Electronic Marketplaces
Oct. 13, 2011
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Four Things
I. Prediction Market Basics
2. Automated Market Making
3. Applications to Finance
4. Some Project Ideas
1. What’s a Prediction Market?
Barack Obama to be re-elected President in 2012

Last prediction was: $4.99 / share

Today’s Change: ▼ -$0.01 (-0.4%) 49.9% CHANCE

Event: 2012 Presidential Election Winner (Individual) (Open to Suggestions)

Intrade
<table>
<thead>
<tr>
<th>Question</th>
<th>Chances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Will the feasibility analysis show the new system can be built for less than $650/unit?</td>
<td>26%</td>
</tr>
<tr>
<td>Which new prototype will get the highest score in quality testing?</td>
<td>22%</td>
</tr>
<tr>
<td>Will research project X make it in to a product line by 2012?</td>
<td>89%</td>
</tr>
</tbody>
</table>
Payouts: Binary and Linear
Think about Traders
The Fallacy of Rational Traders
Zero-Intelligence Modeling
Gode + Sunder ’93
It has no intelligence, does not seek or maximize profits, and does not observe, remember, or learn.
The Simple Static Model
Epsilon-Tweak Model
The same, attractive equilibrium
Traders in Practice
Gates Hillman
Prediction Market
IAR vs. Rank
Conclusions about Traders
2. Automated Market Making
1. Not enough volume
Intrade Higgs Boson
2. Market too large
(huh?)
When does the market clear?
No trade and NP-hard
You selected between October 4th and December 1st, and you’re risking 2.76 tickets.

<table>
<thead>
<tr>
<th>Bet Against:</th>
<th>Bet For:</th>
</tr>
</thead>
<tbody>
<tr>
<td>if the GHC does not open in this span, you make <strong>3.46 tickets.</strong></td>
<td>if the GHC does open in this span, you make <strong>11.33 tickets.</strong> Take this bet if you think the GHC has more than a <strong>24.4%</strong> chance of opening in this span.</td>
</tr>
<tr>
<td>Take this bet if you think the GHC has less than a <strong>20.3%</strong> chance of opening in this span.</td>
<td></td>
</tr>
</tbody>
</table>

w/ Automated MM
3. Run lots of markets on obscure events
Robots: Cheaper than people
Case Study: LMSR
Cost function based market maker
Payout Vector
To go from $x$ to $y$, pay

$C(y) - C(x)$
$C(\mathbf{x}) = b \log \sum \exp(\mathbf{x}_i / b)$
Red Sox - Yankees
(5,3) \rightarrow (6,3)
b=10
\( C(y) - C(x) = 0.562 \)
Bounded Loss
$b \log n$
Contrast with fixed prices
Marginal Prices
Prices change instantaneously as bets are made
\[ p_i = \frac{\exp(x_i/b)}{\sum \exp(x_j/b)} \]
Form a probability distribution!
No-regret online learning
Weighted Majority
My research
How to add in profit, depth, ...
Latest result has four properties
1. Bounded loss
2. Can make a profit
3. Zero bid/ask spread
(in the limit)
4. Unbounded depth (in the limit)
These are hard conditions to mutually satisfy
3. Applications to Finance
Operationalizing
Risk Measures
Finance was here first
AI is here better
Sharpe, VAR, Others
Example
Sharpe $\frac{\mu}{\sigma}$
Risk measure view
Given a set of candidate strategies
...the best is the one with highest Sharpe
Automated trader view
Given the chance to make a trade
...do it if it increases your Sharpe
What does this look like in practice?
Step back
Risk measures are trading agents
Famous risk measures suck
Famous risk measures suck as trading agents
Make better trading agents
Make better risk measures
4. Final Project Ideas
1. Improve Predictalot
2. Dig through my GHPM data
3. Simulate different market makers vs. the same agents...