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Saul Levmore*

I. INTRODUCTION

The conventional view of the mechanisms of market efficiency focuses on large numbers of market participants, at least some of whom are well informed.1 But what if this seemingly obvious and simple mechanism, or requirement, is in fact unnecessary? My aim here is to suggest that efficient markets may in fact be much simpler than normally imagined. The real question, as we will see, is how our understanding of simple markets, with small stakes and modest numbers of players, affects our understanding and regulation of thicker and more complex markets.

II. FANTASY MARKETS

Consider, as a starting point, the Iowa Electronic Markets, or IEM, which may be familiar to many readers because of its presence in the news during U.S. Presidential election campaigns. IEM is a controlled environment, or experiment, operated by the University of Iowa Business School, which allows participants to invest modest amounts of (real) money in certain “decision markets.”2 An individual’s investment is limited to five hundred dollars; imaginative players could, no doubt, use multiple personalities and credit cards to avoid this limit, but it is unlikely that many players do so.

The IEM opened in 1988, and offered trading in but one thing, the expected fraction

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of the popular vote candidates would receive in the November U.S. Presidential election. The Exchange issued securities that promised to pay $2.50 multiplied by whatever share of the vote a specified candidate received on Election Day as reported by the Associated Press the following morning. Thus, if on the Wednesday following the election one held a share of Bush, and Bush received 54% of the vote, then the shareholder would have received $.54 \times 2.50 = 1.35$. (And, in fact, the last trades on the eve of the election were at $1.34$.) As late as the day before the election, shares were bought and sold with respect to the expected vote share of Bush, Dukakis, Jackson and a fourth package, as it were, representing the combined share of the vote to be received by the minor candidates who formed the rest of the field. Under the terms of the originally issued shares, there was no payoff at all for shares of candidates who withdrew from the race, but of course these four packages each produced some payoff.

The IEM itself made no money and took no position on candidates, nor has it become a profit-seeking enterprise in the subsequent fifteen years. IEM initiates markets by offering (an unlimited number of) bundles of all known alternatives. The price of the initial bundle is of no consequence, though the IEM quickly moved to bundles priced at $1.00. Buyers can of course unbundle the candidates and help form markets in individual candidates. For example, if the IEM makes a market in a political election with two known candidates, D and R, it offers, for $1.00, two pieces of paper, representing these two candidates. D plus R will of course garner 100% of the vote. Over time and up to the election, shares of D and R will sell separately, because the original buyer can separate them, and we can expect the price of one D and one R always to sum to $1.00—apart from some small discount to reflect the time value of money.

IEM continues to issue and facilitate trading in shares of this kind, but it has also added more popular winner-take-all shares. Again, as the issuer, it offers shares in bundles priced at $1.00 each, but the new and far more popular promise is that each share associated with the winning candidate will be redeemed for $1.00 after the election, with all other shares regarded as worthless. Both sorts of bundles could contain all possible

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4. The bundles of shares that IEM issues cover every possible contingency in a given marketplace. For example, the IEM is currently running a market on the next Democratic Presidential Primary. The bundles sold contain shares for all announced candidates. As such, each bundle will always pay off a total of $1.00. This eliminates the possibility that the IEM could make money should it sell a bundle that did not include payoffs summing to its purchase price.

5. Pennock, Lawrence, Giles, and Nielsen suggest that this is one of the most basic concepts of market efficiency. See DAVID M. PENNOCK ET AL., NEC RESEARCH INST. TECHNICAL REPORT 2000-168, THE POWER OF PLAY: EFFICIENCY AND FORECAST ACCURACY IN WEB MARKET GAMES (2001), available at http://artificialmarkets.com/am/pennock-nci-tr-2000-168/ (last visited Aug. 19, 2003). They refer to this requirement that a market be arbitrage-free, that no trader be able to make a sure profit without any risk as “internal coherence.” See id. They consider it a fundamental component of the efficient markets hypothesis. See id.

6. In the past two election cycles there have been approximately twice as many participants in IEM’s winner-take-all markets as in its vote-share markets. See Joyce Berg et al., ACCURACY AND FORECAST STANDARD ERROR OF PREDICTION MARKETS, HENRY B. TIPPLE COLLEGE OF BUSINESS ADMINISTRATION, UNIVERSITY OF IOWA (Nov. 2001), available at http://www.biz.uiowa.edu/iem/archive/forecasting.pdf (last visited Aug. 19, 2003). The volume of contracts and of dollars in the winner-take-all markets have been more than ten times greater than comparable volumes in vote-share markets. See id.
candidates, but in fact the trading is in shares of the two major party candidates, with the final vote extrapolated upward to reflect any third party vote. If Candidate D gets 55% of the votes that are cast for the two major candidates, then the "old," or market share, IEM pays $0.55 to holders of D paper, and the "new," or winner-take-all, IEM pays $1.00. Roughly speaking, the prices of the R and D shares start out fairly close to one another, and as Election Day draws near, the price of one draws closer and closer to $1.00, while the other approaches zero. The loser may be projected to draw 48%—or even more than 50%, as we know—of the popular vote, but on the eve of the election the 48% may be thought sufficiently stable, or simply unlikely to grow in the remaining hours, so that the share sells for the same zero price as would one associated with a candidate expected to draw but 10% of the vote. Shares of the market-share IEM security obviously display a different pattern. The market-share variety is less risky, in an obvious sense, though a candidate's withdrawal from the field does drive the return to zero.

The IEM has proved to be remarkably accurate both immediately preceding the general election, as well as several months before that day of reckoning. The market-share security on the IEM has averaged an error rate of 1.37% over the last four elections, and this (election eve) error is well below that of the major polling organizations. Earlier in time, the IEM seems even more impressive, though it is not my intention here to compare errors or discuss the techniques one might use to compare the results offered by various pollsters and markets. Anecdotal evidence is, of course, readily available. Thus, in 1996, most major polls grossly overestimated Clinton's lead up until the last week before the election, while the IEM's price of Clinton and Dole shares hovered much more closely around prices that reflected the eventual outcome of the election.

The newer winner-take-all IEM began selling shares during the 1992 Presidential campaign. In this binary market (where the holder of a share receives either zero or $1.00 after the election is completed), we should expect the spot price of shares to reveal the likelihood that the associated candidate would win the popular vote. For example, if a share of 1996 Clinton sold at $0.65 on October 1, then on that day buyers and sellers appear to think that Clinton has a 65% chance of winning a month—hence ignoring, once again, the time value of money. Indeed, the spot price for a share of Clinton neared $1.00 on election eve. The IEM has continued its modest expansion and it now offers markets in apolitical questions. One can speculate on the question of whether the Federal Reserve Board will raise, lower, or maintain its discount rate in another winner-take-all market. Trading also takes place with respect to the question of whether the Fed's rate change or decrease will be one-quarter or one-half a percentage point.

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7. See id. at Figures 5, 6.
10. See Berg et al., supra note 6, at Figure 5.
11. The IEM only offers these supplemental markets regarding the size of interest rate changes when it perceives that traders are almost certain of a rate change. It then issues a stock split to those who hold shares. For example, if raise was trading at $0.80 a share, the IEM would likely issue shares of quarter point raise and half point raise in exchange for each share of raise. The holders of the two new shares can sell off the components to create the new market. See Iowa Electronics Website, at http://www.biz.uiowa.edu/iem/markets/
Another IEM product may be of even greater import to readers interested in corporate and securities law. I refer to a winner-takes-all market in which the original $1.00 bundle consists of IBM, Microsoft, Apple, and the S&P 500. The $1.00 payoff goes to the shareholder whose paper represents the one (of these four "investments") that has the highest rate of return at the end of a specified month. Thus if, at the end of the specified month, a $100.00 investment in Apple would have done better than the same investment in the other three (real) investments, taking stock price and dividends into account, then the Apple "share" pays off $1.00 and each of the other three receives zero.\footnote{12}

I will soon proceed under the reasonably well-founded assumption that the IEM is a remarkably accurate market. I prefer not to call it efficient because we normally think of an efficient market as one that cannot be outperformed and, as we will see, most people and firms have no reason to try and outperform the IEM. It may be that no one can beat the IEM, in a manner of speaking, but it is not as if many people are trying to do so. Note, in this regard, that the IEM trades in things that are not easily associated with inside information. More generally, the very structure of the IEM is such that it is likely to attract players for whom the monetary risks are a kind of entry fee or cost of consumption, rather than a part of some profit-maximizing, income-producing venture.\footnote{13}

I will not attempt to prove that the IEM is or is not efficient, for it is sufficient to see that it is an interesting and accurate market, and perhaps one that would never have thrived without the Internet. My goal is instead to draw attention to certain kinds of markets, or information games, and to see what we can learn about more serious markets and their regulation from these simple exchanges.

Consider next the “Hollywood Stock Exchange” which trades fictitious shares in films and in film stars. It is much less of a market than the IEM in that participants use “Hollywood dollars,” which is to say money that is no more real than that used in most board games. At the same time, it is more of a market because, among other things, there is no imposition of a binary, winner-take-all feature. Players buy and sell shares in widely released films, and additional shares are issued as films are conceived, developed, produced, refined, and released. The life-cycle of these shares, which is to say the whole game, comes to an end four weeks after the actual film is released. At that time, shares are “redeemed,” with the holder receiving $1.00 for each million dollars of domestic revenues that are actually reported.\footnote{14}

As for the completely fictitious character of the Hollywood Stock Exchange (HSX), one aim is to avoid securities and other regulation, not to mention prohibitions on gambling, even as insiders and amateurs alike get a chance to predict the success of films—and inform the industry of the “market’s” view of their films. The HSX is perhaps more interesting than the IEM because it is easy to believe that it attracts knowledgeable

\footnote{12. The IEM offers these markets every month starting and ending on the third Friday of each month. Note that this market need not track the stock exchange prices of the three firms because what is at stake is the rate of return compared to the three competitors. It is relative success that is being rewarded. See Iowa Electronic Markets Website, at http://www.biz.uiowa.edu/iem/markets/msft.html (last visited Aug. 19, 2003).}
\footnote{13. IEM’s participants normally invest less than $50.00 each, suggesting that profit is not the primary motivation to play. See Berg et al., supra note 9.}
players with information that can prove useful to others. These players may care about their performance in the game because they know one another or simply because they enjoy the game. In turn, their non-financial motivation enables the fantasy market to resemble a real one. The resemblance goes much further if there are many side bets, so that performance in the game has real economic consequences for the players.

In any event, it should be noted that the IEM has labored to receive full regulatory approval, or at least nodding approval, through a special exemption. The IEM’s association with an academic institution, its claim to be a working experiment, and its per-“investor” limit of $500.00 all contribute, no doubt, to the regulators’ blessing. In contrast, the HSX avoids regulation by working with play money. It seeks to aggregate information and avoid too much influence by any single player; the Exchange limits a trader’s holdings in any listed item to 10,000 shares.

Simple as this fantasy market is, it too has proved to be a good predictor. HSX offers good predictions of a film’s gross receipts before release and, relatively speaking, even better predictions after opening weekend—when a large number of traders have some information in the form of (or at least the possibility of) observing the finished film on screen, along with audience reactions. Apparently, studios have begun relying on these estimates to structure the distribution of their films. In turn, the entrepreneur behind the HSX has started to sell data collected through the Exchange to the major studios which can profit from accurate predictions of film revenues. Judging from its website, HSX also thrives on advertising revenue.

Whether to encourage players (and profit from advertising potential on the website) or to develop information that can be sold, the Hollywood Exchange is much quicker to offer or permit an assortment of trades than is the IEM. There is options trading on the HSX; the Exchange informs traders of a strike price for options on a film, with each call (or put) paying off one Hollywood dollar for each million dollars the specified film grosses above (or below) the strike price. The payoff is of course zero if the gross revenue is below (or above) the strike price.

HSX also offers a market in “Star Bonds.” Shares, for lack of a better word, are issued with respect to actors and actresses, and these shares in a career are retired after the release of a film or upon a star’s retirement. The (fantasy) value of these shares is determined by what HSX calls the “Trailing Average Gross,” which is nothing more than the average of the gross receipts of the last five films in which the star performer has appeared. Inasmuch as there is a (fantasy) market for Star Bonds, and trades can take place at any time, a studio might use the market’s prediction of a star’s future value as an indicator of the star’s drawing power, or taste in scripts.

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15. The Commodities and Futures Trading Commission has issued the IEM a no-action letter stating that it will take no action against the IEM as long as it conforms to certain guidelines. See Iowa Electronic Markets Website, at http://www.biz.uiowa.edu/iem/faq.html#Legal (last visited Aug. 19, 2003).

16. The Hollywood Stock Exchange’s predictions of box office receipts were less accurate than those of Brandon Gray, an expert at Box Office Mojo, though only slightly so. See PENNOCK ET AL., supra note 5. Apparently, both predictors made similar errors, and so it is plausible that they influenced one another or relied on the same data. See id.

17. In a sense, a “Star Bond” will differ from a share in a film only when its value is changing based upon a star’s perceived ability to choose a script and drive a film’s receipts regardless of what that film is. Once a star has chosen his or her next project, and that project is itself traded on HSX, then the Star Bond offers nothing interesting. The Star Bond market is measuring the expectation that this star will choose well.
Finally, HSX also issues winner-take-all shares around the time of various awards. Prior to the Academy (of Motion Pictures) Awards, this fantasy market offers opportunities to predict the winners of each of the eight major prizes (best picture, actor, actress, supporting actor, supporting actress, director, original screenplay, and adapted screenplay). As with IEM’s winner-take-all markets, the price of a share comes to reflect the expected payoff and, in this way, the aggregate judgment as to the chance of a given nominee’s victory in a category. Prior to a recent round of awards, the Wall Street Journal, with some controversy, polled members of the Academy. Some members surely chose not to respond to the Journal’s reporters, and others might have changed their votes or intentionally misled reporters, but the Journal did hear from 6% (356) of the voters and then correctly predicted five of six major winners. Meanwhile, HSX predicted eight of eight. This set of HSX predictions, alongside the IEM’s accuracy, emphasizes the fact that these markets, or games, are not merely mechanisms for discovering individuals’ self-assessments, or for sampling voters and consumers. In these markets, participants are combining to predict the behavior of others.

It is easy to dwell too long on these markets, and I endeavor here to pause long enough only to make plausible the assumption that these near-markets or fantasy markets can indeed convey remarkably accurate information. The discussion below requires only that we be able, without too much distraction, to explore the idea that accurate, or even efficient, markets do not—at least in some circumstances—need to involve thousands of traders and hundreds of professionals.

If the IEM represents something of a real market, and an interesting alternative to a more conventional poll, and HSX illustrates the possibility that a fantasy market may convey information as well, or nearly as well, as a real market, then it is useful before moving on to see more of the boundary between games and markets. Games can convey market and other information if the players desire to win, presumably because winning can be as good a motivation as profit. And if games are played with respect to matters where information is naturally dispersed, then a game itself can capture the information that we normally expect to be revealed only through markets, or well thought out and expensive polls or elections.

There is, for example, a good deal of betting on sports competitions but also a fair amount of non-market, or fantasy, competition with respect to some sports. Sporting events attract much gambling, and websites have taken advantage of the fact that some bettors do not have easy access to gambling markets, or prefer to gamble in a way that co-workers will not know about their fortunes. Economists have long been interested in small anomalies in racetrack and other betting, but it would surprise no one to find out that this market for predicting the outcomes in sporting events is fairly accurate. All the

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18. ATLANTA J.-CONST., March 17, 2003, at 1L.
19. See PENNOCK ET AL., supra note 5.
20. Nor is there any reason to think that volume begets accuracy in these markets. The 2000 IEM was less accurate than the 1996 IEM, and yet there was much greater volume in 2000. A casual look at IEM results shows no obvious connection between volume and accuracy. Accuracy is correlated with volume close to the time of election, and there is also greater accuracy with fewer candidates. See Joyce Berg et al., supra note 9. Of course a larger sample is needed to study this connection.
21. Many of the institutions serving this market are located outside of the United States. See, e.g., Tradesports Website, at http://www.tradesports.com/ (last visited Aug. 19, 2003).
more so if insiders participate through legal or illegal means.

Participants in fantasy baseball and football leagues resemble those who "buy" and "sell" Star Bonds on the Hollywood Stock Exchange; fantasy teams win or lose depending on the actual performances of (actual) individual players who have been selected by the fantasy owners, or managers. There may well be fans who take the matter seriously enough that real owners ought to be interested in the prices "paid" by these fans, working as fantasy owners, in a "market" with other such fans. When these fans form a fantasy market, there is also an aggregation of talent at work. Much as we think that thousands of chess players have probably found fairly "efficient" responses, or moves, to recurring situations, so too baseball and movie fans might come to judgments that are superior to those that a single person or company would develop. Despite conventional economic wisdom which exalts markets, it is plausible that hundreds of players who aim to win a game might outperform tens (or more) who aim to profit.22

The decision, or fantasy, markets discussed thus far are nonspontaneous. Indeed, most are entrepreneurial, or designer, markets of one sort or the other. In contrast, there are fantasy markets that arise at the grass roots, much as many real markets do, and these are worth noting. "Foresight Exchange" is a primitive web-based game that serves as a host or intermediary for players who must construct their own questions or play with questions posed by others, but then with fairly short lives.23 Members propose virtually any question of a binary character, such as "Will Sweden say yes to the Euro (at least in its September 2003 referendum?)" and "Will there be a human cloning by the end of 2005?" These were the two most traded items in late July of 2003. The former was "created" in 2003 but the cloning question was posed in 1997, so that at least at the outset it asked for a long-term prediction.24 Questions about politics are also popular, and many of the questions posed ask for predictions very long in advance—and assume that the Foresight Exchange will remain in existence. Again, the price of a share reflects the players' subjective sense of the probability that an event will or will not come true. There are a number of ways to evaluate the accuracy of these spontaneous markets, or games. Readers who look at archived games will be reasonably impressed, I think, by the accuracy of the medium, but its accuracy is not terribly important for the discussion that follows.25

22. The same symbiotic relationship that exists between polls and markets in the IEM may also exist here between those playing fantasy baseball and "experts" offering predictions. There are many published guides for fantasy baseball players. The information provided in these commercially published guides is incorporated into traders' decisions in fantasy baseball. The relationship between the experts and the players is thus similar to that between polling organizations and the IEM.


24. See Foresight Exchange Website, at http://www.ideofutures.com/fx-bin/Claim?claim=SweEur (last visited Aug. 19, 2003); Foresight Exchange Website, at http://www.ideofutures.com/fx-bin/Claim?claim=Clone (last visited Aug. 19, 2003). The format of the exchange is for one member to pose a question and for another to serve as "judge," although not all proposed questions are accepted for trading. The judge can post some guidelines as to how he or she expects to rule. Thus, the cloning question is accompanied by a description of the need for a full-bodied child under the age of one cloned from an adult above the age of sixteen.

25. One might, for example, group questions that "sold" for $0.70 into a bundle and ask whether 70% or so of the predictions came true. Much higher or lower would reflect inaccuracy. See DAVID M. PENNOCK ET AL., Extracting Collective Probabilistic Forecasts from Web Games, SEVENTH ACM SIGKDD INT'L CONFERENCE ON KNOWLEDGE & DATA MINING (Aug. 2001), available at http://artificialmarkets.com/am/pennock-kdd-2001-games/ (last visited Aug. 19, 2003).
Foresight Exchange (FX) is pure fantasy; no money changes hands (unless there are offsite side bets but that, of course, is true of all games). It is true, however, that boasting rights are improved by FX’s practice of posting its most valuable portfolios. HSX does this as well—and somewhat remarkably, (hundreds of millions of) Hollywood dollars are known to trade on eBay for hundreds of real dollars.\footnote{When HSX profits are bought and sold on eBay, the buyer is really taking over another persona; the purchase is of the account name and password. At the high end, the “exchange rate” is on the order of $1.00 US to $1 million Hollywood. The exchange rate is lower when the portfolio is smaller because a smaller portfolio brings less prestige, as it appears lower down on the leader board. See \textit{id}.} The idea seems to be that vain players can buy boasting rights. Success on FX does not appear to be so valued, and in any event, we might expect the trading of HSX indicia of success to come to an end or to be self-defeating.

These are not, of course, the only websites with emerging markets. One site with clear instructions and information about trading volume and the like is “world news eXchange”\footnote{See World News Exchange Website, at http://us.newsfutures.com/guide.html (last visited Aug. 19, 2003).} which is much like Foresight Exchange except that it is centrally designed and controlled, rather than spontaneous. It uses play money but offers modest prizes. There are also market games embedded in larger fantasy games. Economists have noticed the experiments contained in games. For example, EverQuest is a popular Internet/PlayStation2 game with thousands of players, and within its fantasy world there are markets.\footnote{See Everquest Website, at http://everquest.station.sony.com/ (last visited Aug. 19, 2003).} The fantasy money that can be used in this game is also traded on eBay (with a fairly stable exchange rate of real to fantasy dollars) so that, again, the fantasy market is not completely detached from the real world.

This sort of game might be of great interest to economists interested in such things as the role of central banks or the effects of deflation. It is less interesting than IEM or HSX for the purposes pursued here because EverQuest markets offer no alternative to real markets in terms of signaling real prices, whether for legal or investment purposes. Put differently, a pure fantasy game aggregates information that is so internal to the game as to be of little interest to anyone outside the game. IEM and HSX, in contrast, aggregate information that is of use to the outside world.

### III. Markets and Elections

What should we learn from these fantasy markets? One reaction is to be unimpressed and say that it is unsurprising that people who play a game will get good at it. If so, one noteworthy (but tentative) conclusion is that we should be more impressed with experimental economics than is commonly thought warranted. Economists and lawyers alike are interested in but skeptical of experimental results associated with “tests” of the Coase Theorem and other well-known targets of experiment economists; it is common to say that real gains and losses must be at stake before one sees the true power
of rational man. If the IEM and HSX perform as suggested here, then this skepticism must eventually give way to the idea that small sums (which are used in some experiments too), or perhaps the pleasure gained from winning, can drive decisions as well as extensive market pressures. Experimenters might do well to honor the winners, or in some other way offer incentives that seem to be substitutes for market gains.

As an analytic matter, we might take these markets to reveal that market transactions are not so different from votes. These fantasy or quasi-markets tell us something about public choice. The IEM and HSX offer opportunities for numerous interested people to vote on questions with correct answers. Readers familiar with the Condorcet Jury Theorem know that under certain conditions a modest number of voters can succeed by majority vote to find the right answer to a question, or at least have a very great probability of doing so, because their votes serve to aggregate information.\footnote{29} A hundred heads can be much better than one.\footnote{30} The IEM and HSX capture elements of the Condorcet Jury Theorem in several ways. First, they attract participants who are interested in the questions at hand, and are therefore likely to be better than average in predicting or knowing the correct result. Ten thousand likely voters who are polled as to their own preferences or as to the votes they are likely to cast in one month might easily be less useful, if that is a fair word, than a few hundred self-selected voters who are trying to predict what those thousands (and many more) are likely to do in one month. A large number of reasonably good predictors may be much superior to a modest number of excellent predictors. For example, ninety-nine predictors each with a 0.6 chance of getting a question right will outperform nine predictors with an individual chance of 0.8 of getting the same question right.\footnote{31}

In an unconventional way, the IEM and HSX capture another feature of the Condorcet Jury Theorem by offering opportunities for, or even encouraging some expression of, intensity of conviction through multiple vote-casting by a single participant. The simple assumptions advanced by Condorcet, of course, encourage no such intensity; each voter is assumed to be more likely right than wrong and each votes independently. But much as in real circumstances we might easily add in the assumption that deliberation (by jurors, say) adds more to the pot than non-independence subtracts, perhaps because it allows voters to assess the expertise in their midst. So too we might find it plausible that most voters are good at self-assessing whether they are more likely

\footnote{29. See Dennis C. Mueller, Constitutional Democracy 158-59 (1966) (discussing Condorcet's 1785 work); Saul Levmore, Voting with Intensity, 55 Stan. L. Rev. 111, 142-44 (2000) (discussing Condorcet Jury Theorem and issues of preferences and strategic voting).}

\footnote{30. Much as there are declining marginal gains in accuracy from increased numbers of voters under the Condorcet Jury Theorem, these fantasy markets seem to need only a critical mass of participants before becoming impressively accurate. Early players may also be more devoted fans or experts. See David Austen-Smith & Jeffery S. Banks, Information Aggregation Rationality and the Condorcet Jury Theorem, 90 Am. Pol. Sci. Rev. 34, 44 (1996) (explaining that "the identity of the optimal voting rule hinged critically on parameters governing individuals' information").}

\footnote{31. The chance of error for the nine voters with individual accuracy of 0.8 is \[\frac{1 - \sum((2/10)^{(9-n)} x (8/10)^n), n=0, 4)}{1.74592 x 10^{-4}}\] versus the chance of error for the ninety-nine voters with individual accuracy 0.6 is \[\frac{1 - \sum((4/10)^{(99-n)} x (6/10)^n), n=0, 49)}{5.12309 x 10^{-31}}\]. The chance for error in the larger sample with the lower individual accuracy rate is significantly less than in the smaller sample with "experts."}
than most to be right in a given situation.\textsuperscript{32} If voters who are 0.7 likely to be right exercise ten votes, and voters who are on average 0.51 or even 0.4 likely to be right use one or none, then it is plain that even a handful of voters can easily aggregate information to the point where they are virtually certain of reaching the correct group decision. The HSX does this, if at all, by appealing to players who have some knowledge in the first place, and who care about the performance of their portfolios. The IEM does this by offering modest monetary inducements. I will buy more shares if I think I am more likely to be right than the average or even marginal market participant. And repeatedly poor self-assessors may well drop out of the game either because the small financial losses add up, as they might in a Thursday night poker game, or because it is simply less fun to play and pay where one loses. In contrast, it is difficult for mere elections (or even shadow elections) to take self-assessed confidence into account.\textsuperscript{33}

This is not the place to insist on the larger view offered here, albeit in passing, that markets contain elements of what we normally think of as elections. From an information point of view, we benefit from market transactions as well as from aggregations of votes. But from the point of view of market regulation, and especially securities regulation, it can be useful to see the sometimes distinct elements, or methods, of markets and votes. Indeed, if one method is too easily subject to undesirable manipulation, it might be a good strategy to encourage the other method, for resources might be allocated well with correct information from either source.

Note in this regard that these methods are complements, and rarely substitutes, even at the level of operation (much less interpretation). To take one obvious example, the IEM's political markets might be less successful if polling did not exist. The IEM's participants may in fact be good at interpreting poll data and translating the data into information about what to expect in November. If politicians and newspapers ceased to patronize the national polling organizations, perhaps because the IEM offered superior predictions, then it is plausible that the IEM would spiral down into a poor predictor because its own participants might need Gallup and other results. The polling organizations do need sponsors, of course, because polling requires resources. It would therefore be interesting to see how effective an IEM would be with regard to an election where there were no polling data available for the IEM participants.

There is something of the same symbiotic possibility in other markets. Consider, for example, the ability of individual firms to use fantasy markets as a means of obtaining valuable information. A company, \textit{H}, might wish to estimate the number of units it will sell in order to set the correct amount of capital and labor into action. A conventional firm will ask its marketing and sales executives to predict the number of units sold at various prices. And a number of other decisions, including advertising budgets and the like, will come into play before deploying resources. Indeed, this information is probably

\textsuperscript{32} The Condorcet Jury Theorem itself is based on gains in predictive accuracy from a greater number of voters, each of whom is assumed to be more likely than not to be correct. It is plain that deliberation and non-independence could affect the accuracy of a group.

\textsuperscript{33} If these fantasy markets prosper, I suspect we will begin to explore questions about the ability of these markets to incorporate intensity of preferences as compared with the ability of methods such as approval voting, or other means of registering intense preferences or convictions. See Richard G. Niemi, \textit{The Problem of Strategic Behavior Under Approval Voting}, 78 \textit{AM. POL. SCI. REV.} 952, 958 (1984) (examining "what properties characterize [approval voting] when preferences are not dichotomous").
much more useful in most industries than it is in Hollywood; HSX might give studios accurate revenue predictions, but in fact these predictions affect decisions only modestly in comparison to how valuable it would be for a manufacturing, or vertically integrated, company to know its future product sales. But a sales executive has only limited forecasting ability, and may be biased. Predictions that prove too high will make the individual look bad, for it is conventional and perhaps natural for large organizations to evaluate their personnel based on their success in achieving targets. Predictions that are too low will cause the firm to produce too few units, and the executive will get less credit than he or she might have had sales been higher. On balance, the executive might have an incentive to predict correctly, but it is easy to imagine a tendency to err in one direction or the other. Moreover, those who work for this executive might have similar biases. A regional sales manager might think it valuable to exceed a target and be unconcerned that the low prediction generated insufficient inventory. If sales are higher than “expected,” the regional person might be able to draw on stock accumulated elsewhere in the country so that the target will be exceeded.

Unsurprisingly, there are firms that are reported to experiment with fantasy markets in just this sort of setting, and we can look forward to improvements in these techniques in the future.\(^{34}\) H might offer twenty or thirty of its salespeople the opportunity to buy and sell shares where the share pays $1.00 if sales for the year are above X. The shares could be distributed in bundles (one piece pays if sales exceed X and the other pays if and only if sales are X or lower) with the initial holders able to create separate markets. Alternatively, H could structure its fantasy market in the style of a vote share market, or at least unlike a winner-take-all market. H could issue shares with payoffs dependent on some measure of sales multiplied by $1.00. It might redeem shares at a given date at $0.01 for every thousand units sold. H will distribute enough shares to make the game financially interesting for the players. It can keep the redemptions anonymous in order to avoid the danger that salespeople will worry about appearing disloyal if they sell shares or “predict” low sales. There is, of course, a minor moral hazard, namely that in attempting to win bragging rights or redemption income, salespeople will undermine real sales in the field. A salesperson who benefited too much from overall sales of 20,000 units might on the margin work a bit less hard, or even spread nasty rumors, if sales looked like they were going to exceed that number. But this risk is small. In the first place, no single salesperson can influence sales too much. Moreover, H can offset this danger with positive incentives in the form of bonuses or commissions; students of law and economics are familiar with the idea of sticks and carrots accompanying one another.\(^{35}\) Still, it is important to recognize that this sort of moral hazard problem places a limit on the use of fantasy markets by firms seeking information for their own internal use. One important feature of these internal markets is that they (like HSX perhaps) permit anonymity where this characteristic may be quite useful in stimulating honest appraisals.

It is easy to predict that fantasy markets of both the spontaneous and orchestrated

\[^{34}\text{The example in the text is a transparent reference to Hewlett-Packard which has reportedly used these markets to make sales forecasts. See James Surowiecki, Decisions Decisions, THE NEW YORKER, Mar. 24, 2003, at 33.}\]

\[^{35}\text{Saul Levmore, Carrots and Torts, in CHICAGO LECTURES IN LAW AND ECONOMICS 203, 204 (Eric A. Posner ed., 2000) (examining mixed use of positive and negative incentives in law).}\]
kind will become a significant tool of for-profit firms. A similar conclusion is probably unwarranted with respect to politics itself. An elected politician might say that he or she is taking the citizens' views into account, and since polls show that people want X, the politician will act accordingly. The polls may be an imperfect measure of what voters or even all citizens will want in the future, but current polls seem like a reasonable measure of popular opinion. But could a politician succeed by saying that he or she has followed what a fantasy market says will be the will of the people? Even if such a market were a superior means of predicting the future, the market's prediction does not have the same ring as the people's own (current) view.\(^3\)

Governmental organizations can of course use markets, fantasy markets, and elections (cast as markets perhaps) to generate information. Much as a private firm (such as H) can design a market to assist with predictions, so too the government might find it advantageous to create markets where none exists, or to use fantasy markets in order to avoid moral hazard and manipulation problems. The Defense Department has, for example, developed a market, like Foresight Exchange, with a focus on predicting terrorist threats, though it now appears that the market's opening will be delayed or sidestepped because of some political outcry.\(^3\) If participants include analysts who may otherwise be fearful of voicing their opinions, then the markets are quite like that created by H in our earlier example. The moral hazard problem is also alike. H must worry about perverse effects on sales efforts, while the government must guard against the unspeakable danger that its markets or rewards will stimulate—rather than avert—murderous activity, or that potential terrorists will manipulate this "market" in order to divert attention from their true targets.

From H's perspective, it is plausible that this designer fantasy market is the best available means of predicting H's own sales. The market captures information possessed by salespeople who are well situated. The fantasy market can provide some incentive for salespeople and others to develop more information of the kind that is useful to H. H is interested in ongoing estimates of sales, and the market provides this in the ordinary course at least as well as any repeated contest. If H thinks the market, or information, will be improved through participation by other players, including potential buyers, service-center personnel, retailers, and so forth, it can easily open up the market to them with appropriate passwords and the like. Again, H is essentially looking for a series of informed votes, or aggregations of judgments, and one way to get this is through a market or market-like mechanism. It is almost as if a poll tax or poll reward is used to improve the decision-making inherent in this election.

**IV. RECREATIONAL MARKETS, REAL MARKETS, AND THE THREAT OF MANIPULATION**

My goal here is not simply to introduce these fantasy markets, but also to suggest that we might learn something about real markets and their regulation from these small experiments and games. In this Part, I will suggest that these fantasy markets work so

\(^3\) If a fantasy market diverges from a current public opinion poll, it is also likely that the politician's actions based on the poll will change reality, and the fantasy market's result.

well (as predictors and conveyors of information) only because they are recreational for nearly all users; the small stakes limit manipulation without, apparently, destroying the benefits of information aggregation. If someone could profit a great deal from HSX or FX’s mispredicting a question, then it would be fairly easy for this person to spend a modest amount of money to cause such a misprediction. The manipulation point is rather simple. If someone were inclined to spend resources in order to manipulate the IEM, then that market would probably also prove to be a much inferior predictor. The Condorcet Jury Theorem also works best where we do not have several voters trying to reach the wrong result and where no one is paying jurors to vote one way or the other (for reasons other than an attempt to get the correct answer). 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. But in a market where each player can spend a maximum of $500.00, or in one where bragging rights are the coin of the realm, there is little opportunity to make money in a way that corrects manipulation. And it is possible that the incentives that work so well in recreational markets are not up to the task in real markets with manipulative maneuvers.

In contrast, there is much more incentive, and for some players also the opportunity, to manipulate where there is more wealth at stake and few barriers to activity. We are accustomed to thinking of a thick market, like a familiar securities market, as efficient, and a small market, like the IEM, as inefficient and prone to manipulation. But the opposite is likely to be true. There is little opportunity to manipulate the IEM, both because informational advantages are rare and because investment caps make such things as cornering the market or inducing runs in one direction or the other difficult to carry out. In contrast, there is great incentive to invest in schemes that might yield great profits in the familiar securities markets—especially where these schemes aim to move prices to (temporarily) inaccurate places.

One can take this argument too far. For example, it is likely that the tungsten market is easier to manipulate than the market for Exxon’s common stock, so that smaller can be better for the manipulator, but it is useful to see that size and wealth will attract manipulation, even as we now see that size may not be terribly important for market efficiency. Indeed, if we think of efficient markets as a legal concept, which is to say that an efficient market is one for which, with respect to damages and other legal questions, law ought to be strongly inclined to take market prices as correct, then the tungsten market and the New York Stock Exchange are probably both efficient. On the other hand, if participants know that the legal system will take a market price as dispostive in a way that has serious economic implications, so that it can be profitable to try and manipulate market prices, then in smaller markets we will need to worry more about such manipulation, and it is less likely that we will want to regard these markets as efficient for legal purposes. HSX may be efficient, but we would not think it so if participants knew that the price it displayed for an unreleased film would have bearing on a lawsuit involving millions of dollars.

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. If X profits by

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38. Note that one response might be to increase the stakes and thereby increase the costs to manipulate the market. Yet this would probably also have the effect of driving desirable participants out of the market as well.
convincing the market that $20.00 is the right price for something, and X succeeds in driving the price down and then in buying at $21.00 and $20.00, knowing to hold until the price returns to $30.00, then it pays for Y to study X, or the good in question, and to buy at $25.00, say, when the price is on its manipulated way down.\textsuperscript{39} Y’s attempt to profit from X’s manipulation makes X’s scheme more difficult and, in any event, drives the market price toward its correct place. But if it is true that X is more likely to manipulate in a rich market, then it is also true that Y will engage in counteractivity in such a market. Indeed, the more faith one has in free markets and rational actors, the more one need not live in fear of manipulation, at least as a matter of social policy, because the market will generate corrective entrepreneurs and activities. A bold way to say this is that the free market will prove superior to government-sponsored regulators even at the task of regulation itself. For present purposes, there is no need to press this view, for the important point is simply that some combination of regulation and private activity can combat manipulation, but that we might expect more of this in the great securities markets than in the IEM or other small markets.

I am, to be sure, suggesting something of an upside-down view of familiar markets. Conventional wisdom is that the great securities markets are efficient because they are thick markets with thousands of traders—and because there is the opportunity to profit from any incorrect pricing.\textsuperscript{40} Anything that pays to be known will be known, and then reflected in the market price. It is fashionable to remark on the mysteries of efficient markets, such as their occasional volatility and the like, but it is not as if academic commentators uncovered some inexpensive way to profit from these mysteries. The worst one can say about the efficient market hypothesis is that it is true but unimpressive; prices convey the best guess of the future, but it is such a volatile future that the best predictor is not worth much to people who must function in real markets. A corollary would be that although we may not have a better way to allocate resources, market signals may do so unimpressively. For present purposes I will, however, set aside the debate about the usefulness of the efficient market hypothesis and take as a given that the hypothesis is a formidable one. Let us assume that securities markets are efficient and even extremely useful—but then ask what this means in a world where very simple markets and even fantasy markets are (also) remarkably accurate. If fantasy markets outperform corporations’ own internal revenue predictions in important industries, then an efficient securities market looks much less impressive than it did before these fantasy markets were known.

These “simply efficient markets” suggest a kind of equilibrium between regulation and efficiency. The IEM is accurate because a market can apparently work well, at least

\textsuperscript{39} The example assumes that Y does not know exactly where X is taking the price. In Jury Theorem terms, we might say that the market might have had many players with a 0.55 chance of being right, but that X, with a 0.9 chance of being right acts as would traders with a 0.1 chance of being right and this drives the market to the wrong price. Again, Y’s opportunistic correction can help the cause of good information and market signals. The same can occur in elections. Juror A might profess expertise and convince fellow jurors to find someone guilty where the person is innocent. In turn, if juror B exposes the fact that A is related to the defendant, the other voters will find their way to the correct result. The possibility of manipulation fouls the Jury Theorem because it introduces voters who are much more likely than not to move decisions and prices in the wrong direction. The question in both settings is whether there is an incentive for another actor to correct the manipulation.

\textsuperscript{40} Paul G. Mahoney, \textit{Market Microstructure and Market Efficiency}, 28 J. CORP. L. 541 (2003).
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in terms of aggregating information and capturing what I have referred to as its Jury-Theorem qualities, with relatively few participants so long as there is no manipulation. The IEM’s cap on investment limits the incentive to manipulate. When there is an incentive to manipulate, as there might soon be in HSX or in a private firm’s designer fantasy market (where, for example, a vendor or group of employees might manipulate the “market” to encourage the firm to think it needs more inputs), either well-endowed and active market participants or regulation can defeat manipulation. Neither is a perfect antidote to manipulation, and anyone who hopes for the market to provide perfect information or to allocate real resources should hope for less manipulation. Well-funded participants can profit when they discover manipulation because there is money to be made when one knows that the market is at the wrong price. Once again, if X has manipulated the (real or fantasy) price of a share so as to make it high, perhaps because X has been promised a bonus based on stock price or because X wants to win a game or a reward based on this price, then a clever and informed Y can sell the stock short or sell the stock just before X. The latter might be relatively easy to do if Y is aware of the date on which X needs the stock price to be high.\footnote{It is possible that one advantage IEM and HSX have over securities markets is that, in the former, there are certain dates so that the contrarian investor knows when to buy and sell. In contrast, an investor who is “right” in a contrary view of the securities market knows to sell when others buy, but does not know the correct time horizon. The investor does not know when the market will discover the true value of the item in question. It is, for instance, risky to profit when one sees a fad or bubble or Ponzi scheme in the making, because timing is everything. Meanwhile, IEM, HSX, and other fantasy markets normally deal with certain dates, and this makes the information arbitrageur’s job much easier.}

Combating, or simply profiting from, manipulation with counter-manipulation, or with what we might think of as opportunistic investment, is risky. There is also something of a collective action problem because the well-funded opportunistic investor must be concerned that his timing will be wrong, and meanwhile the benefits of a corrected market are spread among many parties. It is not surprising that legal rules ranging from anti-fraud provisions to contract law and to various regulatory schemes are enacted to combat manipulation in the first place. Interest group explanations aside, it is plausible that some regulation can efficiently substitute for counter-manipulation with its corrective side effect. Put differently, if we cared most about a market’s information quality, if only because of the signals it sent to participants in many markets near and far, then we would much prefer a regime in which participants did not seek to manipulate prices. And if regulation could reduce manipulation at relatively low cost, we would be willing and eager to regulate. In any event, I am not claiming that market forces will always offset the manipulation, but neither do I claim that they will never do so. It is simply useful to acknowledge that manipulation presents the opportunity for such counteractivity, and that whether or not a market could work well on its own, in a completely unregulated fashion, it is reasonable to think of counteractivity and regulation as working together to reduce the effect of manipulation, at least in large regulated market, where there is a great deal of wealth to be made and lost.

There will of course be something of an incentive or temptation to manipulate in all markets, including fantasy ones. Much as some people will cheat in a game, whether for bragging rights or prizes, so too there will be some cheating in fantasy markets. As the market grows, and as monetary prizes are awarded, we can expect cheating to rise.
Without a profit incentive, there will be very little incentive to invest resources in order to catch manipulators. The game will either self-destruct or some regulation, formal or informal, will arise to police the behavior of participants.

As the potential gain from participating (and manipulating) in a market increases, we can expect more manipulation but also more countervailing, and market-correcting, investments. And as there is more manipulation it will often, but not always, be the case that there will be increased regulation both because of various interest group pressures and, most simply and optimistically, because regulation may be superior to countervailing market activity. The claim here is not one of a theory of conservation of effort or activity, with regulation increasing as countervailing efforts decrease or as markets thicken. In the thickest of markets there might be no regulation, either because of interest group constellations, or because manipulation is so difficult or because it is best policed by offsetting trades by players who profit from uncovering or predicting manipulative movements. But in some thick markets, as in the great securities markets, we might expect a high level of efficiency and accuracy, and also a high level of regulation—even though there is room to profit from anticipating manipulations. It is of no great concern here whether the regulation should be viewed optimistically or skeptically.

I have already suggested that what is of great interest is the question of whether, without this regulation, the market would be significantly less efficient. It is possible that it would not be so. Perhaps regulators have little impact at present (an unlikely scenario) or perhaps, in the absence of regulation, private profiteers would grow in number to take advantage of the increased manipulative activity until an equilibrium was reached. If so, then the picture sketched here is an elegant one in which as markets grow thicker, richer, and more complex, the opportunities for manipulation increase but so do the incentives to discover manipulation and profit—and to correct market prices in the process. We might even imagine some constant or optimal rate of manipulation for a market.

But if this is not the case and regulation matters, then we might imagine a world, or describe our own, as one where the opportunities for (and social costs of) manipulation increase, and there is increased pressure for regulation but also some private activity with corrective side effects. The New York Stock Exchange offers vast opportunities for manipulators, and spawns an enormous regulatory apparatus. The local market for highway contracts offers some returns to manipulation and it, in turn, generates some inquiries and regulation. Meanwhile, the IEM offers very low returns to manipulators, and so there is both very little manipulation and regulation. A true public choice explanation might add that there will be greater interest group pressures in the large markets than in the small ones, but this sort of argument depends on assumptions that I would rather not employ here. After all, where there are opportunities for manipulation, interest groups might work to prevent regulation, and so a fairly complicated theory of interest groups is required in order to avoid a just-so story. I think it sufficient for present purposes to appeal to the metaphor that crooks go where the money is, but then so do regulators—and still the crooks look there.

Under this view the real mechanism of market efficiency is a small number of motivated traders, but the omnipresent question is whether there is much incentive for manipulation. When there is great opportunity for manipulation, regulation (or a market substitute) is needed. The fantasy markets discussed here show us that where the
manipulation risk is low, impressive markets can function with very little direction, very little regulation, and a fairly low number of traders. No specialists are needed. The mechanism of market efficiency is obvious, and includes—or can be understood as—little more than a vote in which participants are motivated and interested parties. It is the threat of manipulation that creates the need for specialists and more.

Fantasy markets also draw our attention to what we might think of as recreational participants. In the fantasy markets discussed here, these participants seem to be well enough informed that in the aggregate they produce accurate information. Such talented amateurs are likely to be less important in thicker markets, where it is at least as likely that their presence encourages manipulation at their expense. One familiar mystery about the securities markets is why so many participants persist in playing on their own, expending resources on brokers’ commissions and the like, when the evidence is overwhelming that these individuals will not do better than they would have done through low-cost mutual funds. This is not the place to explore this mystery, but one obvious solution is that the participants are engaging in a kind of consumption, or recreation.

It is possible that if more recreational players entered the fantasy markets, these markets would not perform as well. In the securities markets, professional traders (or simply the presence of very large numbers of traders) may improve efficiency, but in the fantasy markets it is talented amateurs that seem to do the job. The commodities markets discourage recreational players with entry requirements, volatility, and the like. More recreational play (and then disappointment) might bring on more regulation, and it is even possible that more recreational play would make these markets work worse rather than better. An interesting mechanism of market efficiency is thus the role of recreational players. They are encouraged in the securities markets, where they subsidize professionals in a manner of speaking; they are discouraged in commodities markets; and they are (at least thus far) selectively cultivated in fantasy markets where the jargon and websites appeal to those who know something about the industries that are involved.

V. CONCLUSION

A pessimistic conclusion is that life could be so simple if people played by simple legal and ethical rules. If our simple little quasi-markets and fantasy markets are as good as they seem, then they reveal that our most important markets are accompanied by an enormous amount of regulatory and private economic activity that consumes real resources, all because of the threat and presence of manipulative activity. We can drive this point home by altering conventional wisdom and ceasing to describe the public stock exchanges as efficient markets, because of the presence of so many traders and other mechanisms. Instead, we could describe many markets as impressive, and go on to say that the securities markets always risk falling off the efficiency bandwagon because of the opportunities for fraud. Some combination of regulation and private activity then seems to do the job of maintaining the efficiency of the markets, but at great expense.

An optimistic conclusion is that the Internet has reduced the transaction costs associated with information exchanges, and that we are witnessing the growth of many new impressive markets that aggregate information through mechanisms that resemble markets, elections, and games in varying proportions. As firms and other market
participants learn to exploit these sources of information, we will likely see great social benefits. The lessons we learn from these markets will no doubt migrate over to the established securities markets, and we can expect new markets and efficiency gains as new products and mechanisms evolve.