

Information Aggregation Mechanism and Market-Based Forecast Combination

Discussion of Chen and Plott (2002)

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Roadmap

- Summary of the paper
 - ▶ Mechanism
 - ▶ Results
- Compare to Gillen, Plott, and Shum (2014)
- Open questions

Background

- Forecast Combination
 - ▶ Model-based: variance-covariance, regression
 - ▶ Survey-based
 - ▶ Market-based
- More info -> better forecast: Wisdom of the crowds!

Summary

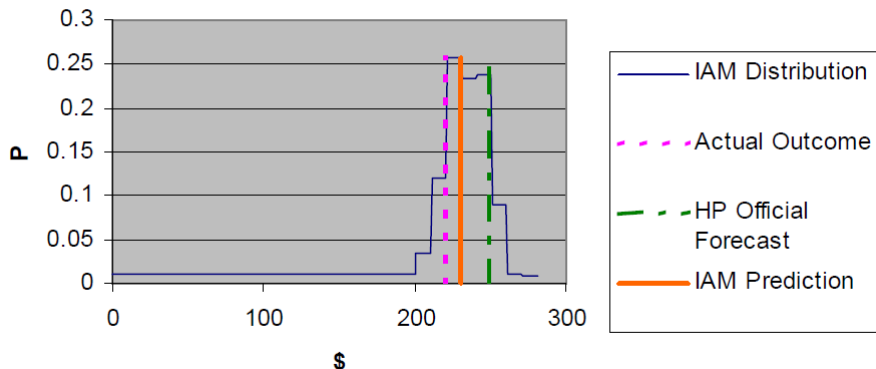
Mechanism

- Instrument
 - ▶ single compound security vs **multiple A-D state-contingent securities**
 - ▶ complete market
- Market
 - ▶ double auction
 - ▶ complete info
- Participants
 - ▶ mainly insiders + a few uninformed lab subjects
 - ▶ insiders: reduce self-selection bias and noise trading
 - ▶ lab subjects: market liquidity and consistency
- Typically, forecast monthly sale three months ahead
- Last for 1 week, market open during lunch and evening

Summary

RESULT 1: Market predictions based on IAM prices outperformed official HP forecasts.

Event 2



Summary

RESULT 2: The probability distributions calculated from market prices are consistent with actual outcomes.

- Difficulties in evaluating density forecast
 - ▶ the true distribution is not observable, even ex-post
 - ▶ need to pool different forecasts together which are heterogeneous in nature
- Probability integral transformation
 - ▶ true distribution of Y_t : $f(y_t)$
 - ▶ density forecast of Y_t : $\hat{f}(y_t)$
 - ▶ cdf of density forecast:

$$z_t = \int_{-\infty}^{y_t} \hat{f}(\tilde{y}_t) d\tilde{y}_t = \hat{F}(y_t) \sim \frac{f(\hat{F}^{-1}(z_t))}{\hat{f}(\hat{F}^{-1}(z_t))}$$

$$z_t \sim \text{iid } U[0, 1], \text{ if } \hat{f}(\cdot) = f(\cdot)$$

- K-S test:
 - ▶ test $U[0, 1]$ under the assumption of *iid*
 - ▶ across the 12 events

Summary

RESULT 3: The IAM makes accurate qualitative predictions about the direction that the actual outcome will occur (above or below) relative to the official forecast.

Event	Cumulative Probability at Official Forecast	Prediction	Official Forecast	Outcome
1	None	N/A	None	N/A
2	86.50%	down	249	220
3	53.79%	down	1838	1152
4	35.62%	up	1681	1840
5	37.46%	Up	1501	2210
6	40.70%	Up	90	128
7	76.33%	down	2084	2002
8	42.92%	Up	1786	1788
9	26.49%	Up	119	166
10	None	N/A	None	N/A
11	None	N/A	None	N/A
12	None	N/A	None	N/A

Compare to Gillen, Plott, and Shum (2014)

- Gillen, Plott, and Shum (2014):
 - ▶ Parimutuel-like betting mechanism
 - ▶ combine density forecasts
- Chen and Plott (2002) potentially combine density forecasts too

Compare to Gillen, Plott, and Shum (2014)

- Market
 - ▶ CP-2002: complete market
 - ▶ GPS-2014: incomplete market as people cannot retrieve the tickets once they have been placed
- Duration
 - ▶ CP-2002: 1 week, potentially more info
 - ▶ GPS-2014: 30 mins, more efficient
- Money
 - ▶ CP-2002: real money, more incentive
 - ▶ GPS-2014: fake money (tickets), reduce risk aversion (but promote risk seeking?)

Open Questions

1. Density forecast evaluation

- Probability integral transformation
 - ▶ true distribution of Y_t : $f(y_t)$
 - ▶ density forecast of Y_t : $\hat{f}(y_t)$
 - ▶ cdf of density forecast:

$$z_t = \int_{-\infty}^{y_t} \hat{f}(\tilde{y}_t) d\tilde{y}_t = \hat{F}(y_t)$$
$$\sim \frac{f(\hat{F}^{-1}(z_t))}{\hat{f}(\hat{F}^{-1}(z_t))}$$
$$z_t \sim \text{iid } U[0, 1], \text{ if } \hat{f}(\cdot) = f(\cdot)$$

- K-S test: test $U[0, 1]$ under the assumption of *iid*
- Test *iid*? But the sample is too small... (12 events)

Open Questions

2. Number of active participants

- Around 20 for each event
 - ▶ too small for efficient market?
 - ▶ may lead to some strange observations: e.g. existence of arbitrage profits
- Mainly insiders + a few uninformed lab subjects. Maybe someone in between would help too?
 - ▶ like other employees in HP
 - ▶ more independent info set, wisdom of the crowds?
 - ▶ optimal signal-noise ratio to reduce bubbles and herd behavior?
 - ★ survey-based vs market-based forecast combination

3. Time path over longer period

- May shed light on how people form and shift their beliefs
- But “No significant trends in the sequences of predictions are observed. One speculation is that information aggregation occurred fairly early.”

4. Observation: “the sum of the prices was always above the winning payoff”

- Market is not efficient due to too few participants?
- Non-rational - risk seeking behavior?