ECONOMICS OF FORECASTING THE FUTURE

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AGENDA

- Motivating example: British election survey
- Prediction markets
  - What are they? Are they legal? How do they work?
- The case for prediction markets
  - Prediction markets vs bookmakers
  - Iowa Electronic Markets
- The case against prediction markets
  - Other issues and ethics
- Other applications
  - Improvements on the old model

FORECASTING BRITISH ELECTIONS

- Parliamentary system where seats are allocated proportional to vote percentage.

- British Election Study (2010) interviewed respondents (16,816) from all 627 constituencies between March 29 and April 7 (773 Murr).

  - Asked who they thought would win in their constituency

  - On a scale of 0 to 10, how likely is it for each of the 5 main parties (Conservatives, Labour, Liberal Democrats, Plaid Cymru, Scottish National Party) to win

  - Actual election held on May 6

PLURALITY VS RANGE VOTING

- Responses interpreted in two ways (Murr 774):

  - i.e. assume there are 3 respondents and two candidates: {A,B}

  - Respondent one believes: {8,4} ~ {.66, .33}

  - Respondent two believes: {5, 5} ~ {.5, .5}

  - Respondent three believes: {1, 9} ~ {.1, .9}

- 1. Plurality

  - One believes A will win, Two is undecided, Three believes B will win, group result indecisive.

- 2. Range

  - Summing the probabilities we see: {1.26, 1.73}. The group believes it is more likely B will win.

RESULTS

- 55 percent of individuals correctly predicted who would win their constituency (25 percent incorrectly predicted and 20 percent provided no clear answer).

- Aggregating the responses by plurality voting increased the chance of a correct prediction to 85.7 percent.

- Aggregating responses by range voting marginally increased the chance of a correct prediction to 86 percent.

Table 1

Performance of individual and aggregated predictions of which party will win in the constituency.

| | Individual level | | Constituency level | | | |
| | | | Plurality voting | | Range voting | |
	N	in %	N	in %	N	in %
Missing/no clear answer	3389	20.2	11	1.8	–	–
Incorrect	4114	24.6	79	12.6	88	14.0
Correct	9220	55.1	537	85.7	539	86.0
Total	16,723	100.0	627	100.0	627	100.0

DIFFERENCE APPEARS IN NUMBER OF SEATS

- Forecasting constituencies allows forecasting of seats won due to proportional allocation.

- Undecideds in plurality voting resolved with coin flips.

- For every party except Plaid Cymru, range voting aggregation produced closer forecasts, note the difference in mean absolute error (Muir 776).

- Additionally, running a regression on the 3 major parties' vote shares on forecasts yielded high R^2 values (.76, .74, .57)

Table 2

Forecast and actual seats using the plurality voting and range voting procedure. The 11 tied constituencies in the plurality voting procedure are decided by a random draw.

Party	Plurality voting			Range voting		
	Forecast seats won	Actual seats won	Error in seats	Forecast seats won	Actual seats won	Error in seats
Conservatives	279	304	−25	290	304	−14
Labour	265	257	+8	256	257	−1
LibDems	69	57	+12	65	57	+8
PC	4	3	+1	6	3	+3
SNP	10	6	+4	10	6	+4
N		627			627	
MAE$_{All\ 5\ Parties}$		10			6	
MAE$_{Main\ 3\ Parties}$		15			7.7	

DATA ANALYSIS

- Both range and plurality voting predict constituency results with impressive accuracy, and range voting forecasts slightly more accurate seats – wisdom of the crowd

    - Individuals, even experts tend not to reach this level of accuracy

- How to account for this phenomenon?

    - Suriowiecki (2004) argues that we can think of individuals as each having some error term when making a prediction

    - Aggregating these error terms cancel each other out, not all people will be biased in the same direction (779 Muir).

    - Suriowiecki argues informational diversity and group size are important predictors of accuracy.

        - Variation in response date and information sources allow the group to form different opinions and form a diverse group opinion that considers all information.

TESTING SURIOWIECKI'S HYPOTHESIS

- Log regression run on correct predictions

- Statistically significant factors: margin of vote, group size and response date

- Increasing group size by 10 increases success by up to 20 percent.

- Increasing the standard deviation of response dates by 1 increases success by 30 percent.

- Surprise: informational diversity seems irrelevant

Table 4

Explaining correct group predictions. Logistic regression model with variables relating to "task difficulty" and "group characteristics".

	Estimate	Std. Error
(Intercept)	−2.27	(4.19)
TASK DIFFICULTY		
Boundary change	0.01	(0.01)
Margin	0.18[a]	(0.02)
Abs. change in turnout	0.02	(0.05)
Size of electorate	−0.24	(0.20)
Number of parties	−0.10	(0.19)
GROUP CHARACTERISTICS		
Decision making		
Group Size	0.08[a]	(0.03)
Informational diversity		
Education	0.26	(0.74)
Interest	0.67	(0.85)
Attention	−0.43	(0.87)
Newspaper	−0.94	(1.73)
Response date	1.21[a]	(0.42)
Sociological diversity		
Age	0.05	(0.06)
Female	−1.57	(3.66)
Income	−0.02	(0.77)
N		627
AIC		393.09
BIC		659.55
log *L*		−136.55
Area under ROC curve		86.3%

[a] Significance at $p < 0.05$; Standard errors in parentheses.
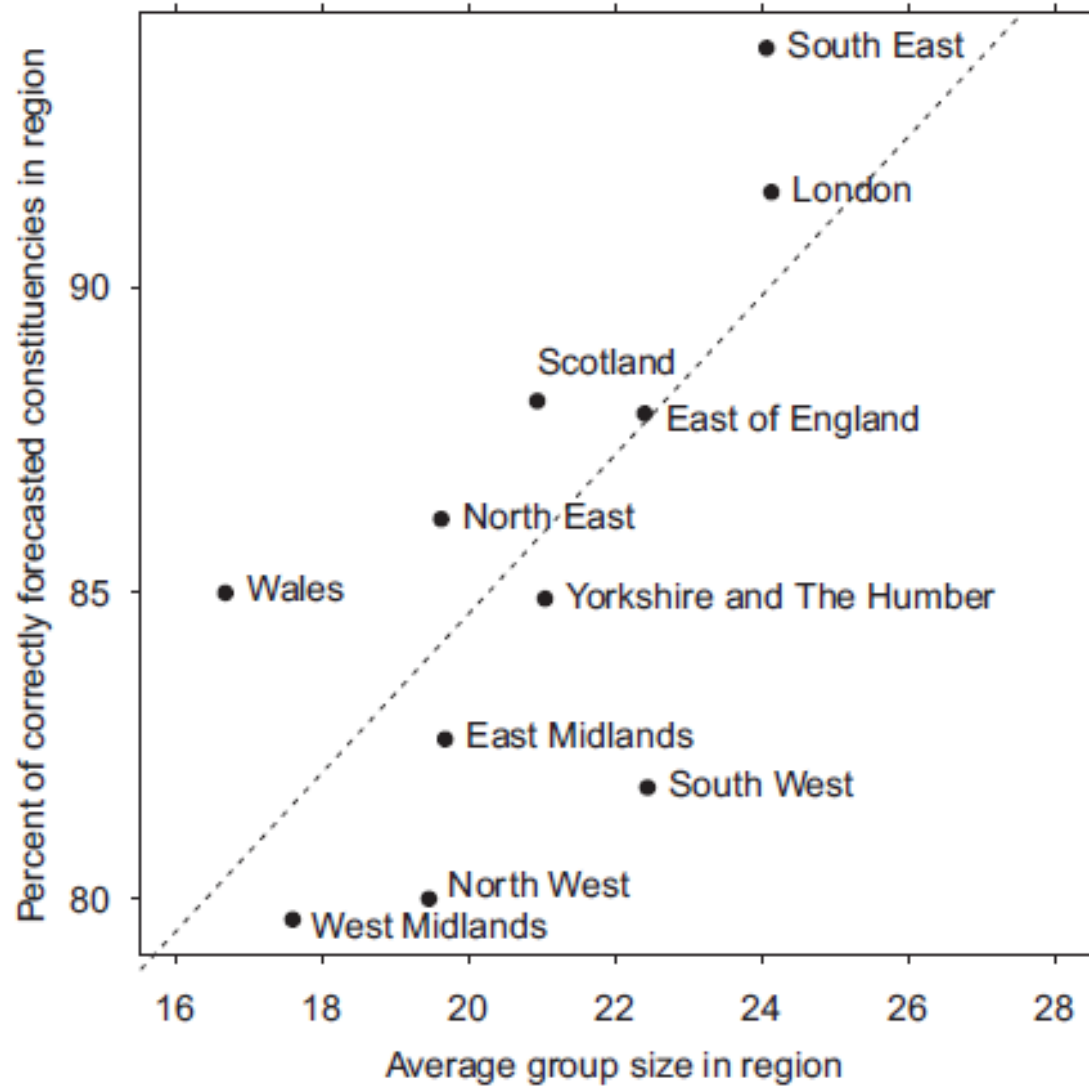
CAN WE GET EVEN MORE ACCURATE RESULTS?

- Iowa Electronic Markets started in 1988 as a teaching aid by University of Iowa's Tippie School of Business (tippie.uiowa.edu).

  - Trade shares (based on probability from 0 to 1) worth real money on various election results.

    - Hold up to $500 risk on an account

    - Double auction system (i.e. stock market)

    - Prices change as you trade

  - 2 types of markets, winner take all (paid if prediction is correct) and vote share (get paid proportional to final vote share).

  - Values are even more continuous than aforementioned survey, instead of having 11 options ranging from 0 to 10, now 99 options ranging from 1 cent to 99 cents.

    - In theory this should make it even more accurate

  - Historically outperformed polls as a predictor of election results (more on this later).

MODERN PREDICTION MARKETS

ASIDE: IS THIS EVEN LEGAL?

- Online gambling is illegal in the U.S.
- Intrade (1999-2013)
  - Set up as "financial exchange"
  - Allowed U.S. investors to play without commenting on legality
  - By 2010, no longer possible to deposit with U.S. bank account (intrade.com)
  - Sued in 2012 by CFTC (Commodity Futures Trading Commission) for speculating on prices of gold, essentially an unregulated (lower fees vs. Chicago Mercantile Exchange) exchange.
    - Closed US accounts in 2012, taking a large hit to user base
    - Shut down in 2013 due to financial inconsistencies (Bloomberg.com)

PREDICTIT, INTRADE'S AMERICAN SUCCESSOR

- Opened in 2014

- Unlike Intrade, Predictit was able to obtain a no-action relief from the FTFC's Division of Market Oversight under the justification of academic research (cftc.gov).

    - Predictit is owned by Victoria University (NZ)

- Certain restrictions exist as a result

    - University is not allowed to collect profits

    - Participants must be over the age of 18

    - The amount of money in an individual contract may not exceed $850 (per participant).

PREDICTIT – HOW DOES IT WORK?

- Shares are valued between $0 to $1, indicating % probability.

  - If a prediction is true, Predictit pays the owner $1 per share at time of expiration.

    - Can re-trade shares at any time before expiration, just need to find a buyer

  - Market is open 24/7 except 4:00-4:30 am EST for maintenance

- Administrative factors:

  - Free to deposit funds, 5% withdrawal fee

  - 10% fee on profits (NOT NET)

- Two types of market types

  - Single contract market – "Will event X happen?" YES or NO

  - Multiple contract market – "Who will be the nominee?", "What range will X be in?"

    - Individual contracts resolve to YES or NO

WINNER TAKE ALL SHARES AS A CONTINGENT CLAIMS MARKET

- Assumptions:

  - Participants have heterogeneous beliefs, are risk-neutral and are price takers that attempt to maximize expected value of their subjective beliefs

  - In a binary market where shares resolve to $1, if m is an event, and n is the contrary event, then $\pi_m + \pi_n = 1$; no arbitrage

  - Then the equilibrium price of contracts should be:

    - $\pi_m = P(q_m > \pi_m)$ where q_m is the subjective belief that an event will occur and P() is cross-section of beliefs amongst price takers

  - Equilibrium solution is uniquely related to $(1 - \pi_m)$-quantile of beliefs (Manski 2).

    - If people think π_m is too low, they will buy m (and buy n if vice versa).

    - Market is sum of these beliefs.

WINNER TAKE ALL SHARES AS A CONTINGENT CLAIMS MARKET (CONT.)

- Prices near the bounds (0 or 1) are very informative about the average trader's beliefs while prices near .50 say very little

- If we remove the assumption that traders only care about subjective probability and market odds, the new equilibrium is (where y is budget):

$$E(y) = (1/\pi_m) \cdot E\{y \cdot 1[q_m > \pi_m]\} = (1/\pi_n) \cdot E\{y \cdot 1[q_m < \pi_m]\}$$

- Which is to say that if a trader's belief and budget is dependent on what others believe, then the equilibrium price depends on the conjunction of everyone's belief and budget (Manski 3).

- If traders do not revise beliefs "too much" based on prices, then the equilibrium price should remain unchanged (Manski 4).

RISK AVERSION – ARE PRICES EQUAL TO BELIEFS?

- May not be realistic to assume that traders are risk-neutral if substantial amounts of money can be bet.

- Gjerstad relaxes Manski's assumptions that assume traders are risk-neutral

  - Under a unimodal (single highest value), risk-averse belief system, traders with a CRRA utility function can still form aggregate beliefs near the equilibrium value (Gjerstad 12).

    - error of about $.008 using popular beta values for risk aversion

- Even under the assumption that beliefs are symmetric, risk-aversion does not end up significantly affecting equilibrium prices (Gjerstad 13).

  - The less variance in risk aversion, the closer market prices will be to equilibrium.

- Deviation between average prices and beliefs were not found to be significant in the .20 to .80 range (Wolfers and Zitzewitz 9).

  - Increasingly disperse beliefs resulted in larger gaps between beliefs and price.

PREDICTIT'S MARKETS

Featured Markets

These are popular political markets that receive a significant amount of attention from the press and the political community.

Who will be the 2016 Democratic nominee?

Top Predictions	💬 6949 Comments
Clinton 💬 685	83¢ ↓2¢
Sanders 💬 949	16¢ NC

Who will be the 2016 Republican nominee?

Top Predictions	💬 46643 Comments
Trump 💬 2762	64¢ ↓1¢
Cruz 💬 507	23¢ ↑1¢

Who will win the 2016 U.S. presidential election?

Top Predictions	💬 6379 Comments
Clinton 💬 379	58¢ ↓2¢
Trump 💬 791	27¢ ↓2¢

Who'll win the Maine Democratic caucuses?

Top Predictions	💬 208 Comments
Sanders 💬 5	98¢ ↑4¢
Clinton	3¢ ↓6¢

Who'll win the Michigan Republican primary?

Top Predictions	💬 200 Comments
Trump 💬 1	76¢ ↑6¢
Kasich	24¢ ↑1¢

Who'll win the Michigan Democratic primary?

Top Predictions	💬 91 Comments
Clinton	92¢ NC
Sanders 💬 6	8¢ ↓1¢

Obama avg. approval 3/11?		
Top Predictions		💬 25 Comments
47.5-47.9	25¢	NC
48.5+	23¢	↑1¢

Direction of country 28.5+ on 3/11?		
Current Market		💬 3 Comments
Yes	25¢	↓3¢
No	75¢	↑3¢
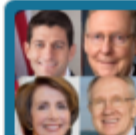
Congress approval 12.5+ on 3/11?		
Current Market		
Yes	53¢	↓1¢
No	47¢	↑1¢

No guns for no-fly list?		
Current Market		💬 58 Comments
Yes	2¢	NC
No	98¢	NC

New Benghazi committee report by May 2?		
Current Market		💬 15 Comments
Yes	32¢	NC
No	68¢	NC

Undivided government under the Republicans after 2016?		
Current Market		💬 52 Comments
Yes	24¢	↓5¢
No	76¢	↑5¢

Apple held in contempt by 3/31?		
Current Market		💬 53 Comments
Yes	5¢	↓2¢
No	95¢	↑2¢
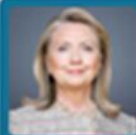
Will Hillary face charges in 2016?		
Current Market		💬 339 Comments
Yes	27¢	↓1¢
No	73¢	↑1¢

Will MI Gov. Snyder resign by June 30?		
Current Market		💬 19 Comments
Yes	23¢	↑5¢
No	77¢	↓5¢

Closer look at rules of a single contract market

Will Republicans control both Congress and the White House after 2016?

Latest Price: 24¢ ↓ 5¢

| Buy Yes | Click to match Offers starting at **28¢**, or to make your own, lower Offer. |
| Buy No | Click to match Offers starting at **75¢**, or to make your own, lower Offer. |

If this prediction comes true, PredictIt will redeem all Yes shares at $1. Shares in No will have zero value. If this prediction does not come true, PredictIt will redeem all No shares at $1. Shares in Yes will have zero value.

Data   **Rules**   Prices   Ownership   History

The nominee of the Republican Party will be elected president of the United States in 2016 and the Republican Party will control a majority in the House of Representatives and its caucus will consist of at least 50 seats in the Senate. This Market will close by the end date or at such time earlier when, in PredictIt's sole judgment, the result is beyond question.

Closer look at a multi-contract market

Who will win the Michigan Republican primary?

Market Type: Linked
End Date: 03/09/2016 11:59 PM (ET)
Status: Open
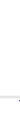
Ask   Bid   "Short"

Contracts   Rules   History

Trade shares from this page by clicking any price in bold. For more information on an individual prediction, click on the name or image.

MIPRMRY16.GOP	Latest	Buy Yes	Sell Yes	Buy No	Sell No	Shares	Buy Offers	Sell Offers
Donald Trump TRUMP.MIPRMRY16.GOP	78¢ ↑ 8¢	79¢	76¢	24¢	21¢	0	0	0
John Kasich KASICH.MIPRMRY16.GOP	21¢ ↓ 2¢	24¢	21¢	79¢	76¢	0	0	0
Ted Cruz CRUZ.MIPRMRY16.GOP	9¢ ↓ 4¢	10¢	9¢	91¢	90¢	0	0	0
Marco Rubio RUBIO.MIPRMRY16.GOP	1¢ NC	2¢	1¢	99¢	98¢	0	0	0
Ben Carson CARSON.MIPRMRY16.GOP	0¢ NC	1¢	None	None	99¢	0	0	0

HOW ARE SHARES CREATED AND TRADED?

- No predetermined shares are issued at the time of the creation of a market (predictit.com).
  - Initially blank slate
- Number and price of shares driven by demand of market players
  - Shares are created when one participant's "YES" contract and another participant's "NO" contract sum up to $1. The server holds the money and issues the shares.
  - When a share is traded, it can be matched with its complementary "YES/NO" offer if the two contracts sum up to $1. Both contracts are taken out of circulation and the server releases funds.
  - Alternatively the share may just pass ownership (analogous to the secondary market for stocks)

HOW ARE MARKETS CREATED?

- Initial set of markets are created by website.

- Users may suggest additional markets and/or options in multi-contract markets (predictit.com).

  - may not be true for all betting markets

CASE STUDY: BETFAIR VS BOOKMAKERS

DIFFERENT PRICING STRUCTURES

- Bookmakers, quote driven market

    - "take-it-or-leave-it" price and odds

    - Odds stay constant throughout the duration of the bet

    - Despite these fixed odds, bookmaker odds are still shown to be a better predictor of the future than statistical models which attempt to model various factors (Fracnk et al. 450).

- Betfair, order-driven market

    - Like predictit, two people must have complementary beliefs of odds for a contract to be formed

    - Similarly, a contract holder can back out of a position even if an event is "in-play" as long as they do so before the contract expires (betfair.com).

BETFAIR BEATS THE BOOKMAKERS

- Comparison of 5478 European football games played in **3** seasons.

- 8 different Bookmakers were compared to matched Betfair ratios collected at the same time

- Odds were transformed into probabilities (Franck et al. 449).

    - If there were arbitrage issues with Betfair's data, a linear transformation was performed

Table 1
Summary statistics of outcome probabilities and forecasts.

	True probabilities	Betfair	Bookmaker
Home win	0.462 (0.498)	0.456 (0.158)	0.448 (0.139)
Draw	0.281 (0.449)	0.280 (0.048)	0.278 (0.038)
Away win	0.256 (0.436)	0.263 (0.135)	0.273 (0.122)
Observations	5478	5478	5478

Notes: The table presents the outcome probabilities and the forecasts of the exchange market and a randomly picked bookmaker. The mean and standard deviation are given. In terms of these summaries, the exchange market's probabilities are closer to the true outcome probabilities.

A NEW BETTING STRATEGY

- Statistical analysis shows that BetFair outperforms bookmakers in many tests

    - Better goodness of fit, R^2 values, Brier score, etc. in direct comparisons with virtually all bookmakers.

- Authors form a simple betting strategy based on differences in price between BetFair and bookmakers

    - If Bookmakers give higher odds than BetFair, place a trade.

    - Result: above average returns in all cases

    - Next slide: column left is average of all bets, column on right is following betting strategy.

Table 4
The mean returns of a simple betting strategy compared to average returns.

Bookmaker	All events		Home win bets		Draw bets		Away win bets	
	All	$R_i^* > 1$	All	$R_i^* > 1$	All	$R_i^* > 1$	All	$R_i^* > 1$
Random	−0.124	−0.028	−0.084	−0.027	−0.096	−0.053	−0.192	0.019
	(16 434)	(8234)	(5478)	(3219)	(5478)	(3339)	(5478)	(1676)
Highest odd	−0.072	0.014	−0.037	0.012	−0.055	−0.016	−0.124	0.082
	(16 434)	(8234)	(5478)	(3219)	(5478)	(3339)	(5478)	(1676)
B365	−0.109	−0.019	−0.069	−0.019	−0.083	−0.043	−0.177	0.027
	(16 371)	(8203)	(5457)	(3205)	(5457)	(3329)	(5457)	(1669)
B&W	−0.111	−0.020	−0.074	−0.021	−0.085	−0.045	−0.174	0.030
	(16 425)	(8229)	(5475)	(3217)	(5475)	(3338)	(5475)	(1674)
GB	−0.109	−0.017	−0.067	−0.015	−0.086	−0.045	−0.175	0.032
	(16 422)	(8228)	(5474)	(3217)	(5474)	(3337)	(5474)	(1674)
IW	−0.141	−0.039	−0.084	−0.022	−0.121	−0.081	−0.218	0.009
	(16 326)	(8177)	(5442)	(3203)	(5442)	(3313)	(5442)	(1661)
LB	−0.134	−0.034	−0.096	−0.039	−0.102	−0.051	−0.204	0.009
	(16 239)	(8135)	(5413)	(3185)	(5413)	(3292)	(5413)	(1658)
WH	−0.137	−0.042	−0.089	−0.033	−0.115	−0.071	−0.208	−0.002
	(16 314)	(8169)	(5438)	(3196)	(5438)	(3311)	(5438)	(1662)
SJ	−0.111	−0.030	−0.88	−0.045	−0.103	−0.063	−0.141	0.062
	(10 911)	(5524)	(3637)	(2083)	(3637)	(2301)	(3637)	(1140)
VC	−0.125	−0.039	−0.090	−0.046	−0.108	−0.068	−0.176	0.032
	(10 806)	(5471)	(3602)	(2068)	(3602)	(2280)	(3602)	(1123)

Notes: The table compares the mean returns for a simple betting strategy (right hand side of each column) with normal returns (left hand side of each column). The number of bets is displayed in parentheses. The trading rule is to place a bet at a given bookmaker whenever the probability of *Betfair* is higher than the average probability of the bookmakers. The results are broken down by the events on which to place a bet (columns) and the bookmakers (rows). The first row presents the results for a randomly chosen bookmaker and the second row for the bookmaker offering the most favorable odds. It can be seen that the rule enables above-average returns in all cases, and, in some cases, even positive returns.

REFLECTIONS

- Betting exchange offers incentives for players to gather and process information

- Investing reflects true valuation of probabilities

- Changing odds allows for the incorporation of news as it becomes available (Fracnk et al. 451).

- BetFair reduces "Longshot Bias" found in bookmaker odds

  - Unlikely events tend to be overestimated

  - Likely events tend to be underestimated

- Is this impressive? Not necessarily…

  - Although they beat statistical models, bookmakers are not driven to set the most accurate odds (Franck et al. 458).

    - Profit maximization first

EFFICIENT MARKETS HYPOTHESIS

- Asset prices reflect all available information

    - Weak form – future prices cannot be predicted from past

    - Semi-strong – prices adjust rapidly to new information

    - Strong – prices reflect all information, public and private

Who will win the Kansas Democratic caucuses?

Market Type: Linked
End Date: 03/05/2016 11:59 PM (ET)
Status: Open

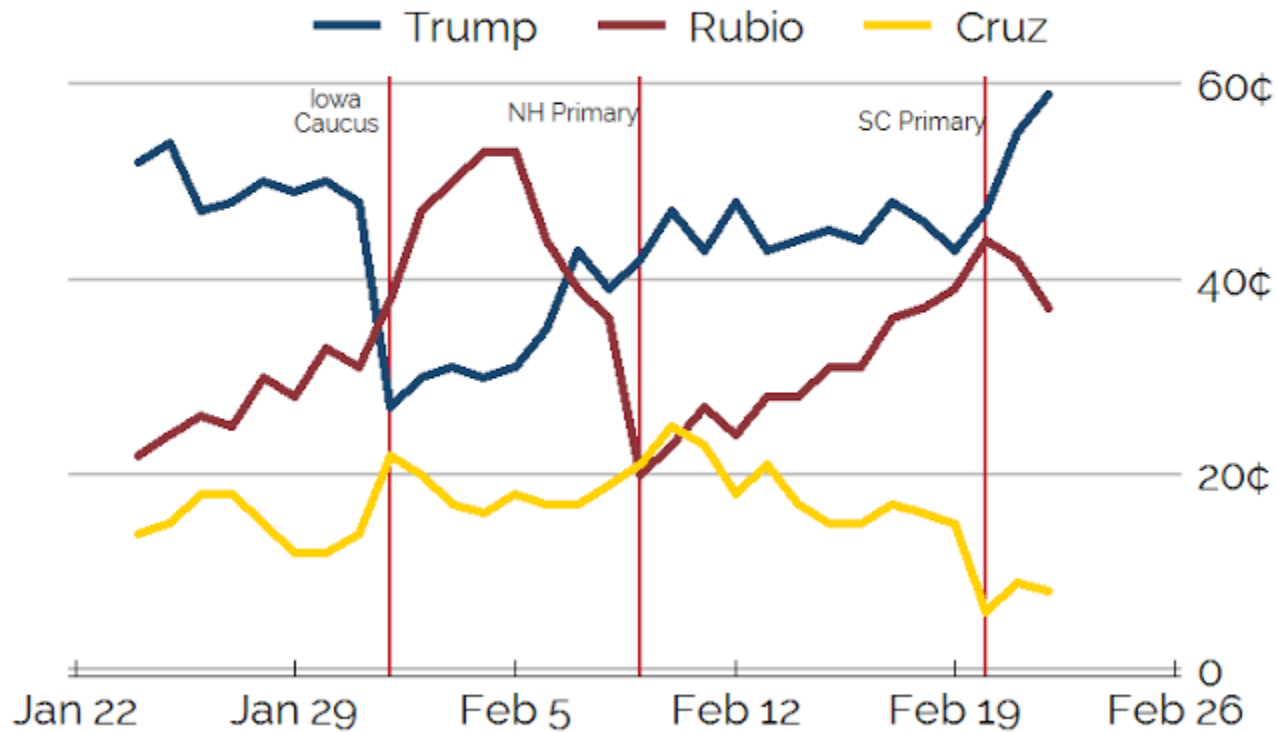Day of Kansas Caucuses (before results called)

Contracts   Rules   History

Trade shares from this page by clicking any price in bold. For more information on an individual prediction, click on the name or image.

↻ KSCAUCUS16.DEM	Latest	Buy Yes	Sell Yes	Buy No	Sell No	Shares	Buy Offers	Sell Offers
Bernie Sanders SANDERS.KSCAUCUS16.DEM	66¢ ↑ 37¢	65¢	50¢	50¢	35¢	0	0	0
Hillary Clinton CLINTON.KSCAUCUS16.DEM	42¢ ↓ 30¢	42¢	30¢	70¢	58¢	0	0	0

Election results and debate performances can have drastic effects on prices

Who Will Win the 2016 Republican Presidential Nomination?

Trump — Rubio — Cruz

Iowa Caucus

NH Primary

SC Primary

60¢

40¢

20¢

0

Jan 22   Jan 29   Feb 5   Feb 12   Feb 19   Feb 26
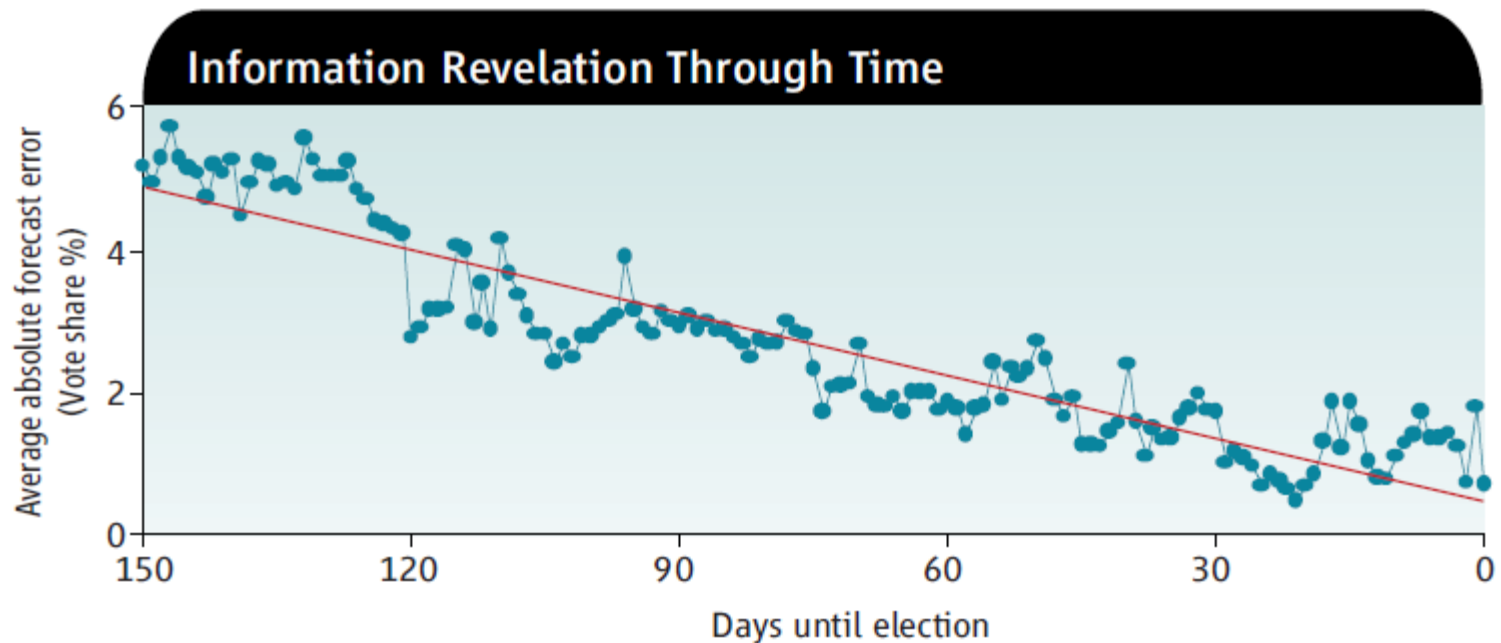
Source: PredictIt

Rubio has debate gaffe

INSIGHTS FROM IEM

- Traders are not representative of the general population (Berg. & Reitz 6).
  - Overwhelmingly male, college degree holding and high voter participation (90%+)
    - Likely no issue with validity since this is polling outcomes instead of potential votes
- Traders are biased (7).
  - 89% believe they are more informed than others
  - Party affiliation affected trader's beliefs of who would win the election (In 2004, 60+% democrats thought Kerry would win, while only 5% of republicans did).
- Some traders were actually robots trying to profit off of arbitrage.
- Large orders can substantially shift prices (9).
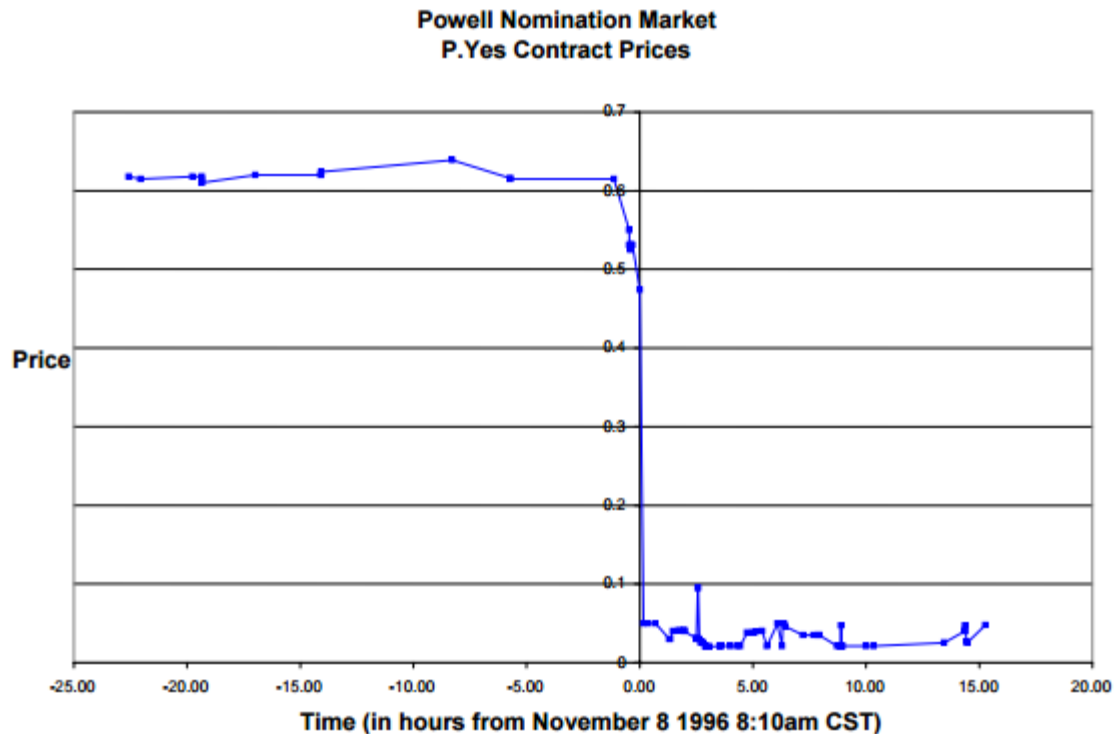
INSIGHTS FROM IEM (CONT)

- IEM prices are accurate relative to polls and in an absolute sense

  - Vote shares on the eve of an election have an average error of 1.33% compared to polls which have an average error of 2%

  - Prices are more accurate than polls even a week away from the election in 76% of the cases.

Information Revelation Through Time

Average absolute forecast error (Vote share %) vs Days until election

INSIGHTS FROM IEM (CONT)

- Accurate even on extremely long time horizons (100+ days), with significantly lower error terms than polls.

- In Winner-take-all markets, prices exhibit the reverse of longshot bias in longer time horizons (which disappear as the eve of election approaches).

  - Likely bets are overestimated

  - Unlikely bets are underestimated

  - This result has not been consistent across other betting platforms: possible explanation is liquidity constraints and fees making likely bets less attractive for profits.

PRICES RESPOND VERY QUICKLY TO INFORMATION (EMH)

Powell Nomination Market
P.Yes Contract Prices

Price

Time (in hours from November 8 1996 8:10am CST)

At 8:10 am CST, Colin Powell says he will make an announcement later in the day. Traders (correctly) believe that he will not declare candidacy.

ARE PREDICTION MARKETS REALLY THAT GREAT? – CONFLICTING VIEWS

- Erikson and Wleizen of Columbia compared IEM market prices to trial-heat polls and adjusted polling numbers

  - Argue that comparing market prices to same day polls is naïve since they do not reflect the same thing – market prices estimate what will happen on election day whereas the polls merely show trends (Erisken and Wleizen 4).

    - Example, candidate A and B are polling at 60 and 40 respectively 1 month out from an election.

    - Instead of taking these numbers at face value, we should create adjusted poll numbers based on past evidence

      - i.e. historically no one will be able to maintain a 60-40 lead up to election day so we should interpret this based on where the candidate with 60 percent vote will end up a month from now (lower).

      - Anti-incumbency bias: Opponents of incumbents tend to surge then drop off right before the election

      - Polls ask who a person would vote for today, many voters don't decide until the day of the election who to vote for, of course early polling will be inaccurate

PREDICTION MARKETS FARE POORLY UNDER THESE NEW ASSUMPTIONS

- Erikson and Wleizen transform presidential polling data into election day outcomes by regressing historical polling data on days from election then applying the relationship to current day polls (Eriksen & Wleizen 6).

- The transformed data was compared with same day prediction market values

  - Transformed poll projections were more accurate than prediction market values

  - 3 out of 5 projections had closer vote shares than prediction market values

  - 4 out of 5 weekly poll projections had closer vote shares than daily prediction market values.

  - In winner take all markets, transformed markets completely dominated prediction markets

- 538's Nate Silver, reputed for correctly predicting the 2008 election with perfect state-by-state results used a similar debiasing method (Rothschild 897).

- But if you want to beat the prediction market, don't even need to do this !

  - Comparing prediction markets to the seven day polling average (Realclearpolitics) results in polling being more accurate than prediction markets (Eriksen & Wleizen 11).

INTERPRETING THE RESULTS

- One possible justification is just that the IEM does not have enough participants to reach efficient market prices.

  - If the IEM had more participants or we looked at a bigger market, there might be less inefficiency

- Participants shown to be persistently wrong (anchoring), only change views when "forced to" by polling data

- On the positive side, polling can be very expensive and difficult to do well, whereas prediction markets are free other than server hosting costs

  - Additionally, some fields that prediction markets spread into have no historical precedence

  - Polling data may be the exception, one of only subjects that has wealth of information

  - However, there are many other issues with prediction markets…

EFFICIENCY ISSUES

- Very confident investors are limited in their ability to affect a market by the $850 cap.

- Arbitrage – markets routinely fail to add up to "common sense" percentages.
  - Multi contract markets may have all "YES"es summing up to over 100%
  - YES and NO of an individual candidate often sum up above or below 100%
  - Consequence of trading structure and rules.
    - The cheaper priced complement of a YES or NO contract requires less liquidity to hold.
    - 10% fee on profit reduces incentives for price discovery.

Who will win the 2016 Republican presidential nomination?

Market Type: Linked

End Date: 09/15/2016 12:00 AM (ET)

Status: Open

Yes bids sum up to 111%!

Contracts   Info   Rules   History

Trade shares from this page by clicking any price in bold. For more information on an individual prediction, click on the name or image.

RNOM16	Latest	Buy Yes	Sell Yes	Buy No	Sell No	Shares	Buy Offers	Sell Offers
Donald Trump TRUMP.RNOM16	67¢ ↑ 1¢	67¢	66¢	34¢	33¢	0	0	0
Ted Cruz CRUZ.RNOM16	21¢ ↑ 1¢	22¢	20¢	80¢	78¢	0	0	0
John Kasich KASICH.RNOM16	9¢ ↓ 2¢	10¢	9¢	91¢	90¢	0	0	0
Marco Rubio RUBIO.RNOM16	8¢ NC	9¢	8¢	92¢	91¢	0	0	0
Mitt Romney ROMNEY.RNOM16	4¢ ↓ 2¢	5¢	4¢	96¢	95¢	0	0	0
Paul Ryan RYAN.RNOM16	4¢ ↓ 1¢	5¢	4¢	96¢	95¢	0	0	0

Herding (caused by unexpectedly poor performances in some of Trump's expected win states) – occurs but market manages to rebound.
Rebound suggests resilience to herding.
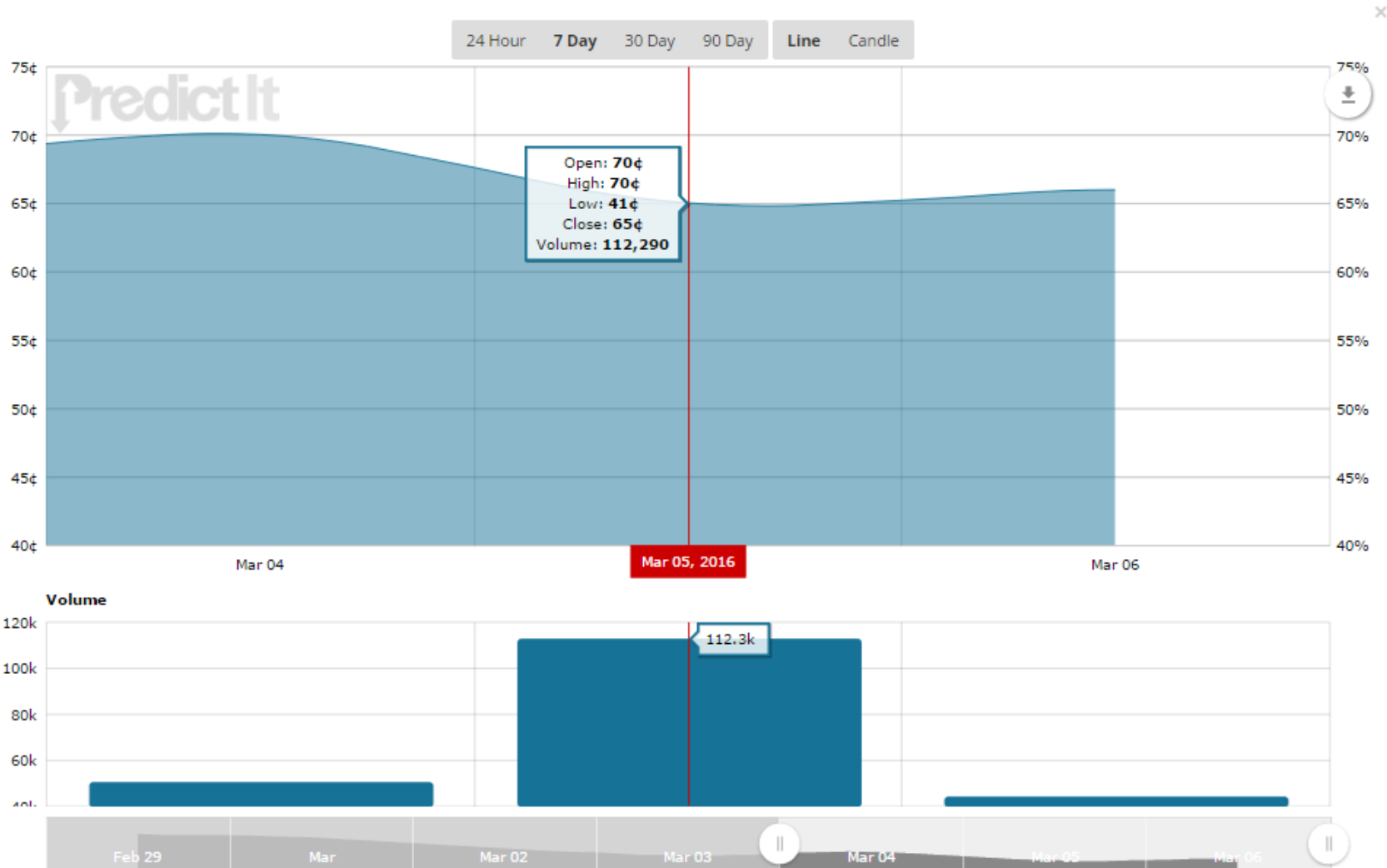
MISINFORMATION

- To facilitate discussion, most websites implement a replies section.

- Being the first to respond to new information (i.e. incoming poll results) can be very profitable

  - Some investors spread misinformation to try to improve their position

    - Pump and dump

- In theory, prediction markets should overcome misinformation (just noise), but unsophisticated investors may be tricked into panic-selling (Graefe et al. 399).

Puerto Rico Primary
@PuertoRicoPoll

🐦 Follow

Morning Puerto Rico @GOP Primary Poll is out! The results 36% #Rubio 34% #Cruz 21% #Trump 6% #Kasich 3% Other. The results are ongoing! #CNN

11:21 AM - 6 Mar 2016

↩   ⟲ 23   ♥ 15
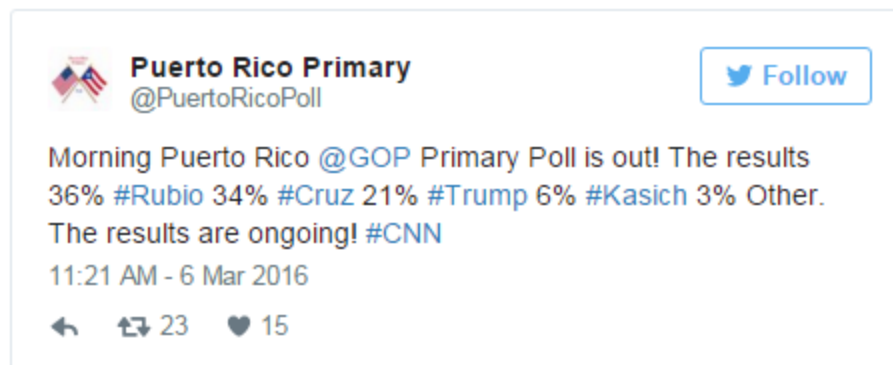
CONFLICT OF INTEREST/INSIDER TRADING

- More prominence in the media could lead to more influence on results

    - 538 has started including discussion of prediction markets in their forecasts, unclear how much they weigh this

    - Some voters may look at market and change their vote to the current winner

    - Politicians may attempt to influence result by investing in the market

        - Offset by market caps and valid personal information registration

    - Conversely, people playing the market may vote for a candidate they do not want because they have money in the market

    - There is nothing stopping political insiders from trading (case for strong EMH)

        - In fact there are many incidences of that happening.

            - Washington interns privy to first information can make large returns (time.com).

MORAL HAZARD AND ETHICAL ISSUES

- Assassination markets

  - Given a sufficiently large bet, a participant may be motivated to go to extreme measures to collect (~ life insurance fraud).

    - Safeguards: market cap prevents prize from getting too large

    - Still need a seller for every buyer

- Terrorism markets – Policy Analysis Market

  - Controversial idea briefly entertained by DARPA (nytimes.com).

  - Predictions on terrorist attacks, coup d'états and other developments in Middle East

  - Never occurred, although Intrade did have markets such as when Bin Laden would be captured

OTHER APPLICATIONS – BUSINESS

- Google has an internal prediction market to help understand its product development speed.

    - No cash, just a points and awards system

    - Prestige is enough for some people to invest in making accurate decisions

- Microsoft is also in the process of implementing one.

- Important for businesses because management may be biased for various reasons (Graefe et al. 402).

    - Groupthink

    - Workers more comfortable stating anonymously how likely they feel a task will be completed on time

THE CASE FOR PREDICTION MARKETS ROUND 2

- Returning to the Columbia study conclusions:

  - Naïve to compare raw data

  - Know poll respondents have bias, so we transform this data for projections

  - Know prediction markets also have bias…

- Why not correct for bias in the prediction markets?

PREDICTWISE, A MARKET AGGREGATOR
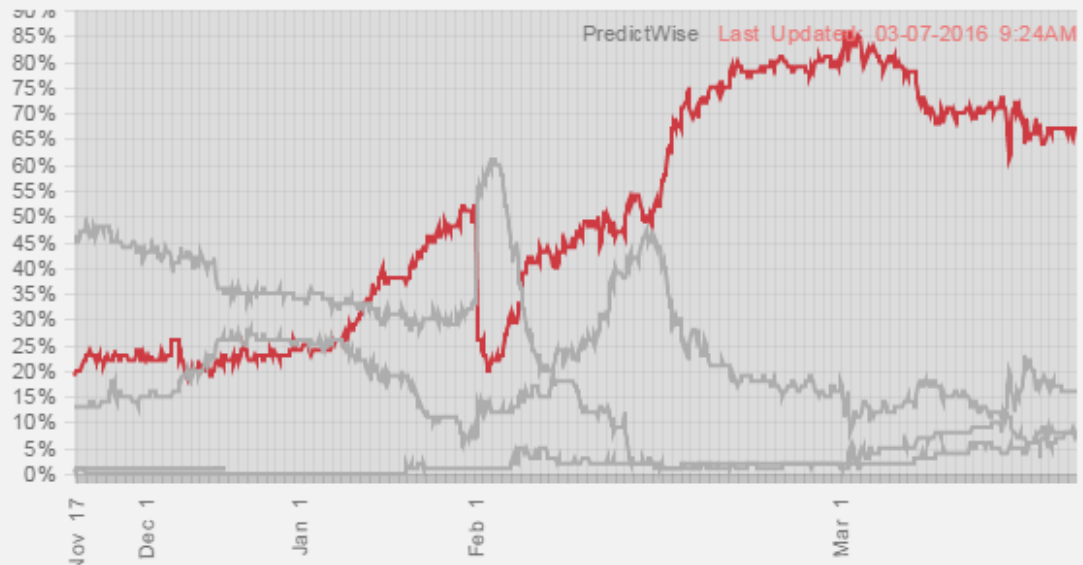
PredictWise

- Website founded and run by David Rothschild, economist at Microsoft Research

- Consolidates odds from multiple betting markets as well as looking at polling data

  - Hollywood Stock Exchange, BetFair, PredictIt, FantasySCOTUS, Hypermind, etc.

- Attempts to correct for historical inaccuracies of prediction markets

  - Correct for extremes near $0 to $1

- Normalization of odds (i.e. transform odds so there is no arbitrage) for mutually exclusive markets (predictwise.com).

EXAMPLE OF RAW DATA TABLE

Potential Candidate	PredictWise	Betfair	PredictIt	Bookie	Pollster	Betfair Back	Betfair Lay	PredictIt Buy	PredictIt Sell	HyperMind	HyperMind Bid	HyperMind Ask	Bookie Odds
Donald Trump	67 %	$ 0.615	$ 0.641	$ 0.637	43.0 %	1.62	1.63	$ 0.650	$ 0.660	$ 0.755	74	77	1.57
Ted Cruz	16 %	$ 0.159	$ 0.168	$ 0.200	16.8 %	6.20	6.40	$ 0.200	$ 0.210	$ 0.145	12	17	5.00
John Kasich	7 %	$ 0.072	$ 0.074	$ 0.067	7.3 %	13.00	15.00	$ 0.090	$ 0.100	$ 0.025	2	3	15.00
Marco Rubio	8 %	$ 0.079	$ 0.063	$ 0.077	18.8 %	12.50	13.00	$ 0.080	$ 0.090	$ 0.050	4	6	13.00
Mitt Romney	1 %	$ 0.010	$ 0.030	$ 0.020	N/A	80.00	140.00	$ 0.040	$ 0.050	$ 0.000	0	0	51.00
Paul Ryan	1 %	$ 0.017	$ 0.022	$ 0.020	N/A	50.00	75.00	$ 0.030	$ 0.040	$ 0.000	0	0	51.00

2016 President – Republican Nomination (Winner)

Donald Trump	67 %
Ted Cruz	16 %
Marco Rubio	8 %
John Kasich	8 %
Mitt Romney	1 %
Paul Ryan	1 %

PredictWise Last Updated 03-07-2016 9:24AM

Potential Candidate	PredictWise	Derived Market Price	Derived Polling Percent
Donald Trump	67 %	$0.615	43.0 %
Ted Cruz	16 %	$0.159	16.8 %
Marco Rubio	8 %	$0.079	18.8 %
John Kasich	8 %	$0.072	7.3 %
Mitt Romney	1 %	$0.010	
Paul Ryan	1 %	$0.017	

CORRECTING FOR PREDICTION MARKET BIAS

- Rothschild compares debiased polls and prediction markets

    - To debias polls, uses a refinement of the method described in Erikson and Wleizen (2008).

    - Debiased prediction market (2008 election data from Intrade) results by correcting for longshot bias

- Debiased prediction market values able to beat best poll based projections

    - Relative to debiased polls, perform better at dates far and near from election time (debiased polls are more accurate in the middle term due to prediction market biases being strong in this period)

    - Predicts close races with more confidence than debiased polls.

- Intrade investors already have polling data available, so the prediction market should be more accurate because there is outside information not being collected (Rothschild 913).

ONE MORE STUDY…

- 2012 study of Xbox users (Wang et al. 981)

  - Opt-in poll on xbox platform 45 days before the election

  - Asked who they would vote for (as well as demographic information).

- Xbox population is nothing like general election population!

  - Skews male, and overwhelmingly young

- Population of survey respondents post-stratified to reflect a presidential election population

  - To account for time bias, a more sophisticated version of projection than Erikson and Wleizen (2008) is done which includes nested state correlations (987).

- Compared to national results, xbox votes were very accurate

- Results also compared to an average of prediction markets at state-level.

GENERALLY DOES EXTREMELY WELL, ALTHOUGH MORE VOLATILE THAN PREDICTION MARKETS
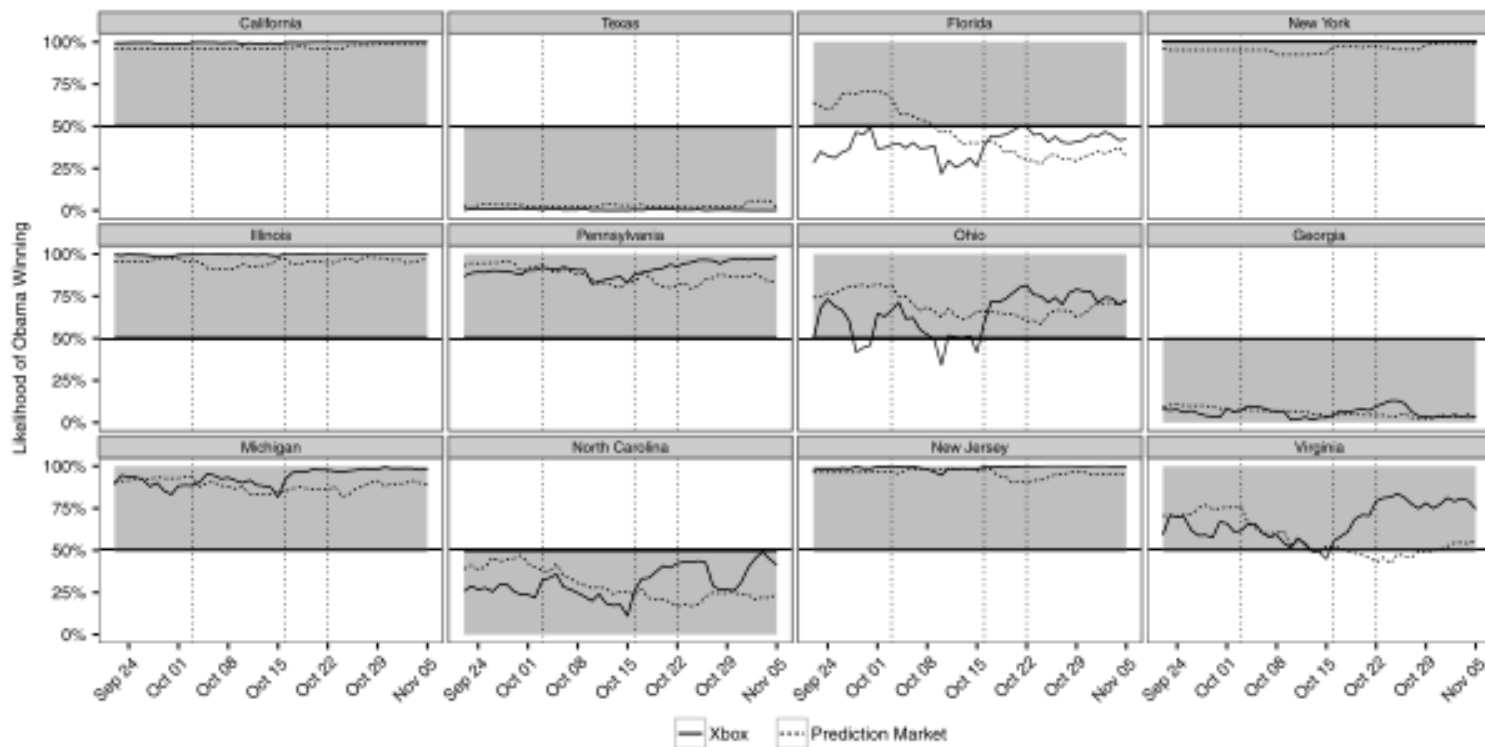

Fig. 8. Comparison between the probabilities of Obama winning the 12 largest Electoral College races based on Xbox and prediction market data. The prediction market data are the average of the raw Betfair and Intrade prices from winner-take-all markets. The three vertical lines represent the dates of the three presidential debates. The shaded halves indicate the direction in which race went.

INTERPRETING RESULTS

- Remarkable accuracy of results considering how non-representative the survey population was (Wang et al. 990).

- May be cost-effective solution for local races where polling is too expensive to perform

- Weakness: does require historical polling data to be able to transform non-representative data sets into representative ones.

THE FUTURE OF PREDICTION MARKETS

- Overall economists seem to believe that prediction markets are useful based on their relatively high rate of success in various fields.

    - If they are as successful as current research believes, it has wide implications for how we will gather and interpret data in the future

    - Still need more information and research to be done on the subject

    - Recommendation to FTFC to allow bigger bets to be filed – up to $2000 (Arrow et al. 878).

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QUESTIONS?