilemma. See ABRAMOWICZ, *supra* note 3, at 166–67. In other words, the market makes an objective assessment about the likelihood of a subjective decision. Professor Abramowicz thinks this “populist approach,” *id.* at 167, would “help constrain ideologically motivated decision making,” *id.* at 163. Professor Abramowicz’s “normative prediction market” is related to his “predictive cost-benefit analysis” in that it asks a second-order question about how a first-order analysis will come out. See *id.* at 173–75. The viability of these innovations is beyond the scope of this Note, with the exception of his jury prediction market, *id.* at 236–40, discussed *infra* at pp. 1230–31.

⁴⁶ ABRAMOWICZ, *supra* note 3, at 36–37.

⁴⁷ Cost-benefit analysis would approve a counterterrorist measure if its cost is less than its expected benefit (preventing the expected loss from the attack). Although this Note assumes that cost-benefit is the proper analytical mode for making counter-terror decisions, this assumption is not uncontroversial. A competing analytical approach to terror risk is epitomized by Vice President Cheney’s “One Percent Doctrine: ‘We have to deal with this new type of threat in a way we haven’t yet defined . . . With a low-probability, high-impact event like this . . . if there’s a one per-

from an act of terror by multiplying its likelihood by its anticipated harm. Both of these numbers are difficult to estimate because information about terror plots is not only unknown, but also actively hidden.⁴⁸ Ad hoc approximations from the bench may not yield helpful measures of risk. Making matters worse, the calculation is highly sensitive to error because it multiplies a very large number (harm from an attack) by a very small number (probability of the attack).⁴⁹

Striking the right balance in countering terror is essential, because there is so much at stake on either side. On the one hand, underestimation of risk will result in great emotional and financial losses. On the other, overestimation may mean sacrificing resources and civil liberties unnecessarily. Liberty and security are each too elementally American to give much flex — terror threatens to destroy life and property, but counterterrorist measures, as currently conceived, threaten liberty.⁵⁰ So in crafting an efficient response to terrorism, a lot depends on the precision of informational inputs.

(b) *Might Information Markets Solve Terrorism's Information Problem?* — This need for better informational inputs prompted the Pentagon-sponsored “terror futures market,” which had a very short and controversial life in 2003. The project, Policy Analysis Market (PAM), was designed to select “events of interest to the Department of Defense” and allow people, experts and laymen alike, to place bets on their occurrence.⁵¹ The website listed hypothetical betting topics such as “the assassination of Palestinian leader Yasser Arafat and a missile attack from North Korea.”⁵² The project precipitated public outcry,

cent chance that Pakistani scientists are helping al Qaeda build or develop a nuclear weapon, we have to treat it as a certainty in terms of our response.” CASS R. SUNSTEIN, *WORST-CASE SCENARIOS* 1 (2007) (omissions in original). For an exploration of the precautionary principle versus cost-benefit analysis debate, see *id.* at 118–75. See also RICHARD A. POSNER, *CATASTROPHE: RISK AND RESPONSE* 139–50 (2004).

⁴⁸ Terrorists, of course, capitalize on this feature of terrorism; theirs is the advantage of surprise. Surprise attacks defeat traditional security measures, which are not as flexible and ad hoc as a terrorist's means. Uncertainty, or lack of information, is both a means and an end of terrorism.

⁴⁹ For example, suppose two experts think that there is a significant, yet slim, chance that terrorists will destroy the Empire State Building by 2015. Both agree that the loss would be \$500 billion if it occurred, but expert *A* thinks the chance of the attack before 2015 is 1%, and expert *B* estimates it at 2%. *A*, therefore, estimates the expected loss at \$5 billion, while *B* estimates it at \$10 billion. The experts would not agree about whether the risk justifies taking a \$7 billion preventative measure.

⁵⁰ Further complicating the balance is a unit conversion problem: optimizing the trade requires understanding one in terms of the other. In other words, in asking ourselves “how much liberty am I willing to give up for some amount of security?” we face an apples-to-oranges problem.

⁵¹ ABRAMOWICZ, *supra* note 3, at 46; see also SUNSTEIN, *supra* note 5, at 106–08; Wolfers & Zitzewitz, *supra* note 32, at 107–08.

⁵² ABRAMOWICZ, *supra* note 3, at 47.

and due to particularly vocal opposition from Senators Ron Wyden, Tom Daschle, and Byron Dorgan, who denounced it as morally repugnant,⁵³ it was shut down before it got off the ground.

PAM would have asked questions about publicly available information that bears on whether and how a terrorist attack might occur, such as nations' economic growth, political instability, and U.S. financial involvement. But the project's website implied that it would also aggregate secret information about actual terror attacks.⁵⁴ Indeed, prominent prediction market scholar Robin Hanson has explored how such a terror futures market would work.⁵⁵ This endeavor recognizes that assessment aggregation only goes so far in fighting terror. Even better would be a mechanism to divine attacks in advance. But the people who have the most and best information about terror threats also have the strongest incentive to keep that information secret. So how to get an information market to reveal secret information?

(c) *The Limits of the Market Solution: Secrecy Makes for Bad Predictions.* — Theoretically, prediction markets are good at incentivizing information sharing where, without a market, knowledgeable people benefit from keeping mum. In the internal Hewlett-Packard market, management sought to overcome a problem of secrecy: salesmen knew what their monthly sales were likely to be, but would underreport that number to reduce the chance that they would fall short and reap the consequences.⁵⁶ The Hewlett-Packard information market solved this problem by providing a financial incentive for salesmen to accurately forecast sales. The salesmen had secrets, but when properly incentivized, they spilled the beans.

Good information that says a security is priced incorrectly is valuable. When that value exceeds the value of keeping the secret, its possessor will make a stock purchase that reflects the good information. Concretely, take the example of a salesman who has an incentive to underestimate his sales figures so as to avoid falling short in his boss's eyes. An information market can "buy" his secret by offering him a gain that more than offsets the risk of falling short. For an entire sales force, lots of small secrets can make for an inaccurate sales forecast. If the price for each secret is relatively small, a company could use an information market to buy each salesman's honest answer.

⁵³ Byron L. Dorgan, Letter to the Editor, *The Pentagon's Ill-Conceived Market*, WASH. POST, Aug. 7, 2003, at A20; Ronald Bailey, *Betting on Terror: Why Futures Markets in Terror and Assassinations Are a Good Idea*, REASONONLINE, July 30, 2003, <http://www.reason.com/rb/rb073003.shtml>.

⁵⁴ Cf. ABRAMOWICZ, *supra* note 3, at 47 ("[T]he PAM Web site included as examples predictions of the assassination of Palestinian leader Yasser Arafat and a missile attack from North Korea, though no decision had been made to make predictions of these possible events.")

⁵⁵ Robin D. Hanson, *Designing Real Terrorism Futures*, 128 PUB. CHOICE 257 (2006).

⁵⁶ SUNSTEIN, *supra* note 5, at 113.

But not all secrets are like the salesman's white lie. Especially in the legal and political contexts, secrets tend to be big, carefully guarded, and therefore expensive to purchase through an information market. Consider a White House aide who knows at 10:00 a.m. on the day of President Bush's announcement of his Supreme Court nominee that he will announce Judge Roberts. He stands to gain a windfall by buying a long position in Judge Roberts or a short position in Judge Clement (remember that her shares were trading at eighty cents on the dollar). But his incentives for keeping the secret are high. He has been asked by the President not to tell anyone, and he fears that if he places a bet, the President will find out and fire him. His job and reputation are worth millions to him, and he is probably unwilling to risk even a slim chance of getting caught. The high value placed on keeping one's confidences in the legal and political arena can make exorbitant the price of inducing a knowledgeable person to place a bet.

So it is with secrets about terrorism. Good information about terror plots is likely to be closely guarded, for two reasons. Terrorists typically have the means and inclination to punish people disloyal to their organization, and terrorist groups are comprised of individuals ideologically committed to the organization's mission of surprise attacks. This is not the arena of the salesman's white lie. For a prediction market to work here, it would have to attract a pool of participants who are close enough to terrorists to have valuable inside information, but who are not so close to them that they fear reprisal or consider themselves part of the group. Additionally, if this market were to improve on existing systems of reporting, it would have to attract people who would not volunteer this information to the authorities anyway, without a market. In the context of terrorism, that pool is likely to be very small.

2. *Information Is Dependent on Individual Idiosyncratic Actors.* — Although it does so by generalizations, law regulates individual, idiosyncratic actors. When someone's compliance with the law is in question, law uses adjudication to resolve the dispute. And although laws may not be individual-specific, adjudication necessarily is. This commitment to individual resolution of claims and transgressions is reflected everywhere in the law — from the “cases and controversies” clause of the Constitution⁵⁷ to the requirement that a judge justify any criminal sentence with observations and facts specific to that defendant.⁵⁸ Information markets deal poorly with idiosyncrasy, and so attempts to use them in the adjudicative context will fail.

⁵⁷ U.S. CONST. art. III, § 2, cl. 1.

⁵⁸ *Gall v. United States*, 128 S. Ct. 586, 596–97 (2007) (“[T]he district judge should then consider all of the § 3553(a) factors to determine whether they support the sentence requested by a

(a) *The Informational Problem of Adjudication.* — Perhaps nowhere in law is uncertainty as pronounced as it is in the context of adjudication. The proliferation of discovery — and the attendant expense — suggests that knowing the idiosyncratic facts behind a dispute is both essential and difficult. The numerous and complicated rules of evidence are mostly defended as promoting truthfulness and reliability. Due process and the ability to appeal serve as safeguards against factual mistake. At least three times in a trial — at discovery, during the trial, and in determining the remedy — a trier of fact must predict or reconstruct an event that is or was in the hands of an individual, idiosyncratic actor.

Most of adjudication's fact determinations are retrospective and so may at first glance seem different from predictions about an uncertain future. But reconstructing the past can be thought of as a prediction in reverse. Imagine a trial about what you had for breakfast. There is dispersed information about what you had for breakfast in the sense that there are good guesses and bad guesses. It is likely you had cereal, or bacon and eggs. It is unlikely that you had shepherd's pie. But these judgments do little to help determine your actual breakfast because although the possibilities are not limitless, they are many. It is entirely up to you what you eat for breakfast, and probably only known by you what you ate today. Our current system solves this informational problem awkwardly, but in its graspings one can see a commitment to preserving the very thing that caused the informational problem: idiosyncrasy.

First, the rules of evidence prohibit the use of “naked statistical evidence.”⁵⁹ Although statistical evidence about human behavior does an excellent job in assessing general trends, it may be accurate and yet still mispredict individual behavior.⁶⁰ Reconsider what it means for a prediction to be wrong. The morning of President Bush's first Supreme Court nomination, share prices reflected an 80% chance that he would name Judge Clement and only a 2% chance that he would name Judge Roberts, the actual nominee. Perhaps there actually *was* an 80% chance that President Bush was going to name Judge Clement. A strange coincidence of factors led to the event that had only a 2% chance of occurring. After all, the *most likely* thing is not *always* the

party. In so doing, he may not presume that the Guidelines range is reasonable. He must make an individualized assessment based on the facts presented.” (citation omitted).

⁵⁹ FREDERICK SCHAUER, PROFILES, PROBABILITIES, AND STEREOTYPES 81 (2003) (quoting David Kaye, *The Limits of the Preponderance of the Evidence Standard: Justifiably Naked Statistical Evidence and Multiple Causation*, 7 AM. B. FOUND. RES. J. 487 (1982) (internal quotation marks omitted)).

⁶⁰ See *id.* at 55–78.

thing that happens.⁶¹ The law's requirement of direct evidence gives defendants the chance to say "most of this time, with this evidence, the defendant would be guilty, but *not this defendant*."

Likewise, the jury system itself is a nod to idiosyncrasy. Rather than asking a single expert to determine adjudicative facts, the jury verdict aggregates the assessments of a group of inexpert people into a single judgment of what actually happened. And the common requirement that jury verdicts be unanimous means any single juror can prevent a verdict either by refusing to vote along with the crowd, or by trying to convince the others to adopt his point of view. In this way, a jury verdict is not simply the product of nine minds thinking about a problem and then voting, as hypothesized by the Condorcet Jury Theorem.⁶² It is an idiosyncratic event because one juror can, on a whim, decide a case — or at least block a decision.

These solutions to the epistemological problem of factfinding are not perfect; epistemological uncertainty about the past persists. Placing factfinding in the hands of a jury has its own epistemological problems: making a jury's verdict idiosyncratic does not guarantee that the verdict will more accurately judge an idiosyncratic event, and naked statistical evidence may be more reliable than eyewitness testimony. These are desperate moves, perhaps, in response to an intractable problem: how can we know what happened *in this particular case*?

(b) *Might Information Markets Solve Adjudication's Information Problem?* — This commitment to particularized factfinding makes adjudication expensive and, arguably, inefficient.⁶³ Might prediction markets help? Professor Abramowicz advocates importing prediction markets' efficiencies "not merely to assist jurists[,] but to perform their work."⁶⁴ Courts would publish evidence in a particular dispute to participants in an information market. Bettors would place bets on whether a (hypothetical) jury would find liability, and then a small sample of trials would actually proceed and be decided by a jury. These verdicts would discipline the prediction market⁶⁵ by providing payouts to those who correctly predicted outcomes, while the other disputes would be decided by the prices of the information market, measured at a given time (to be determined) and relative to a certain value (to be determined).⁶⁶

⁶¹ ABRAMOWICZ, *supra* note 3, at 22.

⁶² See discussion *supra* note 2.

⁶³ But see Charles Silver, *Does Civil Justice Cost Too Much?*, 80 TEX. L. REV. 2073 (2002).

⁶⁴ ABRAMOWICZ, *supra* note 3, at 228.

⁶⁵ *Id.* at 235.

⁶⁶ See generally *id.* at 227–54. For an in-depth discussion of the dimensions along which information markets theoretically outperform deliberative groups, see Cass R. Sunstein, *Deliberation and Information Markets*, in INFORMATION MARKETS, *supra* note 8, at 67.

The idea has several flaws, many of which Professor Abramowicz addresses.⁶⁷ But one of the idea's fatal flaws he heralds as one of its benefits — it will reduce the idiosyncrasy of jury verdicts:

Using a single, randomly selected judge or jury adds randomness to the judicial process. Why not instead use a prediction market to anticipate what decision makers on average would decide if a case were taken to trial? Assuming that prediction markets in fact are effective vehicles for analyzing facts, they can reach verdicts more consistently than can the committee that we call the civil jury.⁶⁸

If adjudication were concerned with *average* behavior, as legislation and law enforcement are, then this idea would make sense. But like the prohibition on naked statistical evidence, the jury system and its common requirement of unanimity exist to preserve idiosyncrasy. To the extent that Professor Abramowicz's idea would abrogate the unanimity requirement, it would abrogate the system's commitment to individualized factfinding.

(c) *Limits of a Market Solution: Prediction Markets Cannot Predict Idiosyncratic Behavior.* — Prediction markets' most notable and dramatic failures have involved events that are dependent on an individual's idiosyncratic choice, such as a jury holdout. These include TradeSports's October 2005 market that predicted that Karl Rove would likely (65%) be indicted in connection with the disclosure of the identity of a CIA agent;⁶⁹ its prediction, earlier that year, that Bush would nominate Judge Clement to the Supreme Court (80%);⁷⁰ and, more recently, Intrade's conclusion that Governor Tim Pawlenty, not Governor Sarah Palin, would be Senator McCain's running mate.⁷¹

These salient failures have prompted information market experts to hint that the markets are unreliable in the face of idiosyncrasy.⁷² In other words, "[a] worldwide prediction market is unlikely to do so well in foreseeing the first book I will read in the next calendar year, or what you are going to have for dinner tomorrow night."⁷³ Where the

⁶⁷ For example, conditional contracts (that is, contracts that pay out only if that trial is selected for traditional adjudication) can be quite risky. Professor Abramowicz solves this problem by nesting markets — that is, making another information market in *whether* that particular decision will be selected for adjudication. ABRAMOWICZ, *supra* note 3, at 234–35; *see also id.* at 249 (“[W]hen a particular prediction market design seems to have some problem or to leave open some question, use another prediction market to solve the problem.”).

⁶⁸ *Id.* at 232.

⁶⁹ SUNSTEIN, *supra* note 5, at 136.

⁷⁰ *Id.* at 135.

⁷¹ Steve Kornacki, *Intrade Loves Pawlenty's Chances*, N.Y. OBSERVER, Aug. 28, 2008, <http://www.observer.com/2008/politics/intrade-loves-pawlentys-chances>.

⁷² *E.g.*, Kerr, *supra* note 37 (“I don't understand why we would expect such sites to reveal anything particularly useful on the question of O'Connor's [sic] replacement. . . . The choice of O'Connor's replacement belongs to one man, George W. Bush.”).

⁷³ SUNSTEIN, *supra* note 5, at 136.

predicted event is not itself the result of aggregated actions or preferences, an information market is not a very good tool.

Perhaps the randomness in jury verdicts that Professor Abramowicz indicts is not a problem with juries, but rather is a more fundamental problem with law's commitment to treating each legal actor individually and learning the facts of their case. To the extent that an information market cannot predict individual, idiosyncratic behavior, it will fail in predicting holdouts. And if a holdout is a rare and unpredictable event, it would seem that betting on a hung jury would always be irrational, so a rational prediction market would underreport the likelihood of holdouts.⁷⁴ The result will be a smoother, less random curve of adjudicative results, but at the cost of the intuition behind the unanimity requirement — that a little idiosyncrasy can help in evaluating idiosyncratic facts.

3. *Information Pertains to Unlikely, But Catastrophic Harms.* — At any moment, disaster might strike. These risks are not likely to be mitigated efficiently without large-scale collective action,⁷⁵ probably at the level of national governments. Without coercive cost-spreading through regulation and taxation, we are sitting ducks to environmental disasters, hurricanes, and stock market crashes. Increasingly, scholars are recognizing government's responsibility to fix these market failures,⁷⁶ but to do so it needs good information about these catastrophes — risks that are inherently difficult to measure and anticipate. The more remote a risk, and the greater its potential loss, the more urgent the need for regulation becomes. Some scholars have advanced prediction markets as a way to develop this information.⁷⁷ But remoteness of risk and magnitude of loss both correlate inversely with a prediction market's accuracy.⁷⁸

⁷⁴ This concern is implicit in Professor Abramowicz's discussion of second-order diversity as it relates to normative prediction markets designed to make administrative decisions. He argues that "[o]nce we know what the differences in views are regarding the ultimate question, we might still have a decision-making rule that chooses the minority view rather than the majority view." ABRAMOWICZ, *supra* note 3, at 166. But if an information market would systematically discount the likelihood of holdouts, it is unclear how we would know from the market prices when the minority view should prevail.

⁷⁵ SUNSTEIN, *supra* note 47, at 23 ("At the individual level, a decision to disregard low-level risks is hardly irrational.").

⁷⁶ See, e.g., POSNER, *supra* note 47, at 176–77.

⁷⁷ See, e.g., SUNSTEIN, *supra* note 5, at 105, 133; Hurricane Futures Market, <http://hurricanefutures.miami.edu> (last visited Jan. 10, 2009). Of course, predicting terrorism may also involve predicting catastrophic events. On this point, see Michael Abramowicz, *Information Markets, Administrative Decisionmaking, and Predictive Cost-Benefit Analysis*, 71 U. CHI. L. REV. 933, 982–83 (2004).

⁷⁸ Judge Posner is skeptical that information markets can help to predict catastrophes. See POSNER, *supra* note 47, at 175 ("The theory is fine but its applicability to terrorism is questionable."). This section builds on his ideas.

(a) *The Informational Problem of Catastrophe.* — Responding efficiently to potential catastrophes presents formidable analytical and institutional challenges.⁷⁹ Cost-benefit analysis of catastrophe is “a function of both the probability that one or another of [the risks] will materialize if we do nothing and the awfulness of the consequences if that happens.”⁸⁰ The result — the risk times the harm — is the benefit gained by taking a measure that prevents the risk, and so would be the maximum rational amount to spend on its prevention. This number is the product of a very small number (the likelihood) and a very large number (the harm), and so is very sensitive to error.⁸¹

The most vexing part of the equation is the smaller number: the probability. According to Judge Posner, “[t]he low probability of such disasters — frequently the *unknown* probability, as in the case of bioterrorism and abrupt global warming — is among the things that baffle efforts at responding rationally to them.”⁸² Some disasters are unimaginable, but even those that can be imagined cannot be confidently predicted; as Professor Sunstein argues, “[i]n the case of terrorism and climate change, nations may be operating in the domain of uncertainty rather than risk, in the sense that they are able to identify the worst outcomes without being able to specify the likelihood that they will occur.”⁸³

The reasons for this uncertainty are diverse and controversial. Professor Sunstein cites social-scientific and psychological phenomena such as availability, probability neglect, and outrage for both under- and over-estimation of low-probability risks.⁸⁴ More controversially, Judge Posner blames scientific illiteracy, science worship, science fiction, doomsters, optimists, limited horizons, false positives, temperament, economics of innovation, global decentralization, and the tragedy of the commons.⁸⁵ But most of Judge Posner’s reasons, and all of Professor Sunstein’s, have something in common: they involve irrationality in thinking about worst-case scenarios. Not surprisingly, both scholars include in their prescription the need to improve the rational assessment of very small probabilities. Might prediction markets help develop good factual predicates for assessing risk?

(b) *Limits of a Market Solution: Information Markets Poorly Predict Catastrophic Events.* — Information markets are bad at predicting very low-probability events for two reasons; one pertains to a sys-

⁷⁹ *Id.* at 8.

⁸⁰ *Id.*

⁸¹ See *supra* p. 1226.

⁸² POSNER, *supra* note 47, at 6.

⁸³ SUNSTEIN, *supra* note 47, at 26.

⁸⁴ *Id.* at 54–66.

⁸⁵ POSNER, *supra* note 47, at 92–138.

tematic bias exhibited in prediction markets, and the other relates to market design. First, prediction markets exhibit a favorite-longshot bias.⁸⁶ This phenomenon may explain why a prediction market predicted an 8% chance that Arnold Schwarzenegger will become president by 2022 — a number Professor Abramowicz finds implausibly high, “[g]iven that the Constitution would need to be amended for this to take place and that he would then need to win the Republican nomination and the general election.”⁸⁷ According to Professor Sunstein, the favorite-longshot bias could be endemic to information markets: “[I]f bettors undervalue near certainties and overvalue low probabilities . . . , prediction markets might not be accurate with respect to highly improbable events.”⁸⁸

Second, predicting a very unlikely event presents a potentially insurmountable design problem. For a contract to have an underlying value that accurately reflects the likelihood of an event, the contract has to have a payout trigger. Defining this event is easy in the case of contests like elections and horse races, where there is a concrete moment at which the predictions will come to fruition.⁸⁹ The occurrence or nonoccurrence of the event is essential for disciplining the market since those with good information who made accurate predictions must be rewarded and those who made foolish bets must be punished.⁹⁰ When it comes to catastrophe, the triggering event (a disaster) is at best speculative, and anyway it is the very thing that the market is designed to help avoid.

Mitigation of catastrophe can come in two forms: prevention and reduction of harm. For events that can be *prevented* — things that are sufficiently within human control — the market may be self-defeating. When a participant purchases a share that is redeemable for cash in the event of a particular catastrophe, he signals his belief that the

⁸⁶ See *supra* notes 27–29 and accompanying text; see also Erik Snowberg & Justin Wolfers, Explaining the Favorite-Longshot Bias: Is It Risk-Love or Misperceptions? (Nov. 17, 2007) (unpublished manuscript, available at http://bpp.wharton.upenn.edu/jwolfers/Papers/Favorite_Longshot_Bias.pdf).

⁸⁷ ABRAMOWICZ, *supra* note 3, at 57 (footnotes omitted).

⁸⁸ SUNSTEIN, *supra* note 5, at 140.

⁸⁹ Justin Wolfers and Eric Zitzewitz included a related problem in their article *Five Open Questions About Prediction Markets* (Nat'l Bureau of Econ. Research, Working Paper No. 12060, 2006), available at <http://www.nber.org/papers/w12060>. “A fundamental problem in mechanism design is that the outcomes of interest are often impossible to write into contracts.” *Id.* at 3. As an example of the problem of uncertainty in triggering events, the authors cite a TradeSports debacle, involving a market for “whether Yasser Arafat would depart the Palestinian state by the end of 2005. When he became ill in late 2004, there was mild controversy on *forum.tradesports.com* about whether seeking medical treatment in Paris or dying was considered departing Palestine.” *Id.* at 9.

⁹⁰ Cf. ABRAMOWICZ, *supra* note 3, at 234–35 (discussing “probabilistic information markets,” designed to discipline themselves even in the absence of regular triggering events).

event will occur. Indeed, the value of the prediction market to lawmakers would be this information. Presumably, if investors manifested enough belief in a risk to make costly prevention efficient, then the government would take preventative action. But just as these measures will prevent the harm, so they will prevent investors from benefiting from their (presumably good) information about the risk, since the catastrophe will now not occur. In short, when an investor purchases a contract, he may actually reduce the likelihood of the event that would allow him to cash in.⁹¹

Of course, some disasters cannot be prevented but can only be mitigated. For these, the self-defeating problem goes away. Suppose a market predicted that a major asteroid would hit the Earth before 2020. Based on this information, the government built an asteroid shield in 2012. Holders of the asteroid-hits-earth contract could still experience a payout if a major asteroid struck and was successfully deflected by the shield in 2015. But most risks, if properly mitigated, will never materialize in a way that makes payout possible.

Whether a catastrophe can be prevented or mitigated, it is (by definition) very unlikely to happen. For investors, payday is at best a remote possibility. Investment in catastrophe markets would be so high-risk that individuals may not bet at more than novelty levels, like participation in a lottery. With the chance of winning so slight, participants may not have a sufficient incentive to educate themselves and purchase according to the confidence of their prediction. Then again, the low probability of house fires does not prevent homeowners from mitigating their risk. In the same way that insurance companies reduce risk through aggregation, disaster firms could reduce the risk of investing in one disaster by offering diversified securities to customers.

This disaster mutual fund idea is the inverse of Judge Posner's prescription for catastrophic uncertainty. He suggests that one "infer the risk of a bioterrorist attack from the premiums charged for insurance against such attacks."⁹² The failure of this model in practice, however, illustrates the difficulty of getting useful information about catastrophe from a market, even if the market offered sufficiently aggregated and diversified securities to make investment rational:

In the wake of 9/11, insurance companies terminated coverage of losses due to terrorism (for which previously they had charged only nominal premiums), and though they were forced to restore coverage by the Terrorism Risk Insurance Act of 2002, the act . . . heavily subsidizes this insurance and makes it difficult to determine the industry's implicit estimate of the probability and magnitude of future terrorist attacks.⁹³

⁹¹ For a discussion of this problem, see Sunstein, *supra* note 66, at 91–92.

⁹² POSNER, *supra* note 47, at 176.

⁹³ *Id.*

Saliency, fear, and the availability heuristic are biases that are strong in the context of disaster. To Americans, having just experienced an attack, the possibility of disaster seemed imminent and so the demand for insurance went up. At the same time, insurance companies' fear of a huge payout, made salient by the 9/11 attacks, caused their willingness to sell at all to plummet. Markets may help reduce bias, but some biases are too strong for the market to overcome.

III. DO PREDICTION MARKETS HAVE ANYTHING TO OFFER LAW?

Prediction markets function well when three conditions are met: information is diffuse throughout the participant pool and is not secret (or anyway not closely guarded), the event predicted itself is the result of an aggregation of information such as voting or sales statistics, and the event predicted is certain to occur (an election) or at least easily defined (will Brad Pitt and Angelina Jolie marry before 2012?). It is no accident that information markets have thrived in the private sector.⁹⁴ The success of a business depends on the aggregative effect of small events — a pattern of sales, a wave of layoffs, agent-principal problems that create companywide inefficiencies. Businesses have long recognized this fact, and so they keep statistics on these and other measures, meaning that bettors have access to information. And because these statistics are valuable to management, companies have created artificial events that give occasion to measure them — the end of a quarter or a periodic evaluation, for example. Moreover, businesses are able to capitalize on the objectivity of prediction markets to counter weak biases (optimistic opening schedules, interdepartmental rivalry) and white lies (understated sales projections). So in the business context, the three conditions of information distribution, nonidiosyncrasy, and concreteness of payouts are easily met.

The second most successful arena for information markets has been the media. The fit between prediction markets and the media is natural for two reasons. First, prediction markets are entertaining. Betting is fun; even unknowledgeable people will participate just for the thrill of being right.⁹⁵ Of course, being right is especially fun when it means making money. But the success of information markets is not necessarily dependent on whether real money is at stake, suggesting that there is a utility in winning bragging rights alone.⁹⁶ Some of the

⁹⁴ See Hanson, *supra* note 55, at 258.

⁹⁵ Surprisingly, having uninformed participants is essential to an information market's success. See Wolfers & Zitzewitz, *supra* note 89, at 2–3, 7–9.

⁹⁶ See Servan-Schreiber et al., *supra* note 13, at 250 (finding that a sports betting market using play money predicts as accurately as one using real money); see also SUNSTEIN, *supra* note 5, at

more popular information markets combine betting with entertainment. At least part of the Hollywood Stock Exchange's popularity (and accuracy!) can be attributed to its content, predicting box office performance, star success, and award winners.⁹⁷ Professor Abramowicz predicts that some day "readers of the sports pages [will] do what readers of the business pages often do: look at a price graph for a snapshot of the day's news."⁹⁸

Second, the media often covers races or competitions, events particularly suited to prediction markets. Information markets about contests — political races, sporting events,⁹⁹ awards ceremonies¹⁰⁰ — tend to be accurate. The IEM has performed impressively over the last twenty years in predicting the outcomes of presidential elections,¹⁰¹ and horse race betting outpredicts the experts.¹⁰² Perhaps this is because races tend to be less idiosyncratic than other events since they are governed by rules and the incentives of the racers (to win) are predictable. Also, races have a well-defined payout event: the end of the race. This makes market design straightforward, and although it may not solve the bubble problem, at least it allows for a more efficient measure of a share's value.

Prediction markets have less to offer legal decisionmaking. While the three necessary conditions for information market success are often present in business and the media, they are seldom present in the legal context. The simplest and perhaps best use of information markets in law is in establishing factual predicates to legal decisions. Because making morally and epistemologically sound legal judgments requires

111 (pointing out that HSX, an online market using play money, outperformed TradeSports, a real-money market, in predicting 2005 Oscar winners).

⁹⁷ See HSX, What is HSX?, <http://www.hsx.com/about/whatishsx.htm> (last visited Jan. 10, 2009).

⁹⁸ ABRAMOWICZ, *supra* note 3, at 18.

⁹⁹ See, e.g., Stephen Figlewski, *Subjective Information and Market Efficiency in a Betting Market*, 87 J. POL. ECON. 75 (1979); Raymond D. Sauer, *The Economics of Wagering Markets*, 36 J. ECON. LIT. 2021 (1998); Sandip Debnath et al., *Information Incorporation in Online In-Game Sports Betting Markets* (June 2003) (unpublished manuscript, available at <http://dpennock.com/papers/debnath-ec-2003-sports-exchange.pdf>).

¹⁰⁰ HSX allows participants to place bets using virtual money on the results of the Oscars. In 2005, HSX correctly predicted the outcome of all eight categories on which betting was allowed. SUNSTEIN, *supra* note 5, at 111.

¹⁰¹ Berg & Reitz, *supra* note 10, at 149–55. One reason why information markets may outperform polls has to do with race. The "Bradley effect" occurs when minority candidates poll better than they fare in actual elections. By hypothesis, people are unwilling to admit their racial biases to a pollster but feel more secure in the anonymity of a voting booth. See Carol M. Swain, *Reauthorization of the Voting Rights Act: How Politics and Symbolism Failed America*, 5 GEO. J.L. & PUB. POL'Y 29, 37 (2007). An information market avoids this phenomenon by being anonymous, and by providing an incentive to share good information about voting attitudes.

¹⁰² Robin Hanson, *Decision Markets for Policy Advice*, in PROMOTING THE GENERAL WELFARE: NEW PERSPECTIVES ON GOVERNMENT PERFORMANCE 151, 156 (Alan S. Gerber & Eric M. Patashnik eds., 2006).

accurate background knowledge, information markets can help law indirectly. Markets that reliably predict political and economic events (that are not secret or catastrophic!) can be used, perhaps in conjunction with other methods for aggregating data, to make the factual basis of a legal decision sound.

For example, an information market in geopolitical events thought to correlate with terrorism may improve the data that the Pentagon uses to calculate efficient terror responses. This was the idea behind PAM, and although it may have been ill-equipped to elicit secret information about actual attacks, it may have been an efficient way to aggregate secondary information that is nevertheless helpful in combating terrorism. Likewise, if background knowledge about the world influences judicial and jury decisionmaking, then information markets that improve that background knowledge could improve the accuracy of trials. Finally, prediction markets in catastrophe are unlikely to work, but still valuable are prediction markets in more mundane events, such as pollution levels or outbreaks of disease, which may *in turn* influence the probability of catastrophe.

Additionally, legal and political institutions could take a cue from companies like Google, Hewlett-Packard, and Yahoo!, and run internal information markets to more efficiently aggregate information. Government workers, no less than printer salesmen, are self-interested actors who have interpersonal or strategic reasons to misrepresent their beliefs about the information with which they work. A manager at the CIA who last week issued a report suggesting the Agency remove resources from Pakistan may downplay a more recent report of unrest in that country. But if he could anonymously bet on the fruition of that unrest, he would share the news with the market and thus with the Agency.¹⁰³ Of course, internal markets have the disadvantage of being limited in scale. Huge payouts would be impossible, and so investment might recede as the novelty wears off.

The spaces in law where prediction markets work are actually quite small. In general, the more that law needs prediction, the less helpful a market for it will be. Most intractable legal informational problems involve a kind of uncertainty — whether secret, idiosyncratic, or catastrophic — not susceptible to aggregation through a market mechanism. To be sure, information markets can improve knowledge in other areas, and so indirectly improve legal decisionmaking, but this role for information markets in law is considerably more niche-like than recent scholarly enthusiasm would imply. Indeed, Professor Abramowicz's "Predictocracy" seems a long way off.

¹⁰³ Of course, for some government agencies, especially the CIA, these markets and share prices would have to be secret, but this could easily be done by putting the market on an internal server.