Conditional Markets

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Predicting a War

$\text{P}(W)$

$\text{P}(\text{not } W)$

$1$

$\$1$ if War$

$\$1$ if No War$

$1$
Predicting War & Troop Move

$1 if Move Troops

$1 if War & Move Troops

$1 if No War & Move Troops

$1 if No War & Not Move Troops

$1 if War & Not Move Troops
Troop Move Decision Advice

- $1 if War & Move Troops
- $1 if War & Not Move Troops
- $1 if Not Move Troops
- $1 if Move Troops

Compare!

- $P(M)$
- $P(\text{not } M)$
- $P(W \mid M)$
- $P(W \mid \text{not } M)$
Markets Can Estimate $E(O|D)$

**Decisions**
- Move US troops
- Dump CEO
- Who US president
- FED raise rates

**Outcomes**
- War deaths
- Stock price
- GDP per capita
- Unemployment
Potential Problems

- Discuss in this talk
  - Decision selection bias
  - Incentives to bias
  - Thin markets

- Some other talk
  - Moral hazard
  - Regulation
  - Secrecy
  - Bozos

- Reduce info sharing
- Rich more “votes”
- Risk distortion
- Bubbles
Decision Selection Bias

- If traders think deciders will use info traders do not have, conditional market price advice may contradict trader info
- Related to “Newcomb’s Problem” in decision theory
A Decision State Space

Imagine a uniform distribution over this area. Expected value over distribution is center of mass.想象一个均匀分布在这区域。分布上的期望值是中心。
If No Selection Bias

- Better to dump Market prices here if decision not correlated with state

Stock if keep CEO

Stock if dump CEO
Well-Informed Deciders

Stock if keep CEO

Stock if dump CEO

Apparent center

Keep

Dump

True center
Problem Seems Uncommon
Avoiding Selection Bias

- Problem scenarios seem rare, but ...
- Let decision makers, advisors, trade
- Make decision time clear to traders
  - Use prices just before decision time
Desires to Bias

- Can interested parties “buy” a favorable decision via trades?
  - Decision gains might outweigh trade losses
Market Microstructure Models

- **Traders Types**
  - Uninformed
  - Informed
  - Noise
  - Liquidity
  - Bias

- **Order of events**
  - All but uninformed traders choose order amount
  - Uninformed see only total order (per group)
  - Uninformed set price to expected asset value

- **With private Info on**
  - Nothing
  - Asset value
  - Next random act
  - New risk to hedge
  - New desire to bias
A Graphical Model of Bias

Private Info on Asset Value

Joint distribution of private info

No desire to bias

Higher than expected

Expected value

Lower than expected

Want lower price

Want higher price

Private Info on Desire to Bias
Simple Bias Equilibrium

Private Info on Asset Value

Private Info on Desire to Bias

Counter-balanced by an anti-bias example

Price should vary with net orders

Assume net orders monotone in asset info

+ bias desire × price effect

Then this is how price should vary with net orders

An example of successful bias

Assume net orders monotone in asset info

+ bias desire × price effect
Baseline: No Bias Desire

Private Info on Asset Value

Private Info on Desire to Bias
If Bias Known, Has No Effect

Private Info on Asset Value

Private Info on Desire to Bias
Strong Correlation, Low Effect

Private Info on Asset Value

Private Info on Desire to Bias
If No Value Info, No Effect

Private Info on Asset Value

Private Info on Desire to Bias
Neg. Correlation, Less Info

Private Info on Asset Value

Private Info on Desire to Bias
Bias Model Implications

- For any group can discern net trades
- Desire to bias has no effect if either
  - Known aggregate bias desire level, or
  - Known group has no info on asset value
- Mixed value/bias info hurts accuracy
  - But adds liquidity, attracts speculators!
- Better to ensure can discern group net trades, than to ban group from trading
Thin Market Problem

- For N events, \( \sim N^2 \) possible conditionals
- To trade, must *coordinate* assets, time
  - Waiting offers suffer adverse selection
  - Call markets, combo match, help, but ...
- Few possible info markets exist
  - Most illegal, but for most of the rest, expect few traders, so don’t bother to make offer
- *If known that only one person has info on topic, simple info market won’t reveal*
Market Scoring Rules (MSRs)

- Proper scoring rule elicits your $p = \{p_i\}_i$
  - if report $r$, state is $i$, paid $s_i(r)$ [e.g., $= \log(r_i)$]
  - if risk-neutral, state-indep. utility, $r = p$
- MSRs let anyone change a shared $p$
  
  “A scoring rule anyone can use at any time, if they agree to pay off the last user”

- User $t$ paid $s_i(p^t) - s_i(p^{t-1})$
- If disagree with $p$, expect to gain if correct
- Gain if $i$ where $p_i \uparrow$, lose if $i$ where $p_i \downarrow$
MSR is Auto Market Maker

- \( p_i(s) \) gives 0-spread price on any asset
  \[ x = \{ x_i \text{ if } i \} \]

- Net sales \( s = \{ s_i \} \), if sell \( s_i \) of \$1 if \( i \)

- If \( x_i \) tiny, price of \( x \) is \( \sum_i x_i p_i(s) \)

- If \( x_i \) big, integrate over changing \( s \)

- Log MSR: \( \rho_i(s) = \exp(\lambda s_i) / \sum_k \exp(\lambda s_k) \)

  - Cost/subsidy bounded, goes as number of variables, when \( i = (v_1, v_2, v_3, \ldots) \)
Summary

- Conditional info markets can advise decisions, but have potential problems.
- Decision selection bias avoided by letting insiders trade, making decision time clear.
- Desire to bias can reduce accuracy of info source, but produces no net bias.
- Liquidity for all possible state-dependent assets provided by market scoring rules.