Prediction market

• A prediction market is a financial market that is designed for information aggregation and prediction
• Payoff of traded item is associated with observed outcome in future
Basic Idea

• Construct a contract on outcome $o \in \{0,1\}$
• Pay $1$ if Clinton elected ($o=1$), $0$ if Trump elected ($o=0$)

• Trader:
  – If belief $p = Pr(o=1)$, then value $p$ for contract
  – Buy if $p >$ price, sell if $p <$ price
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• Efficient market hypothesis: price converges to posterior given dispersed information

What are Pred. Markets Good For?

(Sanmay Das)

Info aggregation
Information dissemination

Will the global avg temp in 10 years be >.2C higher than today?
# Financial vs Prediction Markets

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<thead>
<tr>
<th>Primary use</th>
<th>Financial</th>
<th>Prediction</th>
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<tr>
<td>Capital allocation</td>
<td>Hedge risk</td>
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<th>(verification)</th>
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<td>elicit belief</td>
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<td>prediction market</td>
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Non-market alternatives

- Opinion poll
  - Sampling
  - No incentive to be truthful
  - Equally weighted information
  - Hard to be real-time
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- **Prediction Markets**
  - Self-selection
  - Monetary incentive
  - Money-weighted information
  - Real-time
  - Self-organizing
Example: Intrade market

Applications

• Intrade, Betfair, PredictIt (real money markets). Aggregated by Predictwise
• HP, Google: private markets for sales forecasts
• Iowa Electronic Market
• Gates-Hillman prediction market at CMU
• HSX prediction market movie box office
• InklingMarkets, ConsensusPoint
• https://www.crowdmed.com/

- Racetrack betting odds beat track experts (Figlewski 79)
- Orange juice futures improve weather forecast (Roll 84)
- IEM beat opinion polls 451/596 times (Berg 01, Pennock 02)
- HP prediction market beat internal sales forecasts 6/8 times (Plott 00)

Iowa Electronic Market 1992 Election

[Source: Berg, DARPA Workshop, 2002]
**IEM versus Polls: 1996**
(Berg, Nelson and Rietz, 2001)

[Graph showing predicted vs. actual winning margins for 1996 elections.]

Polls:
- A = ABC
- C = CBS
- N = NBC
- G = Gallup
- H = Harris
- T = Time
- L = Hotline
- P = CNN/Princeton
- Z = Zogby

Clinton/Dole

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**Predictive Accuracy**
Berg, Forsythe, Nelson and Rietz (2001)

[Graph showing predictive accuracy over actual outcomes.]

- US Presidential Elections
  - Avg. Abs. Err. = 1.37%
  - (5 Markets, 12 Contracts)
- Other US Elections
  - Avg. Abs. Err. = 3.43%
  - (14 Markets, 50 Contracts)
- Non-US Elections
  - Avg. Abs. Err. = 2.12%
  - (30 Markets, 175 Contracts)
Intrade Accuracy

- Predicted 49 of 50 states correctly in 2012
- Missed electoral college by total count of 1 in 2008
- Predicted 98 of 100 states correctly over 2004 and 2008

[Source: Wolfers & Zitzewitz 2004]
Does real money matter?

[Servan-Schreiber et. al. 2004]

Head to Head Comparison

- 2003 NFL Season
- Football prediction markets
  - NewsFutures (play $)
  - Tradesports (real $)
- Online football forecasting competition
  - probabilityfootball.com
  - Contestants assess probabilities for each game
  - Quadratic scoring rule
  - ~2,000 “experts”

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Results:

- Play money and real money performed similarly
  - 6th and 8th respectively
Prediction Markets: Basic Idea
(Y. Chen)

1. Turn an uncertain event of interest into a random variable
   - category 3 (or higher) hurricane make landfall in Florida in 2007? (Y/N) => 1/0 random var.

2. Create a financial contract, payoff = value of the random variable
   \[\begin{cases} 
   \$1 & \text{if category 3 (or higher) hurricane make landfall in Florida in 2007} \\
   \$0 & \text{otherwise} 
   \end{cases}\]

3. Open a market in the financial contract and attract traders to wager and speculate

Aggregate Information

- Price = prob “yes” given all information
Different Kinds of Contracts

• Binary (“Clinton” or “Trump”)
• Winner-take all ($1 if HC)

• If outcome is multi-valued (“Tump” or “Rubio” or “Cruz”), then need multiple contracts.
• $1 if DT. $1 if MR. $1 if TC.
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• Continuous (vote share)
• Index (pay $1 * vote share)

Different Kinds of Markets

• Call market
• Continuous Double Auction (CDA)
  – Intrade
  – Betfair
  – HSX
• Automated Market Maker (LMSR)
  – InklingMarkets
  – Crowdcast
  – CrowdMed