Toward an understanding of price movements in betting markets: Profitable trading against the herd

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Efficient Market Hypothesis

Markets for speculative assets always fully incorporate relevant information in prices.

Herding

Participants neglect private info, adjust actions—more representative of previous price movements.

Effect

Price volatility in excess of variations in fundamental information—Bubbles, crashes and bank runs.
Herding in financial markets
No conclusive evidence  (e.g. Sias 2004)

Herding in the Lab
Mixed results
  e.g., Cipriani & Quarino, 2005; Spiwoks et al., 2008)
Using betting markets to examine herding

- Subjective judgments revealed as odds
- Share characteristics with other financial markets (e.g., many, complex, inter-dependent factors influence asset prices)
- Ease of entry, many participants, access to info
- An unequivocal outcome in finite time frame
- Several thousand markets per annum
- Advances over lab-based study: dynamic real-world environ, time stress, experts/familiarity
Our belief

Herding is far more common in markets than previous studies have been able to show and leads to inefficiency
Hypotheses 1

Volatility: Increased volatility in market prices results in increased efficiency of market prices.
Hypotheses 2

Bettors know that informed bettors bet late: to protect information (Asch et al., 1982) to reduce transaction costs (bid–ask higher in early market) capture liquidity

**Herding Prevalence:** Bettors display herding behavior, but to a greater extent in the later stages of the market than in earlier stages.
Hypotheses 3

Betting exchanges facilitate the practice of laying ‘known losers’: horses which are deliberately pulled up or are not allowed to run on their own merits (Arginson, 2010)

Laying: Bettors herd to a greater extent on ‘sell’ (lay) signals than ‘buy’ (back) signals.
Inefficiency: Herding presents an inefficiency, such that it is possible to make positive returns by betting against those who herd.
Data

Betfair odds on 62,124 horses, 6058 UK races, 2009/10

Odds at 1 minutes intervals from 9am to races start (8,500,000 data points)

Segments: (i) 9am–race start (i) 30min prior– start (i i) 15min prior– start (i i) 30min prior– 15 min prior

Training races (first 75%), holdout races (last 25%)
Testing Volatility/Efficiency Hypothesis

\[ p_{ij} = \frac{\exp(\lambda \ln(p_{ij}^s))}{\sum_{i=1}^{n_j} (\lambda \ln(p_{ij}^s))} \]

Distribution of the pseudo-\(R^2\) for high and low volatility sets using a bootstrap methods

High/low volatility races different efficiency levels?

\[ z = \frac{\mu(R_H^2) - \mu(R_L^2)}{\sqrt{s^2(R_H^2) - s^2(R_L^2)}} \]
R^2 High Vol: 0.2014, Low vol: 0.1701, z = 3.33, p < 0.001
Herding Prevalence Hypothesis – Results

**Segment 1: whole betting period**
Large odds movements do not result in odds-implied probs differing from true winning probabilities, i.e. herding behavior is not apparent.

**Segments 2 & 3: Last 30 mins; Last 15 mins**
Large odds movements in the later stages do cause odds-implied probs to differ from true-winning probabilities, but only where odds increase, i.e., bettors herd on increasing odds, not on decreasing odds.

**Segment 4: 30–15 mins from start**
Opposite effect, i.e., bettors herd on decreasing odds but not on increasing odds.
Hypothesis 4: Herding presents an inefficiency

\[ p_{ij} = \frac{\exp \left( f_{3+} (\mu_3^+)_{ij} + f_{4-} (\mu_4^-)_{ij} + \lambda \ln(p_{ij}^s) \right)}{\sum_{i=1}^{n_j} \exp \left( f_{3+} (\mu_3^+)_{ij} + f_{4-} (\mu_4^-) + \lambda \ln(p_{ij}^s) \right)} \]

Betting strategy:

**Kelly assigns bet sizes** \( f_i \) **over all** \( n \) **horses in race**
**to max the log of expected wealth after the race**

**Kelly max asymptotic rate of growth of wealth**
Betting Results

Level stakes
Proportional stakes
Full Kelly
Half Kelly

log(cumulative wealth)

Races bet on
Volatility

Volatile mkts are more efficient—contrast with FM lit (eg Shiller)

Corrections can occur when economies under stress (Kaminsky, 1999)

Volatility in betting mkts:

Introducing informed/insider traders to inefficient mkt—efficiency & volatility.
Noisier traders with no info-based reason to trade volatility.
Also & liquidity ..attracting informed traders & efficiency.
Conclusions

Increased volatility associated with higher efficiency.

Bettors herd, but only under certain conditions.

More herding than empirical studies in financial markets suggest.

Interplay of informed and less informed activity results in largely efficient market.

However, significant profits are possible from trading on herding behaviour.
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