What’s the difference between markets and merchants?

<table>
<thead>
<tr>
<th>Market</th>
<th>Merchant</th>
</tr>
</thead>
<tbody>
<tr>
<td>mechanism for:</td>
<td>provides goods</td>
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<tr>
<td>pricing</td>
<td>provides services</td>
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<tr>
<td>reputation</td>
<td>sets prices</td>
</tr>
<tr>
<td>matching</td>
<td></td>
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</tbody>
</table>

Examples of markets: eBay, NYSE, Google (sponsored search, ads)

Types of markets

- Sponsored Search/Advertising (e.g. Google)
  * auctions
  * targeting
- Peer to Peer (e.g. eBay)
  * reputation (of the sellers)
  * pricing
- Amazon (which is also a merchant)
  * reputation of the product

In all of these mechanisms somehow aggregate/synthesize knowledge of its users into quality information. Now let’s consider a new type of market, a prediction market.

Prediction Markets

- Aggregates human knowledge to predict the outcome of particular events
  * Leveraging the “wisdom of the crowd”
  * Galton’s Ox

Simple prediction market:
The “event” in question must have a well-defined binary outcome (for our simply analysis), e.g. answers to a question like “Will Obama win the 2012 presidential election?”

Let’s consider that question, “Will Obama win?” Possible outcomes are “Yes” and “No”

* Assume that the prediction market does not affect the outcome of the proposition
* There are \( N \) individuals participating in the market
* Individual \( i \)’s belief is that \( p_i \) is the probability of ”Yes” (Obama wins)

Design the prediction market:

- Initially: Every individual pays $1 to the market maker and gets one “Yes” share and one “No” share.
- Finally: When the outcome is known, if the outcome is “Yes” ("No") then every “Yes” (“No”) share earns $1.
- Notice that the when market-maker gives out the \( 2N \) shares he earns a revenue of \( $N \), and he must pay out \( $N \) when an outcome is realized, i.e., there’s no risk for the market-maker. Likewise, a participant could simply hold both his “Yes” and “No” share and earn back his $1 without risk.
- **Interim:** Shares get traded on a “stock exchange”

Details of this “stock exchange”

- \( C_y \) = price at which a “Yes” share is traded
- \( C_n \) = price at which a “No” share is traded
- Notice that if \( C_y + C_n \neq 1 \) there is an arbitrage opportunity.
- Assume no arbitrage and therefore assume \( C_y + C_n = 1 \)
- Again, assume that there are \( N \) individuals, and \( p_i = i^{th} \) individual’s probability estimate of a “Yes” outcome.
- Assume that every individual can hold at most 2 shares

\[
\Rightarrow (# \text{ of individuals } i \text{ with } p_i > C_y) \geq \frac{N}{2} \\
\Rightarrow (# \text{ of individuals } i \text{ with } p_i < C_y) \geq \frac{N}{2}
\]

Conclusion: \( C_y \) is the median of the \( p_i \)

The predictions (using the \( C_y/\text{median } p_i \)) of prediction markets are consistently better predictors of events than polling.

Other uses?

- Could use prediction market to decide if a product will succeed/fail
  * Ask not: “Would you buy this product?”, but ask “Do you think this product will succeed?” Of course this needs to be in the context of a prediction market with proper incentives.

What’s the next application with prediction market?

* That’s where you come in!!!
IEM

*dog enters the classroom, sits next to Ashish*

ESP Game

* Randomly paired players earn points if they describe a given photo with the same words as their partner (w/o communicating)
* In a sense, each player is trying to predict what the other player will say
* Result: very accurate photo tagging

Mechanical Turk

* Can pay for others to do “human intelligence tasks”, e.g., translate this paragraph, describe this product
* Issue: how to make sure the “providers” give quality response?
* Solution: give the same task to 2 “providers”, only pay them if they give the same response. Twice the price, but assured of quality

Potential nefarious uses: auto-generate Gmail (or other) accounts (as a spammer might), etc., by paying “providers” to resolve CAPTCHAs

• Whole idea is to design market so that, given the incentives, what people naturally choose to do is in line with the goals of the market