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PREDICTION MARKETS: ANOTHER TOOL IN THE INTELLIGENCE KITBAG

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ABSTRACT

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Prediction markets (or information markets) are an efficient mechanism to aggregate information from diverse sources to develop the probability of an event. Such markets have accurately forecast presidential elections, Hollywood Academy Award winners and marketing campaigns in corporations, to name a few examples. The U.S. Intelligence Community does not lack for data in the global war on terrorism. However, the *9/11 Commission Report* highlights the difficulty of pooling information gathered by multiple collectors and fusing it into a coherent, comprehensive analysis to be used by strategic leaders. This paper explores the viability of prediction markets to support intelligence analysis by coalescing data from multiple sources into a glimpse of the future.

PREDICTION MARKETS: ANOTHER TOOL IN THE INTELLIGENCE KITBAG

For opinion in good men is but knowledge in the making.

—John Milton, *Areopagitica*

The United States Intelligence Community does not lack data relevant to the global war on terrorism. However, the *9/11 Commission Report*[1] supports the findings of many studies that highlight the difficulty of pooling information gathered by multiple collectors and fusing it into a coherent, comprehensive analysis to be used by strategic leaders. The diverse functional areas and organizational cultures resident in the sixteen agencies that make up our Intelligence Community underscore this challenge.[2]

- Central Intelligence Agency (CIA)
- Department of Energy (DOE)
- Department of Homeland Security (DHS)
- Coast Guard Intelligence element
- Department of State Bureau of Intelligence and Research (INR)
- Department of the Treasury
- Drug Enforcement Administration (DEA)
- Federal Bureau of Investigation (FBI)
- Defense Intelligence Agency (DIA)
- Army, Navy, Air Force and Marine Corps Intelligence elements
- National Security Agency (NSA)
- National Reconnaissance Office (NRO)
- National Geospatial-Intelligence Agency (NGA)

Table 1.

The specialized talent and array of technology brought to bear by each agency produces focused analysis and fine-grained comprehension of information. This distributed approach to

the production of intelligence encourages robust compliance with Executive Order 12333, which directs that

> The United States intelligence effort shall provide the President and the National Security Council with the necessary information on which to base decisions concerning the conduct and development of foreign, defense and economic policy, and the protection of United States national interests from foreign security threats.[3]

E.O. 12333 mandates this diversity: "Maximum emphasis should be given to fostering analytical competition among appropriate elements of the Intelligence Community."[4] But this document poses a dilemma because it also requires that all agencies "cooperate fully to ensure full and free exchange of information in order to derive maximum benefit from the United States intelligence effort."[5] Should the IC reconcile "competition" with "cooperation"?

The Japanese surprise attack on Pearl Harbor in December 1941 and the employment by al Qaeda of suicide aircraft against targets in New York and Washington in September 2001 provide two infamous examples of the failure to fuse intelligence collected by "competing" agencies into one product in time for national leaders to thwart the attacks. In October 2003, an intelligence professional candidly acknowledged that policies and cultural issues inhibit information sharing and collaboration between elements of the Intelligence Community, thereby posing the greatest challenge to true horizontal integration of analysis.[6] The *9/11 Commission Report* summed up the problem thus: "The biggest impediment to all-source analysis — to a greater likelihood of connecting the dots — is the human or systemic resistance to sharing information."[7]

In an attempt to circumvent this selfish human tendency, the Intelligence Community employs interagency task forces, working groups and collaborative centers — such as the FBI's Interagency 2004 Threat Task Force; the Technical Support Working Group which coordinates research and development to defeat terrorism; the Weapons Intelligence, Nonproliferation and Arms Control Center; and the National Counterterrorism Center).[8] The 2001 Patriot Act removed some of the legal barriers which inhibited collaboration between the FBI's domestic counterterrorism efforts and overseas intelligence collection by agencies like CIA and NSA.[9]

But do we have a way to the next logical step past simply sharing data between agencies? Is there a way to pool the collective judgment of analysts into a comprehensive product for national security policy-makers and decision-makers?

James Surowiecki, a financial writer for *The New Yorker*, makes this argument in his 2004 book *The Wisdom of Crowds: Why the Many Are Smarter Than the Few and How Collective Wisdom Shapes Business, Economies, Societies and Nations*:

What was missing in the intelligence community [to prevent the 9/11attacks], though, was any real means of aggregating not just information but also judgments. In other words, there was no mechanism to tap into the collective wisdom of National Security Agency nerds, CIA spooks, and FBI agents. There was decentralization but not aggregation, and therefore no organization. … But everything we know about cognition suggests that a small group of people, no matter how intelligent, simply will not be smarter than the larger group. And the best tool for appreciating the collective significance of the information that the intelligence community had gathered was the collective wisdom of the intelligence community. Centralization is not the answer. But aggregation is….[10]

The Wisdom of the Crowd

H. L. Mencken once quipped, "No one in this world, so far as I know, has ever lost money by underestimating the intelligence of the great masses of the plain people." Surowiecki makes a compelling case for the opposite view: large groups of people are smarter than an elite few, no matter how brilliant. He claims that if four basic conditions are met, a crowd's "collective intelligence" will produce better outcomes than those of a small group of experts. This holds true even if members of the crowd are not aware of all the facts or choose, as individuals, to act irrationally. "Wise crowds" need (1) diversity of opinion; (2) independence of members from one another; (3) decentralization; and (4) a good method for aggregating opinions.[11]

Diversity brings into play the private information held by each person, which may be simply their peculiar interpretation of the known factors. Diversity is especially important in smaller groups because it adds perspectives that may not be inherently present in a group drawn from a uniform population, such as an ad-hoc "tiger team" thrown together within the same office to tackle a problem. A wide range of opinions tends to eliminate the more negative aspects of group decision-making ("group-think") and offers a larger set of possible solutions or novel approaches.

Surowiecki maintains that a group of *highly* intelligent people is not as effective because the members' thought processes tend to resemble one another. He quotes James March, a famous organizational theorist: "The development of knowledge may depend on maintaining an influx of the naïve and the ignorant, and … competitive victory does not reliably go to the properly educated."[12]

Surowiecki cautions, however, that a group of diverse but *thoroughly uninformed* people will not produce a collective decision that is more accurate than the opinion of one expert. A diverse group whose members have varying degrees of knowledge about a subject will, in the long run, generate better solutions than that single expert. The expert, like any human, has an ego and is prone to overestimate the probability that he is correct.[13]

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Independent group members are insulated from the decisions made by others and are not influenced by a single opinion leader. This freedom to think throughout the crowd provides two valuable advantages. First, individual mistakes do not develop into a correlated but incorrect judgment. People become biased when their judgment is dependent on information from other parties. Second, information contributed by independent individuals is likely to offer a fresh perspective, not a recycled version of the familiar data.[14]

Decentralization allows specialists to draw on local knowledge and tends to bypass the errors inevitably present in each person's opinion. Surowiecki refers to this as *tacit knowledge* — that which can't be easily summarized or conveyed to others because it is specific to a particular place or job or experience.[15] The U.S. Army champions the doctrine of decentralization every day with its empowerment of junior leaders to use their tacit knowledge to make decisions that accomplish the intent of their commander as communicated to them through his mission-type orders. Successful multinational corporations practice decentralization when they empower local managers in each country to shape marketing and distribution schemes adapted to the local culture and infrastructure.

However, decentralization loses its effectiveness if tacit knowledge or unique intelligence does not migrate to the other people within a system who would benefit from it. So the fourth attribute of a "wise crowd" reinforces decentralization: an *aggregation mechanism* to mold all the private opinions into a collective decision.   This paper will explore the viability for the U.S. Intelligence Community of one such mechanism, called a *prediction market* or *information market*.

> Surowiecki surely warrants such a consideration:
>
> … [the collective decision's superiority] rests on a mathematical truism. If you ask a large enough group of diverse, independent people to make a prediction or estimate a probability, and then average those estimates, the errors each of them makes in coming up with an answer will cancel themselves out. Each person's guess, you might say, has two components: information and error. Subtract the error, and you're left with the information.[16]

The Japanese place great cultural emphasis on working as a group. One of their proverbs captures the spirit of the "wise crowd" with the elegance of a haiku: "None of us is as smart as all of us."

Collective Intelligence via the Marketplace

Surowiecki is not the first observer of this phenomenon. The Danish philosopher Soren Kierkegaard was commenting on religious dogma in 1846 when he recognized the tendency for a group of people to arrive at an accurate observation: "There is a view of life which holds that

where the crowd is, the truth is also, that it is a need in truth itself, that it must have the crowd on its side."[17]

A simple demonstration of collective intelligence was published in 1906 by the eminent British anthropologist and statistician, Francis Galton. He was passing by an English county fair when he noticed an advertisement for a contest to guess the weight of an ox. Participants were invited to write their name and estimate on a slip of paper, then the answer closest to the actual dressed weight of the beast would win a prize. The founder of differential psychology, Galton studied human abilities and attempted to correlate them to intelligence, genetics and social factors. He hoped that the guesses of these common farmers might yield insights into the ability of voters to choose the best candidate in a democratic election.

He was able to borrow the 800 or so slips of paper and discovered that the mean (or average) of all the estimates fell within one percent of the true weight of the ox. Galton offered this grudging acknowledgement that non-intellectuals could construct a useful collective opinion: "The result seems more creditable to the trustworthiness of a democratic judgment than might have been expected."[18]

Friedrich Hayek, the British economist who won the 1974 Nobel Prize for Economics, published his "Efficient-Market Theory" in 1948, in which he asserted that people can transmit their local knowledge about a commodity to each other through the mechanism of the market.

> The whole acts as one market, not because any of its members survey the whole field, but because their limited individual fields of vision sufficiently overlap so that through many intermediaries the relevant information is communicated to all. The mere fact that there is one price for any commodity — or rather that local prices are connected in a manner determined by the cost of transport, etc. — brings about the solution which (it is just conceptually possible) might have been arrived at by one single mind possessing all the information which is in fact dispersed among all the people involved in the process…The most significant fact about this system [price] is the economy of knowledge with which it operates, or how little the individual participants need to know in order to be able to take the right action.[19]

Kenneth Arrow and Gerard Debreu then restricted Hayek's theory to an ideal market which contains complete information about the commodities being traded regardless of location or time period. Their 1954 model predicts a set of prices such that aggregate supplies will equal aggregate demands for every commodity in the economy.[20] Debreu went on to win the 1983 Nobel Prize for Economics for his rigorous refinement of their theory.

In 1956, Vernon L. Smith, professor of economics at the California Institute of Technology (Caltech), wanted to discover if people with disparate, incomplete knowledge and limited analytical capability could marshal resources to the right place at the right cost. He coached his

economics students as they ran an imaginary double auction stock market using Arrow-Debreu securities. In a double auction, buyers and sellers shout bids and asks for each security, which are matched with shouted responses from those interested in accepting them. The price for each mock security quickly converged to an optimal price, known to economists as the *market clearing price*. Smith was recognized as a pioneer in the field of experimental economics by the 2002 Nobel Prize for Economics.

What did Smith's experiment demonstrate? Don't stock and commodity markets set the price of securities worth billions of dollars every day, in much the same fashion? As Smith pointed out, though, these commercial markets are populated by professional traders who are *specialists* in analyzing wheat and pork-belly futures, or airlines and automotive stocks. His experiment showed that *ordinary* people ("naïve, unsophisticated agents," as he referred to them) could perform as well as the experts when using a market as a means of sharing information. Charles R. Plott, another Caltech economics professor and Smith's collaborator in other work, calls such a market an *Information Aggregation Mechanism*.[21]

Collective intelligence sometimes exhibits itself in unexpected venues. Research in 1984 validated the long-held notion that the price of orange juice futures, traded by the Citrus Associates on the New York Cotton Exchange, is a better predictor of weather in citrus-growing states than U.S. Weather Service forecasts.[22] The crash of the space shuttle *Challenger* demonstrated the power of the market to coalesce information into decision. Within minutes of the 1986 explosion, traders on U.S. stock exchanges dumped shares of the four NASA contractors involved with the space shuttle program. By the end of the trading day, the market had focused its blame on the maker of *Challenger's* solid-rocket boosters: Morton Thiokol's share price continued to plummet while the other three non-culpable stocks had regained most of their losses. The averaged opinions of thousands of traders almost instantaneously converged on the culprit, an achievement that required four months of investigation by a presidential commission.[23]

What are Prediction Markets?

There is a growing body of literature on the use of markets to merge information from disparate sources and then represent the result as a probability. These markets are referred to by the generic term *prediction markets* but are variably called *information markets, idea futures* or *event futures*. Two business professors who have written extensively in this area, Justin Wolfers and Eric Zitzewitz, describe them as markets where "participants trade contracts whose payoffs are tied to a future event, thereby yielding prices that can be interpreted as market-

aggregated forecasts. The price can be taken to express a probability (percentage) of that event occurring."[24]

This concept is not without its critics. Charles Manski, an economics professor at Northwestern University, asked in 2004, "What is the logical basis for interpreting the price of an all-or-nothing futures contract as a market probability that the event will occur?"[25] But his contention was specifically rebutted by Wolfers and Zitzewitz in 2006. Using a formal model , they demonstrated that prediction market prices are usually close to the mean estimates of traders. [26]

Robin Hanson, a George Mason University economics professor, established **Foresight Exchange** in 1994, a seminal prediction market still in operation today.[27] He is credited with coining the term *ideas futures* in 1999. He advocated trading contingent contracts linked to the outcomes of more than one event in *decision markets* to examine the correlation between events. Hanson concluded that such derivative contracts can estimate the net effect of any policy choice on any outcome of interest *that can be verified after the fact.*[28]

The Department of Defense is no stranger to prediction markets. In 1968, a team led by Dr. John Craven, Chief Scientist of the U.S. Navy's Special Projects Division, was tasked to search for the nuclear submarine *USS Scorpion,* then missing in the Atlantic Ocean. He organized an internal prediction market among the scientists, salvage experts and submarine officers on his team to solicit their best guesses, given the scenario surrounding the sub's sinking. Craven employed Bayes' theorem — useful for calculating the impact of new information on a prediction — to aggregate their guesses into a starting point for the search. After a five-month effort, *Scorpion's* final resting place was discovered to be 220 yards from the group's starting point.[29]

DoD's First Intelligence Prediction Market: FutureMAP

Let's return to our question of intelligence aggregation for policy-makers. A search for such a system had been underway within the Department of Defense for five months when the al Qaeda attacks occurred in September 2001. The Defense Advanced Research Projects Agency (DARPA) issued a call for proposals in May 2001 under the title of "Electronic Market-Based Decision Support," later renamed "Future Markets Applied to Prediction (FutureMAP)". The program objective stated that FutureMAP would concentrate on market-based techniques for avoiding surprise and predicting future events. It recognized that independent contributions from experts in a wide variety of fields would have to be combined into one assessment on topics such as political stability in regions of the world and the impact on national security of

emerging technologies. DARPA also noted that the rapid reaction of markets to knowledge held by only a few participants may provide an early warning system to avoid surprise.[30]

A company called Net Exchange (with Robin Hanson as subcontractor) won a contract with its proposal for a Policy Analysis Market (PAM) to focus on the key Middle East nations of Turkey, Egypt, Saudi Arabia, Israel, Syria, Jordan, Iraq and Iran. This Internet-based PAM would establish trading markets to cover the economic health, civil stability and military posture of each country, along with their economic interactions and military involvements with the United States. Each of these markets would track a financial index customized by the Economist Intelligence Unit (EIU), a subsidiary of *The Economist* magazine.[31]

At the start of each quarter, the Policy Analysis Market would issue securities which stated that the EIU index in each market for each country would exceed a published target. Traders would buy and sell contracts based on their knowledge about this result. Constrained between $0 and $100, the final price of the contract would be analogous to the probability (expressed as a percentage) of that event occurring. Each security would mature in one year, whereupon the EIU would adjudicate the results. The PAM would then pay off the winning predictions.[32]

Net Exchange proposed two other types of futures contracts to be offered under the Policy Analysis Market. One type would track global economic and conflict indicators, such as the U.S. stock market, the U.S. Gross Domestic Product, global trade, deaths attributed to terrorism, and U.S. military casualties. A second category would offer contracts on specific possible events, such as American recognition of a Palestinian State in the first quarter of 2005. Traders could also construct derivative securities that combined the different markets: "If Turkey's 'military involvement with the U.S.' index tops X, will Syria's 'military posture' index exceed Y?"[33]

Once traders expressed interest in a specific event, Net Exchange would nominate a definition to the EIU, stated as "yes/no" or "happened/did not happen." If the EIU accepted the responsibility of assessing the security at maturity, Net Exchange would place the new security into trade on the Policy Analysis Market website.

The following table, provided during a briefing by Net Exchange in June 2003, illustrates how trading in these securities might work.[34]

Security listed on 15 Dec 2003	Posted Prediction	Trader and Perception	Trader Action
Turkish econ. health in Q2 '04 will be > 115 (an index measure)	36¢	Bank officer charged with Turkey risk assessment considers this more likely	Buy contracts in this security until prediction = 45¢
Civilian deaths from terrorism in Q4 '04	500	Reporter with a Middle Eastern news agency considers this too high	Sell contracts until prediction = 300
The U.S. recognizes a provisional Palestinian state in Q3 '04	55¢	Professor of Middle Eastern studies thinks this is high	Sell contracts until prediction = 40¢
If Q3 '04 Iraqi econ. health > 150, then Q4 '04 Syrian civil stability < 100	42¢	Expert in Syrian domestic politics considers this far too low	Buy contracts until prediction = 60¢

Table 2.

Net Exchange intended to operate the PAM under two different regimes. PAM #1 would be restricted to about 2000 traders who were employees of U.S. Government agencies. PAM #2 would expand their number to include an additional 6000 traders, who would add the diversity of tacit knowledge found in academia, the media, policy research institutes ("think tanks"), insurance companies, non-governmental organizations and the general public. Net Exchange hoped to recruit half of the traders in PAM #2 from outside the United States — eventually including officials of foreign governments.[35]

FutureMAP's debut in July 2003 met with harsh criticism from Congress and the media. Their tirades centered on the misconception that the PAM would be a forum for traders to profit from assassinations and terrorist attacks, a ghoulish waste of public money which would produce no public benefit. DARPA canceled the project within a few days but the media posturing endured for several months. At the time of FutureMAP's demise, Net Exchange was recruiting the first cohort to begin trading using their company's proprietary market-making software; the project had expended a total of about $1 million.[36]

Opposition to the "Terrorism Futures Market"

The arguments against the Policy Analysis Market fell into seven general categories, according to Robin Hanson[37] and Robert Looney.[38] It is useful to examine each one before deciding the utility of prediction markets for this task.

(1) *The system creates a strong incentive for someone to buy futures in a violent act and then carry out the act: the Insider Information Problem.* This possibility is not new; it is common

knowledge that al Qaeda is suspected of selling short their stocks of airline and hotel companies just prior to their September 2001 airplane attacks. However, the small dollar amounts of trades to be conducted in the Policy Analysis Market made it doubtful that terrorists could realize any significant funding by betting on their own operations. Terrorists trading in the PAM would actually make the information content of the price more realistic.

(2) *The system would create incentives for participants to manipulate the market by spreading rumors about the likelihood of events.* This argument concerns an event which would not be the main focus of the Policy Analysis Market, such as the assassination of a foreign head of state. The market automatically takes into account that the head of state's government would take action to pre-empt this act, so there would be no dramatic increase in the share price from which a terrorist could quickly profit. As noted previously, most PAM contracts would have covered an index linked to a long-term indicator, not a specific event that could be easily altered or manipulated.

(3) *The PAM would suffer from insufficient trader participation.* Joseph Stiglitz, winner of the 2001 Nobel Prize for Economics, argued that the PAM would lack fidelity because it would be a "thin" market.[39] He referred to his 1976 study conducted with Sanford Grossman[40] in which they contended that the Efficient-Market Theory was idealistic. They claimed that because acquiring information to make knowledgeable trades is costly, prices cannot perfectly reflect all available information. If prices were truly Hayekian, then traders who spent resources to obtain information would receive no compensation. Grossman's and Stiglitz' hypothesis would act as an economic disincentive to potential traders in the PAM. They also challenged the assumption that the market price would accurately capture the probability of the event covered by the contract. However, Jed Christiansen's 2006 research, using prediction markets which covered five British and international rowing regattas, demonstrated remarkable market calibration with participation by as few as sixteen traders.[41]

(4) *Participants would have doubts that anyone could ever cash in on a future contract, as it is likely that public outrage would not allow it.* Imagine Congress allowing a trader to collect his winnings after successfully predicting the September 2001 al Qaeda attacks! Again, this is a fallacious argument concerning a contract not likely to be offered on the Policy Analysis Market. If DoD ever refused to pay off a contract, no one would again participate in the PAM; such a refusal would defeat the purpose of the market, which is to solicit intelligence.

(5) *Futures contracts can be written only for events that are explicitly anticipated.* Given the inexhaustible creativity of the human mind, many events of interest to policy-makers would

be difficult to anticipate. But, again, most of the PAM's securities would cover leading indicators of the strategic environment rather than spectacular incidents.

(6) *The PAM is a gambling parlor.* Net Exchange negotiated with the Securities and Exchange Commission, the Commodity Futures Trading Commission and the Internal Revenue Service to limit transactions to $100, thus staying under the threshold of U.S. gambling laws and futures-trading regulations. Furthermore, the gambling laws do not apply to speculators in futures markets who often risk sums of millions of dollars. The difference between the definition of *gambling* and *speculating* is the degree of chance regarding the outcome — speculators risk money when they have a high level of confidence that they will be rewarded.

(7) *The PAM would be inequitable.* Another accusation put forward by Stiglitz portrayed the Policy Analysis Market as a ploy by the Bush Administration to allow rich Americans to hedge against terrorism events by playing the PAM, while the majority of U.S. citizens would remain ignorant and financially vulnerable.[42] But the PAM limit on the size of bets prevents the wealthy from profiting in much the same way as it restricts the terrorists from realizing any substantial monetary gains. Further, rich people use insurance to protect themselves against economic loss.

Prediction Markets in the Business World

Numerous examples of successful prediction markets in the commercial and academic world prompted DARPA to explore this option for intelligence collection. Puong Fei Yeh, writing in the December 2006 issue of the CIA's *Studies in Intelligence*, provides a comprehensive survey of prediction markets in general and the PAM in particular.[43] Consider the following examples:

The **Iowa Electronic Markets** (IEM)[44] have been operated as an educational and research project since 1988 by the Henry B. Tippie College of Business at the University of Iowa. *Elections* contracts in the IEM cover U.S. Presidential and Congressional elections, selected U.S. state and foreign elections, and economic matters ranging from corporate earnings and the Mexican peso to the monetary policy of the Federal Reserve Open Market Committee ("The Fed"). Trade prices are constrained between $0.00 and $1.00 in increments of $0.001 to reflect a probability between zero and 100%. The IEM capped accounts at $500 in order to qualify for a letter of "no regulatory action" from the Commodity Futures Trading Commission.[45] The IEM *economic* markets are specifically restricted to traders from academia, but the general public may participate in any of the *elections* markets. The latter exhibit impressive correlation between IEM predictions and actual outcomes for elections, with errors

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ranging between 1.37% and 3.44%. The IEM *elections* markets have performed about as well as, or slightly better than, the average of several national elections polls.[46]

Started in 1996, the **Hollywood Stock Exchange** (HSX) calls itself "the world's longest continuously operating commercial prediction market." Tens of thousands of film aficionados around the world regularly buy and sell contracts using virtual "Hollywood dollars" (no monetary value) to back their predictions of Oscar and Grammy winners, movie star popularity, and box-office receipts for movies. Now a unit of the financial services company Cantor Fitzgerald, HSX sells its predictions of long-term and short-term film revenues to studios and producers.[47]

NewsFutures advertises itself as the leading provider of prediction markets worldwide (50,000 markets since 2000) under the slogan "Trading uncertainty for collective wisdom." It runs no-cost predictions markets to enable the public to bet on such topics as:

- Palestine is recognized by the UN as a member state on or prior to January 1, 2008
- Nouri al-Maliki will remain Prime Minister of Iraq through the rest of Bush's presidency
- The U.S. will catch Osama bin Laden while Bush is president
- Islamic terrorists will attack in the U.S. before attacking within the European Union
- Islamic terrorists will hit the U.S. homeland again while Bush is president.[48]

NewsFutures also designs and operates prediction markets for corporate clients to help them gain insight into sales and strategic commodity price forecasting, new product development, dates of project completions, business intelligence, and industry trend-spotting. Their clients include industry leaders such as Yahoo!, SAIC, Siemens, Lilly, Corning, Dentsu (Japan's largest advertising firm), and Arcelor (a European and South American steel producer).[49] Finally, NewsFutures operates the virtual-money Global Risks Prediction Market on behalf of the World Economic Forum in Geneva, Switzerland.[50]

Inkling Markets, founded in Chicago in 2005, advertises itself as an online service for individuals and organizations to create and manage their own prediction markets. Its services have been used by both corporations and academic researchers.[51]

Intrade bills itself as "the leading public prediction market platform, with over 65,000 eligible members from over 125 countries generating predictions on thousands of event futures since 2000." Intrade, incorporated in Ireland, handles for-profit bets on politics, economics, current events and the weather, requiring an initial deposit of $250. It is a subsidiary of the Irish on-line betting firm Tradesports; both entities are exempt from U.S. gambling and securities laws.[52]

Hedge Street calls itself "the first Internet-based, government regulated market where traders can hedge against or speculate on economic events and price movements." The

company is registered as a futures exchange with the Commodity Futures Trading Commission and allows consumers to trade in small futures contracts ranging from commodities and currencies to economic indicators (such as employment, fuel, housing prices, inflation, and interest and mortgage rates). One novel option allows workers to try to offset their commuting costs by hedging with weekly futures contracts predicting gasoline prices.[53]

At this point, a discerning reader will ask: Does the accuracy of a prediction market depend on the use of real money versus virtual trading currency? Servan-Schreiber et al. compared the predictions produced on Tradesports (actual money) with NewsFutures (play money) during the 2003 season of the National Football League; both markets displayed equal accuracy.[54] Many traders seem to be motivated simply by the prestige of success.

The growing academic and commercial interest in prediction markets is reflected in the **Prediction Markets Cluster**, whose mission statement calls it "the open industry commons and consortium for prediction markets ... a collaboration of vendors, academia, traders, users, developers, markets, regulators and stakeholders." Besides corporate and academic sponsors, it lists recent conferences covering prediction markets:[55]

- ***Prediction Markets Conference***, 18 January 2007, sponsored by the American Enterprise Institute-Brookings Joint Center, Washington, DC; proceedings available at http://www.pmcluster.com/IAD.htm.

- ***Prediction Markets: Tapping the Wisdom of Crowds***, 13 December 2006, sponsored by Yahoo! Technology Development Group, Sunnyvale, California; proceedings available at http://confab.yahoo.com.

- ***Information and Prediction Markets — European Summit***, 2 November 2006, sponsored by Colabria, Vienna, Austria; proceedings available at http://pmcluster.com/VIE.htm.

The **American Enterprise Institute-Brookings Joint Center** in Washington, DC maintains a webpage featuring its own research on information markets, notably a book co-authored by several contemporary scholars referenced in this paper.[56] This webpage also highlights other scholarly articles, op-ed pieces, and a comprehensive listing of other websites concerning prediction markets.[57]

Recommendations for Implementing Prediction Markets in the Intelligence Community

(1) Designate several analysts from each of the 16 members of the national Intelligence Community to trade on contracts of interest in existing commercial prediction markets (NewsFutures, Intrade, Inkling). For markets requiring real money, each agency could bankroll its traders with mission funds and allow them to keep any winnings as a performance award. Track the results of these contracts.

(2) Create a prediction market as a *classified* intelligence aggregation mechanism, similar in structure to PAM #1. It would be open only to employees of the Intelligence Community and selected outside experts with the appropriate security clearance. This prediction market would cover the same type of contracts described earlier in this paper for the original PAM. The Intelligence Community should find it useful to calibrate this market's results with appropriate analogous contracts traded in the market of Recommendation #1.

One legal challenge is gaining authorization for the transfer of appropriated funds between government agencies without the approval of Congress. Under PAM, Net Exchange proposed that DoD act as the market-maker and provide all traders (from all agencies) with funds from a DoD appropriated budget line. Each trader would be able to keep any profits; winnings of DoD employees would be booked as performance awards to account for the internal transfer of funds from the DoD mission account to its personnel account.[58]

(3) Revive PAM #2 under a new name. Devise a carefully-planned strategic communications campaign to forestall the unfavorable publicity of its first incarnation. Recruit participants from a diverse cross-section of society, using the same criteria as PAM #2 to select about 8000 traders. To provide comparison, structure the contracts to mirror appropriate issues tracked in the classified, U.S. Government-only market proposed in Recommendation #2.

(4) Senior officials at each intelligence agency must support participation of their traders and be willing to incorporate the predictions produced by the various markets into the intelligence fusion process.

Conclusion

Prediction markets à la the Policy Analysis Market will not reveal brilliant insights about terrorist intentions; they won't provide tactical initiative but may prevent strategic surprise. The final, probabilistic prices of the various contracts can act as a signal for strategic leaders about where intelligence efforts should be more focused.

The professed Congressional unease that the original PAM would allow people to profit by a market in death and destruction is myopic and nonsensical. Such a market has existed for hundreds of years — it's called the insurance industry. Every day, insurance companies earn money by predicting who will die and when, and what kind of disaster might strike.

A similar logic can be applied to the concern that terrorists might profit in an intelligence prediction market by using their tacit knowledge. Paying money to unsavory characters in exchange for intelligence is nothing new; the Sanhedrin paid Judas Iscariot thirty pieces of silver

for providing the time and place that Jesus would be alone in Gethsemane.[59] An intelligence

prediction market is just another economic enticement to elicit information from human sources.

Terrorist movements exhibit enormous creativity in inventing new ways to attack the

United States. Let's give our Intelligence Community every possible tool to defeat them.

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