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THE REGULATION AND VALUE OF PREDICTION MARKETS

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Abstract

Prediction markets are important information-aggregation tools for researchers, businesses, individuals, and governments. This paper provides an overview of why prediction markets matter, how they are regulated, and how the regulation can be improved. The value of prediction markets is illustrated with discussions of their forecasting ability and the characteristics these markets possess which give them advantages over other means of forecasting and information aggregation. The past, current, and future regulatory environment is surveyed.

JEL codes: D7, D8, C53, K2, G14, G13

Keywords: prediction markets, regulation, futures markets, forecasting

The Regulation and Value of Prediction Markets

Adam Ozimek

Prediction markets are exchanges where individuals trade what are sometimes called "event contracts." Broadly speaking, these contracts specify some future event with different possible outcomes, define a payment structure based on those outcomes, and state a date when the contract expires. An example would be a contract that specifies "Barack Obama wins the US presidential election in 2012" and that pays out $10 after the election if that outcome occurs or $0 if it does not occur. The direct purpose of such markets is to allow individuals to bet on uncertain future events; however, these markets also produce prices that can provide valuable information. In fact, these markets are sometimes specifically created to gather the information that their prices reveal, rather than for the utility of trading to market participants.

Prediction market prices have informational value because they aggregate the beliefs of market participants and reveal what the market overall forecasts are the odds of the event at hand occurring. For example, if the aforementioned contract is selling at a price of $5.50, it means that the market thinks the odds of Obama getting reelected are 55 percent. In the run-up to the election, the media and anyone interested in a market-based measure of the odds of Obama's reelection could watch the prevailing prices in this market.

Prediction markets have generated forecasts for a wide variety of purposes beyond elections: who will win the Academy Awards, sales of a particular product, and how bad the flu season will be. This information is useful not only to traders wishing to profit from their forecasting and information-gathering abilities, but to researchers, businesses, governments, and others. Yet, despite the variety of ways that these markets have proven valuable, the regulatory

environment for prediction markets in the United States has been more skeptical than supportive. In particular, the recent blocking of movie box-office and political prediction markets indicates a worsening regulatory environment.

This paper provides an overview of how we learn from prediction markets, the benefits they generate, their advantages compared to other forecasts, and the regulatory environment. It then makes suggestions for regulatory reform.

1. How We Learn from Prediction Markets

1.1. Winner-Take-All Contracts

There are many types of prediction market contracts, each of which reveals different information. The most prominent by far is the "winner-take-all" contract.[1] The example of a contract for President Obama's reelection represents such a contract. These contracts are similar to what in finance are known as "binary options." In both, there is some event that will or will not occur. If it occurs, there is a specified payout to the contract holder, and if it does not occur, then the contract holder receives nothing. Other specific examples of these markets include the following:

- magnitude 9.0 earthquake to occur anywhere before midnight ET, Dec. 31, 2012
- successor to Pope Benedict XVI to be from Italy (expires on March 31, 2013)
- Arctic sea ice extent for September 2012 to be less than 4.3 million square kilometers
- any country currently using the euro to announce intention to drop it before midnight ET, Dec. 31, 2012
- Argo to win best picture at the 85th annual Academy Awards

[1] This section will follow the nomenclature defined in Wolfers and Zitzewitz (2004).

- The US debt limit to be raised before midnight ET Dec. 31, 2012
- Higgs boson particle to be observed on/before Dec. 31, 2012[2]

If any of these events occurred within the stated time limit, the contracts paid out $10; if the events did not occur, then the contracts paid nothing.

In some markets, whether the event has occurred or not is clear. For example, Argo clearly won best picture at the 85th annual Academy Awards.[3] Other contracts require more specificity about what constitutes the event occurring. For example, the contract for the market on whether any country would leave the euro specified the following rules:

> The market will be settled using official statements from the EU and Euro-member states, as reported in three independent and reliable media sources.
>
> The market will be settled when an announcement is made—the Euro does not actually have to be dropped as a national currency by the date specified in the contract. For example, if there is an announcement on December 1st 2013 that the Euro will be dropped in June 2014 the market will be settled at $10.00 on the date of the announcement (December 1st 2013) and not the date the Euro will no longer be used (June 2014).[4]

The contract rules also state that if a country is kicked out of the eurozone, the contract holder receives the payout. The level of detail required in the contract rules depends on the potential for disagreement about what outcome has occurred. As the euro example shows, the details of the contract rule can also significantly affect the information that contract prices reveal. If the rules specified that the euro would have to be dropped by the end of the contract date, or if a country being kicked out of the eurozone did not count, then the information gleaned from this market would be substantially different.

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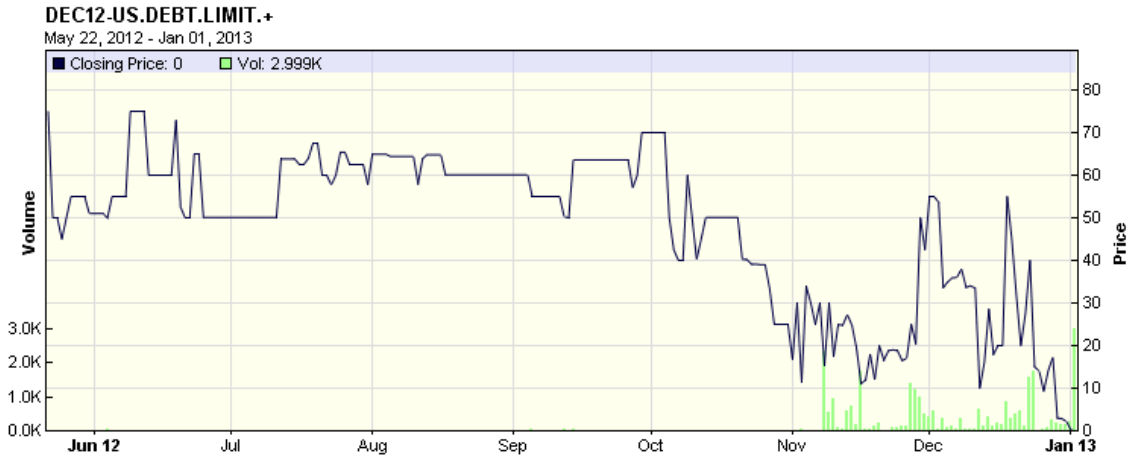
[2] Each example is an actual expired contract from Intrade.
[3] Even for this contract, there is a small chance of uncertainty due to the possibility of a tie, which has occurred six times in the history of the Academy Awards.
[4] See Intrade, "Any country currently using the Euro to announce intention to drop it before midnight ET 31 Dec 2012," http://www.intrade.com/v4/markets/contract/?contractId=713737.

The main informational value of a prediction market comes from examining its prices. For winner-take-all contracts, given some basic assumptions about the markets,[5] the price equals the market's expectation of the probability of the outcome occurring. For a contract paying $10 if an event occurs, if the current price is $9, then the market believes the probability of the event occurring is 90 percent. By watching how these prices change over time, participants and observers can see how the market's aggregate expectation of an event's probability changes. For example, figure 1 shows the daily closing price for the contract on whether the US debt limit would be raised by the end of 2012. The numbers suggest that the probability the government would raise the debt limit appeared strong from June 2012 until early October, when prices began to decline, likely due to speculation starting in early October that the debt ceiling would not be reached until January 2013.[6]

Figure 1. Daily Closing Price of Intrade Contract: "The US debt limit to be raised before midnight ET 31 Dec 2012"



Source: www.intrade.com.

[5] The required assumptions are that markets are efficient and that the market performs as a risk-neutral representative trader. While these assumptions may be strong, the observed divergences are likely to be small enough that the conclusions are approximately true. Furthermore, the predictions made under these assumptions perform well. See Snowberg, Wolfers, and Zitzewitz (2012).

[6] See, for example, Damian Paletta, "U.S. Appears Set to Hit Debt Ceiling in January," *Washington Wire*, October 15, 2012, http://blogs.wsj.com/washwire/2012/10/15/u-s-appears-set-hit-debt-ceiling-in-january/.

In addition to the mean, one can utilize winner-take-all prices to estimate a complete forecast distribution of a variable. For instance, one could have a contract that pays off if the official unemployment rate is between 5.00 percent and 5.25 percent by a certain date, another contract that pays off if the rate is between 5.25 percent and 5.5 percent, another for 5.75 percent to 6.00 percent, and so on. By looking at the prices of each contract, the participants in the prediction market estimate the probability that the value will fall within a particular range, and with enough contracts, we can estimate the full probability distribution of an outcome variable (Wolfers and Zitzewitz 2004).

1.2. Alternative Contract Structures

Other types of prediction market structures include index and spread contracts (Wolfers and Zitzewitz 2004). For index contracts, the amount paid is a function of the level of some outcome variable. For example, the Iowa Electronic Markets are prediction markets that offer vote share contracts that pay out based on a political party's share of the popular vote in the presidential election. If Democrats win 45 percent of the popular vote, then the contract pays out 45 cents to whoever holds contracts for the Democratic share. These prices reveal the market's belief of the variable's expected value, or mean.

Index contracts can also be structured to reveal other market beliefs about the distribution of the measure at hand. For example, an index contract could pay out based on the squared value of the Democratic vote share. This would reveal $E[d^2]$ where d is the Democrats' share of the popular vote. Combining this estimate with a basic index for this variable would allow the estimation of the variance using $Var(d) = E[d^2] - E[d]^2$. Traders may be interested in such markets if, for example, they have beliefs about the market's volatility. These types of markets

would be useful, for example, to firms looking to understand the uncertainty of forecast revenue. If market designers prefer a particular structure like this for informational purposes, but traders have insufficient demand for these types of contracts, then participation subsidies can be used to generate trading.

A third type of contract is a spread, in which the payout and cost are fixed, as say $2 and $1. The going price of the contract specifies the minimum value that the outcome must take in order to receive the payout, and varies until there are an equal number of buyers and sellers. This type of bet is common, and it includes point spreads in sports gambling. These contracts allow the discovery of market beliefs of percentiles. For instance, if the payout is $2 and the cost is $1, then the prevailing market price will be the median. If the payout is $4 and the cost is $3, then the market price will be in the 75th percentile (Wolfers and Zitzewitz 2004).

Other more complex market structures can also be used that allow the recovery of the full joint probability distribution over many variables, meaning that one could measure how the probabilities of two events are related. For example, one might be interested in how the odds of the following two outcomes are related: (1) whether a particular candidate will be elected president, and (2) whether GDP will grow by 4 percent or more that year. Measuring the joint probability would tell you the probability of (1) occurring, contingent on particular probabilities of (2), and vice versa. For example, if the candidate is expected to enact economic policies that lead to the specified economic growth rate, and the probability of the candidate being elected is 80 percent, the joint probability might tell you that there is a 60 percent chance that GDP will grow by at least 4 percent, while if the odds of the candidate being elected are 10 percent, the probability of this fast economic growth might be more like 25 percent. These markets work by allowing participants to specify combinations of outcomes and use scoring functions to determine payout (Hanson 2003).

Many other modifications and types of prediction market designs exist. For example, various prediction market modifications have been proposed that would allow interested parties to subsidize participation, and others have been designed to work with "play money" and prizes (Abramowicz 2008). Alternative index structures are useful to consider both because traders may desire different betting structures and because prediction market designers may wish to extract different information.

2. The Benefits of Prediction Markets

2.1. The Informational Value of Prediction Markets

In most cases, the beneficiaries of speculative markets are those seeking to trade in them: firms that wish to sell stock to raise capital, bond traders who wish to buy and sell bonds for profit. For futures and options markets, the closest financial instruments to prediction markets, their hedging value to traders is commonly cited as the primary economic benefit. For example, farmers use futures markets in their crops to hedge against the possibility of lower crop prices in the future, and airlines use futures markets for oil to hedge against the risk of higher fuel prices. While speculative markets have the added benefit of inducing people to gather information and aggregating it into prices, until recently this benefit has not been a primary justification for those markets. For prediction markets, in contrast, the informational value of prices can be the primary benefit rather than the utility to the market participants (Hanson 2008).

Furthermore, even in cases when hedging or speculation is the primary reason that prediction markets exist, the value of the information these markets generate can be substantial. To see how prediction markets can generate positive benefits beyond those accruing to traders, consider the example of historical presidential betting markets.

Markets to bet on the outcomes of future events have existed for a long time, and elections in particular have a long history as the subject of betting markets. As Rhode and Strumpf's (2004) analysis of historical presidential betting markets shows, public and open political betting dates back to George Washington's election, and organized election-betting markets have existed since the 1860s.[7] These markets became so popular that by the 1900s, the amount of money bet in them was at times larger than amount invested in stocks and bonds. In 1916, the $165 million exchanged in election-betting markets was more than double what was spent on election campaigns that year.

The popularity of these markets meant the current odds reflected the aggregation of a wide and diverse pool of knowledge and information. An added benefit of their popularity was that the current odds were made widely available. From 1896 to 1924, the *New York Times*, *Sun*, and *World* provided price quotes almost daily, giving newspaper readers up-to-date information that was otherwise largely unavailable in an age when polling was scarce and unscientific. With these odds, those interested in the election could catch up quickly on its status using the aggregated beliefs of dispersed market participants to see who had the lead and by how much.

We can see this wider utility of prices in Andrew Carnegie's comments at a press conference after returning from a trip to Scotland in 1904: "From what I see of the betting . . . I do not think that Mr. Roosevelt will need my vote. I am sure of his election."

A similar indication of the high confidence people placed in the market odds as representing accurate forecasts comes from the *New York Times*, which reported that "the Wall Street odds represent the consensus of a large body of extremely impartial opinion that talks with money and approaches Coolidge and Davis as dispassionately as it pronounces judgment on Anaconda and Bethlehem Steel."

[7] The historical facts and quotes in this section come from Rhode and Strumpf (2004).

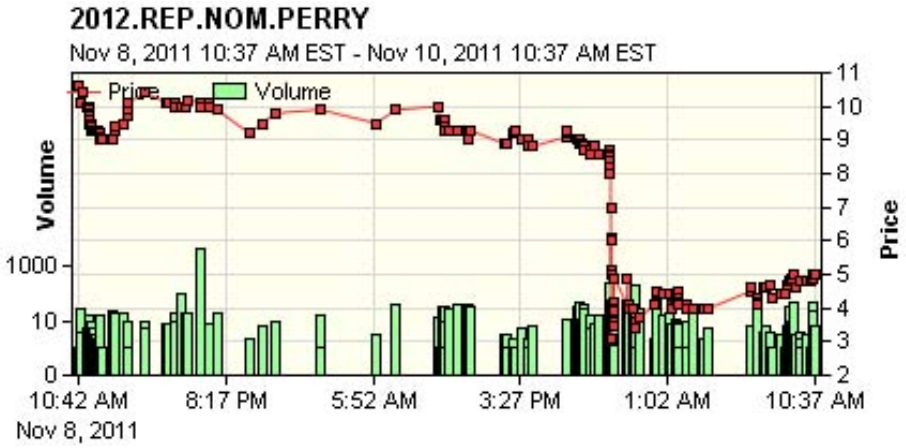
The confidence was well placed: historical presidential betting markets almost always predicted the correct winner, and well in advance of the election, despite the lack of scientific polling to inform the betting (Rhode and Strumpf 2004). In fact, Erikson and Wlezien (2009) find that these markets predicted better in the era before scientific polling (election years 1880–1932) than in the era with scientific polling (1936–2008), and that these early markets performed at least as well as later polling would.[8]

History thus shows that prediction markets are capable of producing valuable information and, as a result, are capable of being closely watched indicators. However, their usefulness is not only a historical artifact. Starting in the early 2000s, political and other prediction markets once again became a popular source of information. Their resurgence in popularity reflects both their good forecasting record and their ability to produce fine-grained data that polls, expert surveys, or other methods of aggregating beliefs cannot replicate.

Consider, for example, a story appearing on the website of the *New York Times* about a gaffe by presidential candidate Rick Perry during the 2012 GOP primary debate. The article showed how the prices on an Intrade contract that paid off if Governor Perry won the GOP nomination changed in the minutes and hours following his gaffe. The results, shown in figure 2, implied that his odds of receiving the nomination fell by around half. The ability to produce objective, up-to-the-minute assessments like this is unique to prediction markets, and thus part of why they are valuable sources of information.

[8] This result is paradoxical given that scientific polling should have provided betting markets with more information and thus increased their accuracy. However, part of the explanation may be that in the earlier era, betting markets were much thicker. Rhode and Strumpf (2004) report that the peak betting volume in the earlier era was 200 times what is wagered on today's Iowa Electronic Markets.

Figure 2. Change in Price of Intrade Contract for Gov. Rick Perry's Possible GOP Nomination



Source: www.intrade.com.

The resurgent popularity of prediction markets as informational sources has not been limited to elections. Stories in the *New York Times* in the last few years have cited Intrade prices on a wide range of topics, including whether the Higgs boson particle would be discovered;[9] whether the Patient Protection and Affordable Care Act (Obamacare) would pass[10]—and then whether the Supreme Court would strike down its individual mandate;[11] whether Lebron James would sign to play for the New York Knicks;[12] whether Ben Bernanke would be reconfirmed as Fed chair;[13] whether Treasury Secretary Geithner was going to be fired;[14] and whether Sonia Sotomayor would be confirmed to the Supreme Court.[15] In each of these examples, the author found prediction markets to be the best available source of information for summarizing the odds of the event occurring. The objectivity of prediction markets compared to an individual expert's subjective, and perhaps politically partisan or

[9] Dennis Overby, "New Data on Elusive Particle Is Shrouded in Secrecy," *New York Times*, June 19, 2012.
[10] Paul Krugman, "Health Care Resurrection," *New York Times*, March 9, 2010.
[11] Eduardo Porter, "Self-Interest Meets Mandate," *New York Times*, June 19, 2012.
[12] J. David Goodman, "King James and Other Small Things," *New York Times*, July 8, 2010.
[13] Catherine Rampell, "The Betting on Bernanke," *New York Times*, January 22, 2010.
[14] Dealbook, "Betting on Geithner's Exit," *New York Times*, March 18, 2009.
[15] Kate Phillips, "Grassley to Vote against Sotomayor," *New York Times*, July 27, 2009.

otherwise biased, assessment makes prediction markets particularly valuable to journalists, for whom the appearance of objectivity is essential.

As Perry's gaffe showed, the real-time, constantly updating nature of prediction markets means they provide a highly refined measure that polls, expert surveys, and other methods of aggregating beliefs cannot easily replicate. However, this information is not just useful to individuals who want up-to-date information, but also to academics and other researchers. The following examples of academic studies using prediction-market data show the variety of questions these markets can address:

- how Democrat versus Republican presidential victories affect the stock market (Snowberg, Wolfers, and Zitzewitz 2007)
- how a cap-and-trade bill would affect various industries (Meng 2013)
- the impact of health care reform (before such legislation had been enacted) on health care industry stocks (Al-Ississ and Miller 2010)
- whether star actors increase revenue for movies (Elberse 2007)
- how the Iraq War was expected to affect oil prices and the stock market (Wolfers and Zitzewitz 2009)

We can see the optimism for the potential value of prediction-market data to researchers in the paper "How Prediction Markets Can Save Event Studies," wherein Snowberg, Wolfers, and Zitzewitz (2012) argue that "by augmenting event studies with prediction markets, other scholars will no doubt come up with creative ways to address many other unanswered questions."

Overall, the historical record and modern usage by the media and academics show the usefulness of prediction markets as a source of information. In many instances, individuals

choose prediction markets' probabilities over their next-best informational option, which illustrates that they are economically valuable to nontraders.

2.2. Prediction Markets' Successful Record of Forecasting

An important reason that political prediction markets are useful is that despite the availability of scientific polling, poll aggregators, and a wide variety of forecasts and expert opinions, prediction markets have a track record of successfully forecasting election outcomes. Since 1988, the Iowa Electronic Markets have provided a platform for prediction markets for elections. In addition, in elections from 2006 through 2012, prediction markets on Intrade remained closely watched and much discussed. Again, the focus on these markets' prices as forecasts is well placed: compared to polls, prediction markets are more accurate and have half the forecast error (Snowberg, Wolfers, and Zitzowitz 2012).

While prediction markets undoubtedly outperform individual polls, a variety of sophisticated poll aggregators are now available that remove known biases in polls and therefore raise the question of whether prediction markets add anything to these results. However, in competitions between debiased polls and debiased prediction markets, prediction markets forecast better. Rothschild (2009) compares the forecasting ability of Nate Silver's FiveThirtyEight forecast based on debiased polls to the political prediction markets on Intrade for the 2008 election. While FiveThirtyEight forecast slightly better than raw prediction markets within 30 days of the election and forecast worse before that point, prediction markets corrected for the known long-shot bias forecast better than either at any time period.

Perhaps more important than the head-to-head forecasting ability of prediction markets versus polls or fundamentals is whether the prediction markets provide different information than

the alternatives. If prediction markets are merely aggregating and debiasing polls, then their value is limited given the availability of other poll aggregators. However, forecasts that combine aggregated polls, prediction markets, and fundamentals-based forecasts together outperform all three individually (Rothschild 2013). This finding indicates that there is unique information in political prediction markets that improves election forecasts beyond what polling and fundamentals can do.

The forecasting success of political prediction markets is perhaps the most well-known example, but the broad utility of markets as information sources goes far beyond forecasting elections, and the ability of markets to forecast better than alternatives can be found in a variety of places. For example, researchers have shown that orange juice futures markets improve on US National Weather Service forecasts (Roll 1984) and that horse race betting markets outperform professional handicappers (Figlewski 1979).

Prediction markets designed for information revelation, in particular, have been successfully utilized to improve forecasts. Prediction markets forecast Google's IPO price better than Google did with its auction mechanisms (Berg, Neumann, and Reitz 2009). In the health field, such markets have provided forecasts of seasonal influenza activity two to four weeks in advance that performed better than historically based forecasts (Polgreen, Nelson, and Neumann 2007) and have accurately forecast the number of dengue fever outbreaks (Franco et al. 2010). Prediction markets tied to macroeconomic indicator data releases also outperformed a survey of professional forecasters. These markets were better able to forecast payrolls, unemployment claims, retail sales, business confidence, and other measures of macroeconomic performance, reducing forecast error by 5 percent on average (Gurkaynak and Wolfers 2006).

We can see the information-revelation benefits of these markets in the examples of firms that have successfully used internal prediction markets for forecasting. Hewlett-Packard used

internal prediction markets to forecast sales of printers and found that the markets outperformed the company's official forecasts (Chen and Plott 2002). HP also reported that prediction markets for the price of computer memory three and six months ahead were 70 percent more accurate than the firm's traditional forecasts.[16] Siemens used an internal prediction market to correctly forecast that a product would not be delivered on time despite the firm's traditional planning tools suggesting otherwise (Ortner 1998). Best Buy has used prediction markets for a wide variety of purposes, including the demand for digital set-top boxes, store opening dates, and whether new services will be introduced on time.[17]

While many prediction markets are likely run without public knowledge, known examples of companies that have used prediction markets include Abbott Labs, Arcelor Mittal, Best Buy, Chrysler, Corning, Electronic Arts, Eli Lilly, Frito Lay, General Electric, GE Healthcare, General Mills, Intel, InterContinental Hotels, Masterfoods, Microsoft, Motorola, Nokia, Pfizer, Qualcomm, Swisscomm, and TNT (Cowgill et al. 2009).[18] The extent of these private markets is a good indicator that the information they reveal is valuable.

2.3. The Advantages of Prediction Markets

Prediction markets have a variety of characteristics that give them advantages over other forms of forecasts: (1) they efficiently aggregate a variety of information and beliefs, (2) they create financial incentives for truthful revelations, (3) they provide incentives for gathering relevant information, (4) they incorporate new information quickly, and (5) they are difficult to manipulate.

[16] Steve Lohr, "Betting to Improve the Odds," *New York Times*, April 9, 2008.
[17] Ibid.
[18] Ibid.

The problem that prediction markets address is that individuals have different sets of information and different beliefs, and therefore arrive at different expectations of the probabilities of uncertain future outcomes. Given this disagreement, what is the best way to aggregate probability beliefs to forecast outcomes? One alternative is to give everyone's beliefs equal weight. Another is to create some rule that provides weights based on past prediction performance. What prediction markets provide is a market-based aggregation of beliefs.

In essence, the prediction market method of aggregation assumes that more weight should be placed on the opinions of individuals who are willing to bet more money on their beliefs. One advantage of this weighting is that individuals are more likely to be truthful about what they believe, and how strongly they believe it, when they have an economic incentive to do so. Experimental evidence has shown that when you ask individuals political questions with factual answers, like whether inflation went up, down, or was unchanged while George W. Bush was president, there is an obvious partisan bias in their answers. However, when individuals are paid for getting the answer correct, this bias diminishes (Bullock et al. 2013). This incentive for truthful revelation is an immediate positive effect of the economic incentives prediction markets provide.

Prediction markets also lead to a positive participant-selection mechanism. Because false beliefs must be paid for in the long run, individuals who continually lose money by making bad predictions will be incentivized to stop participating in the market. Those who make good predictions, in contrast, will be rewarded and have the incentive to continue participating. In essence, the market selects for good predictors rather than presuming that anyone who wishes to make a prediction is equally capable, or designing a centralized system for selecting the best predictors.

In addition, when prediction markets are open to the public and their contracts are widely traded, individuals who may have useful information have an incentive to come forward to trade on that information, thereby revealing it to the market. Rather than requiring an a priori selection of who has the most relevant information, as with polling a panel of experts based on criteria used by the person doing the selecting, prediction markets create an incentive for those with information to come forward and participate. This process is similar to the selection of unbiased predictors, but it brings new information to the market rather than just getting better predictions from existing information.

Prediction markets not only bring new information to markets, they tend to incorporate this information quickly. Snowberg, Wolfers, and Zitzewitz (2012) provide an illustrative example in the death Osama bin Laden. On May 1, 2011, at 10:25 p.m. ET, Donald Rumsfeld's former chief of staff Keith Urbahn announced the following on Twitter: "So I'm told by a reputable person they have killed Osama Bin Laden. Hot Damn." Intrade prediction markets on bin Laden's death quickly rose, going from 7 percent to 99 percent within 25 minutes. In contrast, the media did not announce the story until 33 minutes after Urbahn's announcement. The point here is not to suggest that prediction markets can or should supplant breaking news services, but that market prices incorporate new information rapidly. For many forecasts, like the probability of outbreaks of deadly disease, the speed at which new information is incorporated is critical.

Finally, prediction markets are useful aggregators because they are difficult to manipulate. There have been some attempts to manipulate these markets, most notably by individuals wishing to generate media attention by suggesting that the chance of a particular candidate winning an election is higher than it is (Snowberg, Wolfers, and Zitzewitz 2012). However, when multiple prediction markets exist, it creates an arbitrage opportunity when

divergences based on manipulation occur. If one market says a candidate's odds are 5 percent and another says they are 10 percent, then this leaves free money on the table for traders. Manipulation attempts will generate profit for other traders and help make markets more accurate (Hanson and Oprea 2009). Indeed, most evidence suggests that attempts at manipulation are unsuccessful and generate little media attention (Snowberg, Wolfers, and Zitzewitz 2012).

Given the success of markets and prices for making use of the "dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess" (Hayek 1945), it is not surprising that they would prove useful in directly aggregating dispersed information, as the empirical evidence presented in this section has shown.

2.4. Criticisms and Opponents of Prediction Markets

Despite the evidence of prediction markets' success, there are several common criticisms that are worth addressing. First is the criticism that prediction markets merely reflect conventional wisdom and that traders do not have any new information. While in many cases it is true that the markets are unlikely to reflect information that is not already widely dispersed, this criticism ignores the value in the objective aggregation of conventional wisdom. The history of the Policy Analysis Market (PAM) provides a particularly important example of how such criticism is misplaced. The United States' Defense Advanced Research Projects Agency (DARPA) created this prediction market, which was to debut in 2003, but it was shut down before it began due to widespread criticism. Nobel Prize winner Joseph Stiglitz brought the "no new information" critique of PAM:

> But what was [DARPA's John M. Poindexter] thinking? Did he believe there is widespread information about terrorist activity not currently being either captured or

> appropriately analyzed by the "experts" in the FBI and the CIA? Did he believe that the 1,000 people "selected" for the new futures program would have this information? If so, shouldn't these people be investigated rather than rewarded?[19]

However, as Abramowicz (2008) argues, PAM's goal was not to bring forth private information about terrorism that traders held, but to create an objective aggregation of assessments. As PAM architect Robin Hanson (2007) noted, "Successful intelligence requires not only the collection and interpretation of pieces of information, but also that the information be combined into consensus forecasts and passed up the chain of command." This kind of consensus forecast may be especially useful in government and business bureaucracies, where group decisions and disagreements might otherwise be adjudicated by deliberation. In contrast to prediction markets, deliberation can be hampered by social sanction for disagreement, which can lead to group biases that exaggerate rather than ameliorate individual cognitive biases (Sunstein 2007).

In other contexts, however, the benefit of bringing forth new, relevant information may fail to occur. Moreover, some markets may not generate enough interest to draw a significant pool of traders so that even the belief-aggregation mechanism fails. As Hanson argues, such criticisms are not identifying a market failure, but instead point to an efficient market outcome:

> When you offer to pay a certain price for info, an efficient info exchange mechanism will typically induce some supply of that info, but only up to the point where the marginal cost of supplying info reaches the price you have offered to pay. It is no failure of an exchange mechanism when buyers cannot always buy everything they want at as low a price as they want.[20]

Nevertheless, regardless of whether one calls this a "failure" of prediction markets or an efficient outcome, it remains true that in some contexts prediction markets will not function without subsidies to traders.

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[19] Joseph Stiglitz, "Terrorism: There's No Futures in It," *Los Angeles Times*, July 31, 2003.
[20] Robin Hanson, "Prediction Markets 'Fail' to Mooch," *Overcoming Bias*, July 19, 2012, http://www.overcoming bias.com/2012/07/prediction-markets-fail-to-mooch.html.

A related criticism is that prediction-market forecasts are often incorrect. However, few prediction-market proponents would claim that prediction markets are infallible. Events that prediction markets target are inherently uncertain, and the best that any forecast can do is make the most of the available information. Therefore, when a market does not predict the outcome, this result can reflect a failure of reality to be predictable rather than a failure of the market to optimally aggregate information. Furthermore, this criticism misunderstands the nature of probability: even events that have a 95 percent chance of occurring will not occur 5 percent of the time. While it is true that prediction markets cannot forecast with certainty the necessarily uncertain, it would be unreasonable to expect this outcome of any means of forecasting.

Another criticism points to divergences that can emerge between different prediction markets and to cases where individuals have been alleged to manipulate markets as evidence of market inefficiency. While there is some evidence that differences in market prices can arise due to single participants attempting to manipulate the market (Rothschild and Sethi 2013), the ability of these individuals to do so is partly a function of the number of traders willing to bet against them. Overall, there is no reason to believe that prediction markets are inherently any more manipulable or subject to arbitrage limits than the stock market. As prediction market skeptic Barry Ritholz has argued, the difference between the bond market and existing futures markets "is in the size, scale, and liquidity."[21] What's more, as section 2.3 of this paper argues, these attempts at manipulation create profit opportunities for other traders, and as a result should become more difficult in the long run as more trades occur. As a result, to the extent that market inefficiencies have occurred in modern prediction markets, it is difficult to disentangle these

[21] Barry Ritholz, "A Few Words on Prediction Markets," *The Big Picture*, May 26, 2005, http://www.ritholtz.com /blog/2005/05/a-few-words-on-prediction-markets/.

outcomes from the limitations on these markets created by the restrictive legal environment they have operated in.

For example, since 2005, Intrade has been required to only allow US participants with verified assets of at least $5 million. It seems likely that even if Intrade ignored this regulation, the threat of legal action reduced participation even when Intrade was at its most popular. In addition to explicit regulation, uncertainty about regulation in the industry creates a chilling effect that has likely further reduced trader participation even at these markets' peak liquidity.

A final criticism questions why prediction markets have failed to be adopted more frequently as a social institution. PAM's failure shows two important drivers of prediction market resistance: misunderstanding and moral objections. We can see clearly the importance of misunderstanding in the comments of Stiglitz, who despite a Nobel Prize for informational economics fails to understand the value of assessment aggregation. Moving beyond anecdotal misunderstanding, econometric analysis of over 500 media articles about PAM showed that the less informed the author was about the issue, the less favorable he or she was toward PAM (Hanson 2005).

The words critics use in moral objections to prediction markets include "repugnant," "shocking," "sick," "turn the stomach," "absurd," "bizarre," and "lunacy" (Hanson 2007). While moral arguments are outside the scope of economics, it can at least be noted that this charge may be inconsistent given the variety of explicit and implicit betting on life and death that occurs in other fully legal and nonstigmatized contexts. Life insurance, for example, bets where beneficiaries on the margin will explicitly realize an economic profit from death.[22] In fact, in the

[22] Graeme Wood, "Death at the Summit," *Pacific Standard*, November 4, 2013, http://www.psmag.com/business-economics/death-summit-67326/.

past, life insurance was seen as immoral because it was "gambling on human life."[23] As Hanson has pointed out, "Nearly all financial instruments we use today were at one point or another considered illegal and immoral."[24] Just as the social stigma against life insurance eventually dissipated in the face of the product's economic benefits, it seems plausible that the same could happen for prediction markets. Similarly, the government intelligence agents who are skilled at predicting terrorist attacks outside prediction markets benefit economically from doing so in the form of promotions. In any case, most people would not find it repugnant to learn that an intelligence agent was promoted for predicting a terrorist attack, nor that said agent acted knowing that a promotion would follow.

In addition to moral objections to contracts that specifically appear repugnant, prediction markets also suffer social stigma related to their similarities with gambling. Sidestepping the debate over whether gambling is desirable, there are significant differences between gambling and prediction markets.

Three elements typically delineate an activity as gambling under US law: prize, chance, and consideration. Prediction markets for real money contain the element of prizes in the payoffs for winning predictions. However, US law designates chance as occurring "*only if skill offers no edge in determining who comes out ahead in an exchange*" (Bell 2011). Given the litany of forecasters, pundits, and consultants that are regularly hired to make predictions about the events that prediction markets are commonly the subject of, it seems unlikely that skill offers no advantage in generating predictions. Unlike picking lottery numbers, there is a large market for those making political, socioeconomic, and even entertainment predictions for for-profit

[23] Ibid.
[24] Ibid.

entities.[25] If individuals and firms can sell their abilities to formulate predictions in a competitive market, then it strongly suggests that skill provides an economically substantial advantage.

Another distinction is that while the primary, and in some cases only, purpose of gambling is for the entertainment of those placing the bets, one of the main purposes of prediction markets is to create prices that are useful to a wide variety of parties. In fact, it is easy to argue that this generation of prices has been the primary purpose for most prediction markets. Most media coverage of Intrade markets, for example, has not been to inform readers of a place where they can bet on uncertain events, but to report on the information contained in the prices.

Regardless of the coherence of the moral arguments against prediction markets, the legalization of Internet gambling in New Jersey, Nevada, and Delaware, and the interest in legalization from other states, suggests that public opinion, or at least the median voter, may be turning in favor of online gambling. In New Jersey, opposition to legalizing online gambling fell from 67 percent to 46 percent from 2011 to 2013.[26] By extension, the prediction markets that are accused of being a form of online gambling should benefit from reduced stigma as well.

Overall, it is undeniable that prediction markets will not always correctly forecast the future, and that in some instances they may fail to bring new information or even traders. However, popular opposition to these markets can be driven more by misunderstanding than by concerns that the markets are being utilized ineffectively or for negative results. In addition, even when specific failures of prediction markets are identified, it is difficult to argue that these failures reflect an inherent problem with the mechanism rather than a result of the limitations

[25] For example, consider the firm MPG, which charges up to $20,000 to predict for movie studios whether a script will be successful. See Brooks Barnes, "Solving Equation of a Hit Film Script, With Data," *New York Times*, May 5, 2013, http://www.nytimes.com/2013/05/06/business/media/solving-equation-of-a-hit-film-script-with-data.html.
[26] Associated Press, "Opposition to Internet Gambling Lessening in N.J.," *Daily Finance*, March 20, 2013, http://www.dailyfinance.com/2013/03/20/internet-gambling-opposition-lessening-nj-christie/.

resulting from the regulatory climate. If prediction markets were allowed to grow and flourish as an industry, it is likely that their performance would increase and inefficiencies would diminish.

3. The Regulation of Prediction Markets

3.1. The Past and Current Regulatory Environment of Public Prediction Markets

Prediction markets have long operated under a restrictive legal environment as a result of both explicit regulation and legal uncertainty. To understand this legal context, a natural first question is: why do these markets raise any legal issues to begin with? In fact, as long as there is no cash or prize offered, a prediction market would likely raise no legal issues. As a noncommercial means of reporting on opinions, it would likely be protected by the First Amendment as free expression rather than free enterprise (Bell 2011). The regulation of real-money prediction markets, on the other hand, is complicated because they resemble, but are not equivalent to, two other highly regulated goods: commodity futures and gambling. As a result, prediction markets have historically been affected by laws and regulatory bodies targeted at these industries.

As the primary regulator of commodity futures and options, the Commodity Futures Trading Commission (CFTC) has broadly defined what constitutes a commodity under its regulatory purview as "all commodities, goods, articles, services, rights, and interests which are or may be the subject of futures contracts"(CFTC 2010). In short, nearly anything that could possibly be the subject of a futures market is a commodity potentially within the CFTC's jurisdiction.

One of the earliest CFTC decisions regarding prediction markets was the issuance of two nonaction statements in the early 1990s for the Iowa Electronic Markets (IEM), a well-known and currently operating academic prediction market run by the University of Iowa's Tippie College of Business. The market's stated purpose is for research and educational purposes, but participants

are engaging in real money bets. In two nonaction statements, the CFTC declined to establish jurisdiction over the markets. However, those letters still place restrictions on the IEM. First, while anyone may purchase contracts in IEM's political prediction markets, nonpolitical markets are only open to "academic traders." In addition, individuals are limited to a maximum investment of $500 dollars, and submarkets are limited to 1,000–2,000 traders. Finally, the CFTC premised its nonaction on the IEM's academic purpose and nonprofit operation (Bell 2011).

With the exception of IEM, the rest of the early prediction-market industry operated under a cloud of regulatory uncertainty owing largely to gambling laws. As section 2 noted, the presence of skill in prediction markets would appear to differentiate them from gambling under US law. However, US laws targeting gambling have had important impacts on the functioning of prediction markets.

One important source of uncertainty for prediction markets has been the Wire Act of 1961, which prohibited the transmission of bets over telecommunications systems. Despite a 2002 Fifth Circuit Court of Appeals interpretation as only applying to sports betting, the Department of Justice early in the first decade of the 21st century held that the act applied to all forms of gambling. The result was the prediction market industry operating in a "gray zone" of legality (Chiang 2007). At that time, even legal scholars who believed some prediction markets would be legal saw the chilling effect of the uncertainty, where the possibility of "even ill-considered and ultimately futile claims" could mean judicial exoneration came only after "a bruising legal battle" (Bell 2006).

The uncertain application of gambling law and the CFTC's nonaction letter on IEM was the primary legal context for prediction markets from the founding of IEM in 1989 until the middle of the first decade of the 21st century. Then in October 2005, the CFTC filed charges

against Intrade for allowing US citizens to trade in options for the following commodities that fell under its purview:

- gold futures
- daily crude oil
- light sweet crude oil futures
- the intraday euro versus US dollar rate
- the US dollar versus yen exchange rate

Intrade agreed to pay a fine and comply with several conditions going forward, including warning US customers via website pop-ups about contracts they were banned from trading. Then in November 2005, the CFTC granted Intrade the status of an exempt board of trade. While this status allowed Intrade to operate legally, it could only allow "eligible contract participants" with assets of more than $5 million to $10 million (Bell 2005).[27] Complying with this rule would have significantly reduced the liquidity of Intrade markets at a time when US residents represented as much as 40 percent of its customer base (CFTC 2005).

Another large regulatory setback for prediction markets came shortly after in 2006, when President Bush signed the Unlawful Internet Gambling Enforcement Act (UIGEA). Among other things, this law empowered the Treasury Department to create rules preventing US banks and credit card companies from engaging in financial transactions with "gambling" sites abroad. Specifically, the act targets "unlawful Internet gambling," which it defines as any bets that violate federal or state law. The "gray zone" uncertainty created by the Wire Act was not clarified, but instead magnified (Chiang 2007).

[27] Tom W. Bell, "TEN's Plans for a Legal U.S. Prediction Market," *Agoraphilia*, December 7, 2005, http://agoraphilia.blogspot.com/2005/12/tens-plans-for-legal-us-prediction.html. Individuals with $5 million in assets were eligible if they entered the "transaction to manage the risk associated with an asset owned or a liability incurred, or reasonably likely to be owned or incurred." Otherwise assets were required to be over $10 million.

Despite the continuing legal uncertainty, the UIGEA effectively disrupted prediction markets. Even before the Treasury Department could write the rules, some banks began refusing to transfer money. Intrade users received the following notice:

> Most US-based members will find it difficult to fund their accounts by credit card. It is very likely that any attempted credit card transfer will not be authorised by your bank. Please note that this is the policy of the bank and not that of the Exchange.

By the time the regulations were written, Intrade was not accepting credit cards, only check and wire payments (Goldberg 2010, n. 29).

Despite the 2006 passage of the UIGEA and a general environment of regulatory uncertainty, there was a growing interest in prediction markets leading up to the 2008 election. As a result of the heightened interest, the CFTC announced it was reviewing the applicability of the Commodity Exchange Act (CEA) to event contracts and released a request for comments.[28] While it did not issue a comprehensive response to the comments, in 2010 the CFTC allowed the operation of two prediction markets for box-office futures. The commission found that movie revenues constituted "a non-price-based measure of an economic activity, commercial activity or environmental event" that was similar to other commodities for which the CFTC has approved futures or options contracts (CFTC 2010). The commission's statement clarified its stance on prediction markets by explicitly arguing that "event contracts" were potentially commodities within the CFTC's jurisdiction:

> The term "event" contract has no meaning under the Act. More than 500 contracts have already been submitted to the Commission that are based on some type of event or activity with economic consequences. The statutory definition of "commodity" does not suggest that an "event" cannot underlie a futures or options contract. Thus, that a contract is based on an event does not preclude it from being a commodity under section 1(a)(4). (CFTC 2010)

[28] From the CFTC request for public comments: "Since 2005, the Commission's staff has received a substantial number of requests for guidance on the propriety of offering and trading financial agreements that may primarily function as information aggregation vehicles."

The commission also offered support for the economic value of box-office prediction markets. Until 2000, the CEA required an "economic purpose test," which specified that a futures or option contract had to have utility as a hedging or price-basing tool (CFTC 2010). While the Commodity Futures Modernization Act of 2000 repealed this requirement, the commission's statement on box-office futures made clear it believed box-office futures markets passed the economic purpose test and could serve both hedging and price-discovery purposes.

The exemption for box-office futures markets was short lived, as the Dodd-Frank Act modified the CEA to explicitly define box-office revenues as not a commodity, and thereby effectively banned box-office futures (Anderson 2011). In addition, Dodd-Frank provided explicit rules requiring the CFTC to prevent the listing or trading of "event contracts" if they are determined to be "contrary to the public interest," which is defined as involving

1. activity that is unlawful under any federal or state law,
2. terrorism,
3. assassination,
4. war,
5. gaming, or
6. other similar activity determined by the Commission, by rule or regulation, to be contrary to the public interest (Stawick 2012).

The sixth criterion in particular potentially grants a large degree of discretion to regulators. What constitutes "contrary to the public interest" and the CFTC's general view of prediction markets post–Dodd-Frank can be seen in a 2012 ruling against the North American Derivatives Exchange (NADEX) political futures market. To determine whether a contract was contrary to the public interest, the CFTC argued it should utilize the same "economic purpose

test" that was part of the CEA until 2000 and required hedging or pricing utility. In the ruling against NADEX, the CFTC argued that political futures had no hedging or pricing purpose due to "the unpredictability of the specific economic consequences of an election" (Stawick 2012).

The commission also has discretion to consider other factors in addition to the "economic purpose test" in determining public interest. In the NADEX ruling, it argued that political prediction markets were against the public interest because they "can potentially be used in ways that would have an adverse effect on the integrity of elections, for example by creating monetary incentives to vote for particular candidates even when such a vote may be contrary to the voter's political views of such candidates" (Stawick 2012).

An additional move to limit prediction markets came in November 2012 when the CFTC sued Intrade for violating the conditions of the 2005 order it had consented to and the terms required of it as an exempt board of trade. Intrade had allowed US customers to trade prohibited contracts. In particular, the CFTC alleged that Intrade was offering binary options in the following markets:

- gold: "February 2011 gold futures to close on or above 1,000 on 30 Dec 2011"
- currencies: "euro/US dollar to close on or above 1.0000 on 30 Dec 2011"
- US economic numbers: "United States will go into recession during 2011"
- banking: "75 or more US banks to fail during 2011"
- war: "United States to conduct overt military action against North Korea before midnight ET on 31 Dec 2011" (Banar and Slovick 2012)

In addition, the CFTC alleged that Intrade failed to warn US customers via website pop-ups that they were not allowed to trade these options, and it alleged that Intrade was not verifying that US customers were "eligible contract participants" with assets exceeding $5 million to $10 million.

The suit asked a federal judge to file an injunction against Intrade and fine it for violating federal commodity law.[29] As a result of the CFTC complaint, Intrade ceased allowing US customers to trade and instructed them to empty their accounts.[30] Volume on Intrade collapsed, and the following March, all trading was shut down, with the company citing "financial irregularities."[31]

The modern regulatory history of prediction markets has generally been a move from uncertainty and legal gray areas to gradually more restrictive laws and enforcement. The legal space carved out for the Iowa Electronic Markets has proved to be an exception.

Traders in private markets face greater liability under insider trading laws than those in public markets. These laws forbid insiders from trading a company's securities "on the basis of material, nonpublic information." Normally, these laws apply to executives and not to average employees or independent contractors. However, if they participate in private prediction markets that give them material nonpublic information, these low-level employees or contractors can become "remote temporary insiders" for whom insider trading laws apply. Even if the corporation takes the necessary precautions and sees a minimal chance of insider trading occurring, the added risks can discourage prediction markets simply because "no corporation would welcome the heavy evidentiary burdens imposed by investigations into illegal trading of its shares" (Bell 2008).

3.3. Regulatory Reforms

Lawmakers and regulators could take a variety of steps to foster the existence of prediction markets. This section will propose actions that the executive, legislative, and judicial branches

[29] David Ingram, "Commodities Regulator Sues Intrade over Trading in U.S.," *Reuters*, November 26, 2012, http://www.reuters.com/article/2012/11/26/us-cftc-intrade-idUSBRE8AP0P220121126.
[30] Matt Egan, "Intrade Tells U.S. Customers to Empty Accounts after CFTC Suit," *Fox Business*, November 26, 2012, http://www.foxbusiness.com/industries/2012/11/26/intrade-tells-us-customers-to-empty-accounts-after-cftc-suit/.
[31] Joe Weisenthal, "Betting Site InTrade Is Completely Shutting Down Trading," *Business Insider*, March 10, 2013, http://www.businessinsider.com/intrade-shutting-down-2013-3#ixzz2vf0vQjwB.

could take. While it is unclear what the optimal regulation of these markets is, the extant research does not support the current restrictive regulatory environment.

A key question is whether these markets should remain under the CFTC's purview. An important benefit of CFTC jurisdiction is the preemption of state laws, including state-level antigambling laws (Bell 2008). While Bell has argued that antigambling laws would not likely apply to many prediction markets,[32] the chilling effects could still be substantial.

If prediction markets remain under CFTC regulation, a key change that lawmakers should make is to remove the provision of the Dodd-Frank Act that banned box-office futures. The aforementioned CFTC approval of these markets as passing the "economic purpose test" indicates a lack of economic justification for this ban. In addition, legislation should undo Dodd-Frank's alteration of the CEA that banned prediction markets on terrorism and war, which, as section 2 argued, provide valuable information.

With or without these suggested legislative changes, an important regulatory improvement would be for the CFTC to act within its existing authority to approve prediction markets. One rationale for such approval is the CFTC's "economic purpose test," which requires that prediction markets have a hedging or price-setting purpose. While the primary benefit of prediction markets lies in the informational value they generate, if the regulatory environment allowed prediction markets to grow and evolve, they could become liquid enough to support hedging. The CFTC recognized this value in its statement approving Media Derivaties, Inc. (MDEX), the box-office futures market:

> The Commission found that the contracts can perform hedging and price discovery purposes. Industry profit and losses have a clear and direct relationship to box office revenues. A contract based on those revenues could be used to hedge related risks. . . .

[32] Bell (2006) argues that "real-money prediction market in claims about science and technology should run little risk of violating the various prohibitions that U.S. law imposes on unlicensed gambling transactions."

> Information provided through staff discussions with industry sources, as well as through written comments and statements by several participants at the May 19, 2010, hearing, revealed that there are various risks associated with film production that could be hedged with risk management tools. (CFTC 2010)

The potential for economically beneficial hedging is not limited to box-office futures. As 19 of the leading academics studying prediction markets argued in a joint statement to the CFTC, even political prediction markets have a potential to serve a hedging function (Zitzewitz et al. 2012).[33] The potential for prediction markets to evolve into highly liquid markets with the possibility for hedging and the participation of institutional investors suggests the CFTC could use its current authority to approve prediction markets to operate under the basis of the "economic purpose test." With the removal of the Dodd-Frank changes to the CEA, the CFTC's scope for approval would be even greater.

In addition, the CFTC should recognize that a major economic benefit of prediction markets lies in the value of the information they generate. If a large percentage of the value of prediction markets is in a long thick tail of topics where interest would be among a smaller number of individuals, then the regulatory barriers should be as low as possible. The CFTC could accommodate such markets by carving out a space to allow information-motivated prediction markets to function with low barriers in contrast to the costly regulations applied to risk-hedging-motivated markets (Hanson 2008). One solution would be for the CFTC to create an "exit option" for prediction markets that see the CFTC's regulation as overly burdensome. This option could be accomplished by clearly defining a limit to the CFTC's jurisdiction. Bell et al. (2008) give three examples of limiting principles: (1) the prediction market only offers trading to members of a particular firm, (2) the market offers no significant hedging benefits, or

[33] Evidence for possible hedging motivations can be seen in, for example, Snowberg, Wolfers, and Zitzewitz (2007), which shows that Republican presidential wins are associated with higher equity valuations and bond yields.

(3) the market only offers spot trading in negotiable conditional notes.[34] These criteria would provide some legal protection for private prediction markets.

Another way to allow a low regulatory bar would be for the CFTC to return to the approach taken with IEM and issue nonaction letters (Bell 2008). However, in recognition of the benefits of allowing these markets flourish, the restrictions placed on "no action" markets should be more flexible than the limits on participation in IEM. For example, participation should not be limited to academics, and total contribution limits should be more than $500. The letter to the CFTC from 19 prediction-market academics advised that a higher limit of $5,000 would effectively prevent hedging (Zitzewitz et al. 2012).

There are also actions the judicial system could take to improve the regulatory environment for prediction markets. Legal scholars Cherry and Rogers (2008) have argued that the First Amendment should protect prediction markets as free speech. They state that such markets constitute expression by individual participants, and that "the market itself may be a speaker." In addition, prediction markets further truth-seeking and should be protected similarly to how courts have protected computer code. By protecting prediction markets under the First Amendment, the courts could effectively remove CFTC jurisdiction over them.

Another important step would be for legislative or executive action to remove the chilling effect of the UIGEA on prediction markets by specifying that prediction-market sites do not constitute gambling so that banks are free to allow their customers to transmit money to these sites. While a 2011 Justice Department decision clarified that the Wire Act only made online sports betting illegal, and thus subject to the UIGEA, the historical uncertainty of online

[34] The third exit option defines the trades as notes rather than futures contracts. The difference is that futures contracts offer future delivery of unconditional rights (e.g., "1 oz. of gold will be delivered on January 1, 2015") versus current delivery of conditional rights (e.g., "this note can be redeemed for $X if Y comes true").

gambling laws has likely created a chilling effect that will stifle innovation in this market without proactive legislation that clarifies the rules. We can see evidence of this chilling effect in banks' unwillingness to process payments for online gambling transactions even in the states where it has been legalized. Reflecting this unwillingness, the vice president of compliance for the American Bankers Association has stated, "There's still the uncertainty over Internet gambling and the liability that could fall on a bank."[35] Without specific federal legislation or regulation clarifying the legality of prediction markets with respect to the UIGEA, this and other chilling effects would likely be a problem for this industry as well.

An additional and more exhaustive legislative step would be to pass a law specifically protecting prediction markets. Bell (2006) offers a draft of legislation aimed at protecting prediction markets for scientific claims; however, this legislation could be expanded to protect all prediction markets. The legislation's goal would be to prevent the application of any state or federal laws to prediction markets except those laws that regulate general commerce. Such legislation would preempt state gambling, bucket-shop, insurance, and similar laws. It would remove prediction markets from the CFTC's purview while still offering protection from state-by-state litigation. As with the proposed regulatory approaches, this law could distinguish between prediction markets that are designed for significant hedging and those that are not, and leave the former under CFTC purview. It would not remove all legal authority from these markets, but would leave their regulation to state contract, tort, and property law. In addition, the law could be designed to allow laws that apply to general commercial transactions, such as the FTC's unfair trade practices laws.

[35] Christopher Palmeri and Elizabeth Dexheimer, "Online Casinos Hobbled as Credit-Card Issuers Reject Bets," *Bloomberg Businessweek*, November 15, 2013, http://www.businessweek.com/news/2013-11-15/web-gaming-curbed-as-paypal-to-bank-of-america-refuse-bets-tech#p1.

Overall, there remains room for executive, judicial, and legislative action to provide a better regulatory environment for prediction markets. While it is unclear which regulatory approach is optimal, the significant benefits and economic value of prediction markets are at odds with the current highly restrictive regulatory environment.

4. Conclusion

Prediction markets are important information-aggregation tools for researchers, businesses, individuals, and governments. Even given the restricted regulatory environment they have functioned in, prediction markets have shown promising applications in fields from demand forecasting to public health. Regulators should allow these markets to grow and evolve.

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