

# Herd Behavior in Financial Markets: A Field Experiment with Financial Market Professional

Very Preliminary and Incomplete

# Transaction Costs and Informational Cascades in Financial Markets: Theory and Experimental Evidence

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# HERDING

## *Informational herding:*

✓ rational agents disregard private information  
(and imitate)

# Motivations

- In recent years: increasing interest in herd behavior in financial markets.

Banerjee 1992, QJE

Bikhchandani, Hirshleifer, Welch 1992, JPE

Avery and Zemsky, AER 1998

Lee, RES, 1998

Cipriani and Guarino, 2003

- Empirical analyses

Lakonishok, Shleifer and Vishny, JFE, 1992.

Wermers, JF, 1999.

- It is difficult to test models of herd behavior empirically:

*lack of data on traders' private information*

- In an experimental study we have data not available in empirical analyses.

# Experimental Literature

## **Experimental work:**

Anderson and Holt, AER 1996.

Kariv and Celen, AER, 2004

Cipriani and Guarino, AER 2005.

Drehmann, Oechssler and Rider, AER 2005.

## **Field Experiments:**

Alevy et. al, JoF, 2006

# A Sketch of the Model

- One asset economy.

Asset's fundamental value  $V$ .

- Agents.

Infinite number of traders and one market maker.

- Sequential trade.

$T$  periods of trade

At each time  $t$  one trader is randomly chosen to trade with the market maker.

## *The Traders*

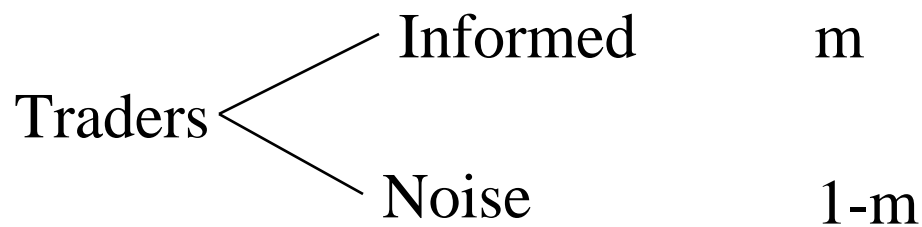
- Any trader trades at most once. He can buy, sell or not trade one unit of the asset.

- Traders and market maker observe the history of past trades:

$$H^t = \{ \dots h^1, h^2, \dots h^{t-1} \},$$

where  $h^t = \{ \text{BUY, SELL, NO TRADE} \}$

# *Informed and Noise Traders*



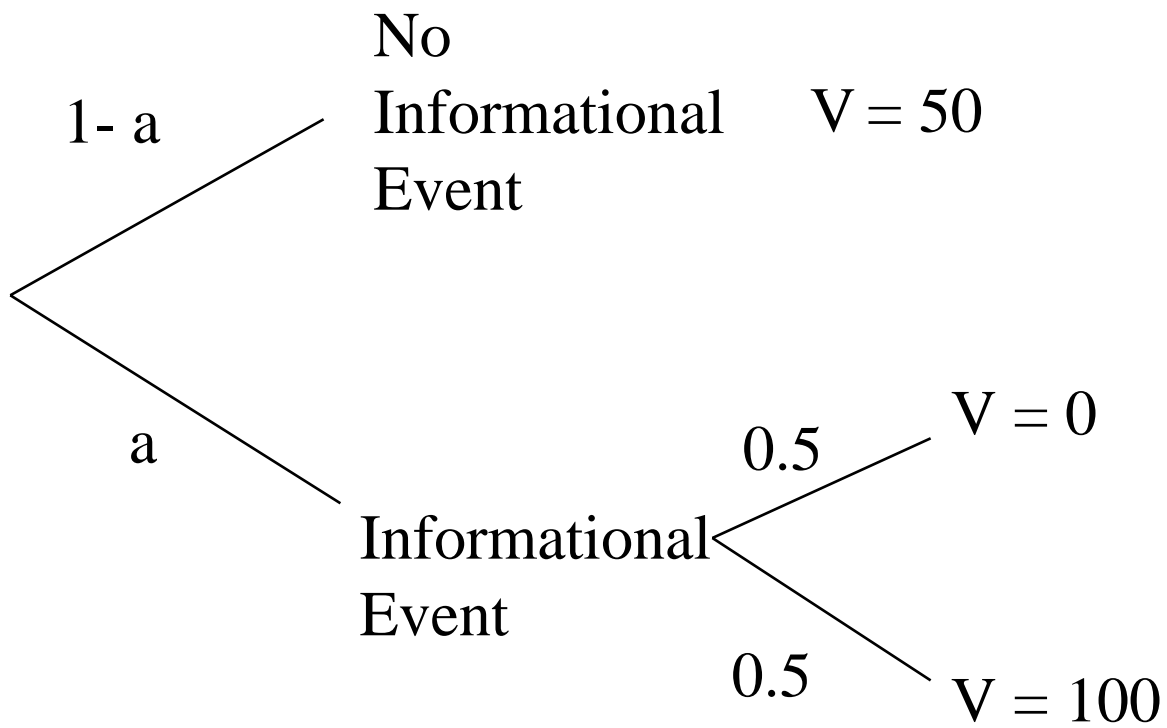
- Informed traders receive private information and trade to **maximize expected profits**.
- Noise traders act **for exogenous reasons**, without regard for expected profits.
  - They are assumed buy, sell or no trade with fixed probabilities.

## *The Market Maker*

- The traders exchange the asset with a market maker.
- The market maker sets the price at which the asset is exchanged.
- He sets only one price

$$P_t = E [V | H_t]$$

# *Information Event*



# *Informational Uncertainty*

- No information event: **only noise traders.**
- Information event: **both informed and noise traders.**

**if  $a < 1$**

- ✓ The market maker does not know whether an information event has occurred.
- ✓ He does not know whether there are informed traders in the market.

# *The Signal*

✓ Symmetric binary signal with precision 0.7.

$$X = \{x^L, x^H\}$$

$$\Pr(x^L|V=0) = \Pr(x^H|V=100) = 0.7$$

# Herd Behavior

There is herd behavior when **all informed traders choose the same action** (independently of their private information).

**Result I:** When  $a=1$  (no event uncertainty), herd behavior never arises.

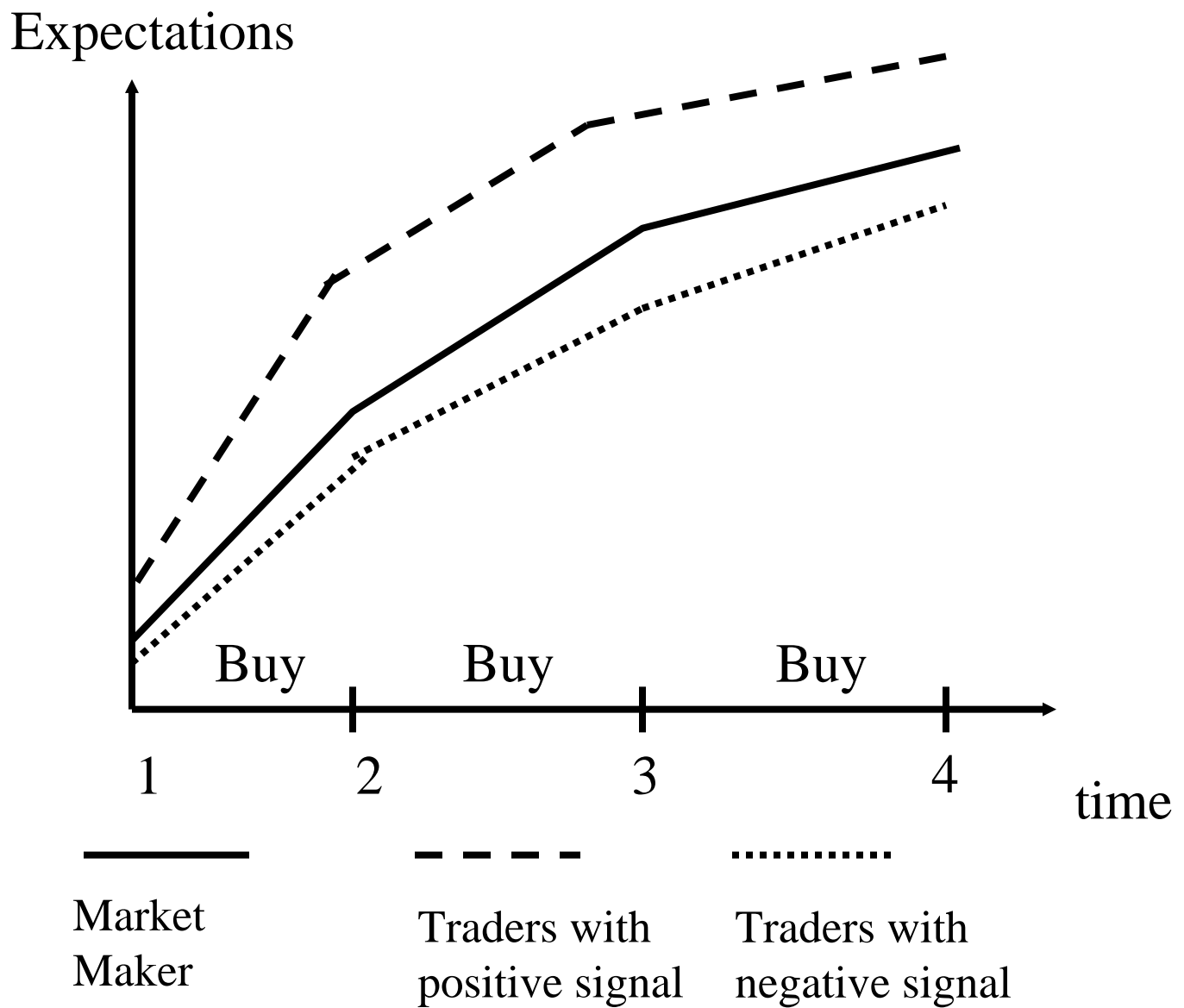
**Result II:** When  $a<1$  (event uncertainty), herd behavior arises with positive probability.

# Intuition

- ✓ Let's assume that a series of buys arrive to the market.
- ✓ We compute the expectations of the market maker, informed traders with a high signal and informed traders with a low signal.

# No Event Uncertainty

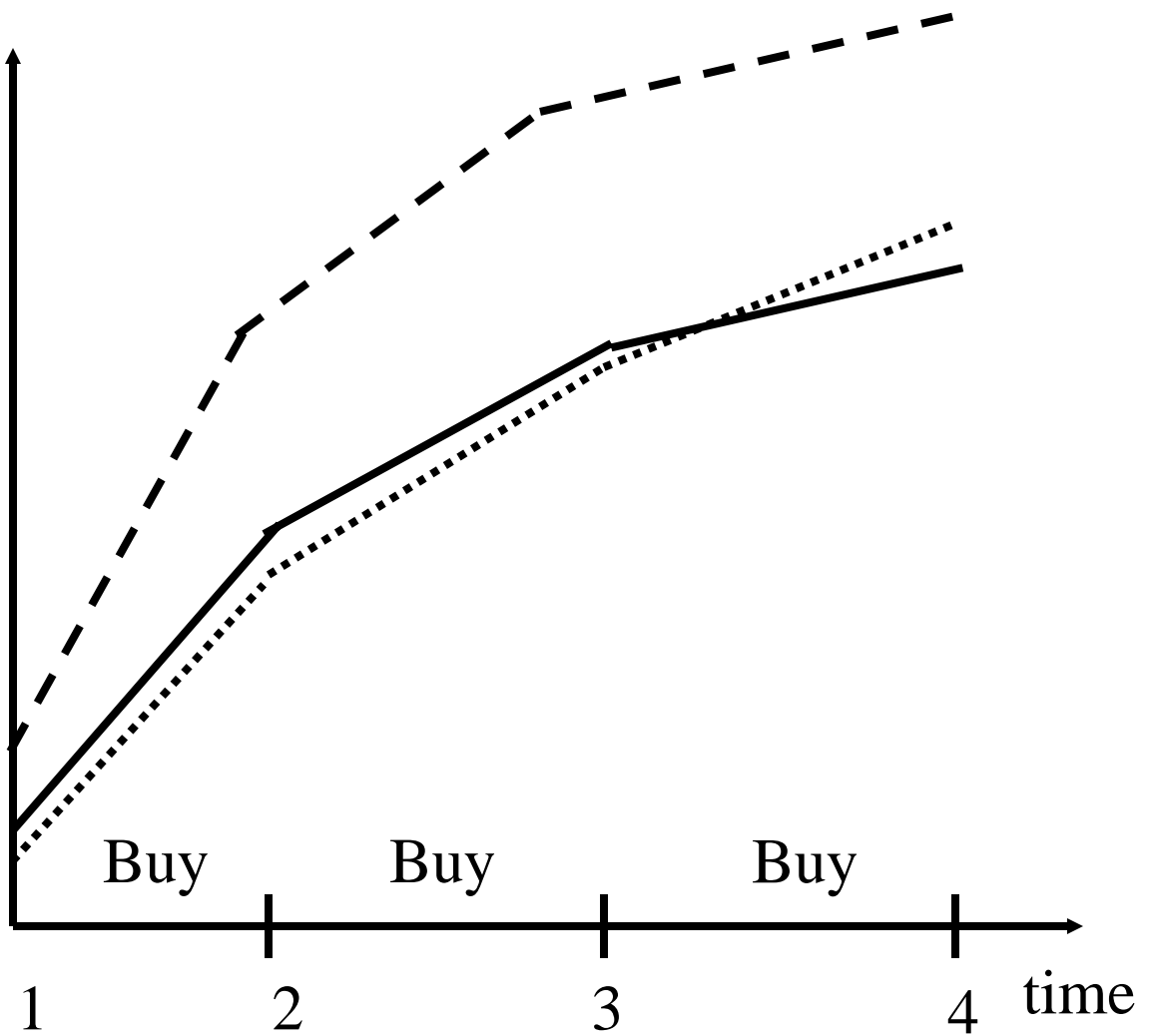
$$\underline{a=1}$$



# Information Uncertainty

$$\underline{a < 1}$$

Expectations



—————  
Market  
Maker

- - - - -  
Traders with  
positive signal

.....  
Traders with  
negative signal

# The Experiment

- 2 Treatments.
- 4 sessions
- 7 rounds for Treatment 1; then 7 rounds for Treatment 2.
- 2 pilot rounds at the beginning of each session (whose results we do not report.)
- 8 subjects per session.
- Subject trade with a computer, that acts a Market Maker.

# *Experimental Design*

## **2 Treatments:**

### 1) No Information Event Treatment

$$a=1$$

$$m=1$$

The market maker updated the price knowing all traders were informed.

### 2) Information Event Treatment

$$a=0.15$$

$$m=0.95$$

The market maker updates the price knowing that with high probability he faces uninformed traders.

# Participants

Participants were financial market professionals working in London.

32 participants

Av Tenure	4y
% Males	84%
% Ph.D.	8%
% MA/MS	62%
% BA/BS	30

% Traders	28%
% Analysts	42%
% Sales	6%
% Other	25%

## *Procedures for each round*

- At time 1, all 8 participants posted two orders one conditional on receiving a signal and one conditional on receiving a low signal.
  - E.g., buy if high; sell if low
- The order could be BUY or NT or SELL
- They knew the price.
- The computer randomly chose one of the 8 subjects as the first trader;
- The computer drew a signal for the subject a his chosen action was executed.
- The other traders did not know the identity of the first trader; they could only see the order executed on the screen;

## *Procedures*

- After the first trade the price was updated;
- At time 2, the 7 remaining subjects watched this price and the previous trade and posted again an order conditional on both signals;
- Another trader was randomly chosen and so on, until all participants had traded just once.
- Finally, the asset value was revealed and participants knew their payoff;

## *The Payoff*

### Per round payoff:

➤ Buy:  $V-P$

➤ Sell:  $P-V$

➤ No trade:  $0$

- Payoffs were in fictitious currency and converted into £ at the end of the experiment.

- Average payment: £135

## *Treatment 1*

Decision	
Following Private Information	45.7%
Partially Following Private information	19.6%
Cascade Trading Behavior	19.0%
Cascade No-Trading Behavior	12.3%

Average behavior in Treatment I.

## *Cascade Behavior in Treatment 1*

Absolute Value of the Trade Imbalance	Cascade Trading	Herd	Contrarianism
0	5.8%		
1	18.5%	5.7%	12.9%
2	42.7%	16.1%	26.6%
3	54.3%	23.9%	30.4%
$\geq 4$	62.5%	21.9%	40.6%

Cascade trading behavior in Treatment 1.

# *Individual Herding Behavior in Treatment 1*

Percentage of herd decisions	Percentage of Subjects
0	70
1 – 20	7
21 – 40	7
41 – 60	0
61 – 80	3
81 – 100	13

Percentage of herding decisions at individual level for a trade imbalance of at least 2 in Treatment I.

## *Treatment 2*

Decision	
Following Private Information	50.9%
Partially Following Private information	20.1%
Cascade Trading Behavior	12.0%
Cascade No-Trading Behavior	16.5%
Inconsistent Behavior	0.05%
Total	100.0%

Average behavior in Treatment II.

➤ **48% of Rational Trades**

## *Cascade Behavior in Treatment 2*

Absolute Value of Trade Imbalance	Herd	Contrarianism
0		2.2%
1	4.4%	3.8%
2	18.4%	4.6%
3	30.3%	4.0%
$\geq 4$	40.4%	0.0%

Cascade trading behavior in Treatment II.

# *Individual Behavior Regression*

	Rationality	Payoff
Gender	No	No
Age	Yes	No
Tenure	Yes	No
Education	No	No
Trader Dummy	No	Yes

Regression on Individual behavior (e.g., % of rational action) versus individual characteristics (e.g., sex). Standard error corrected for cluster effects. Significance level: 0.05.

# What Happens if Trade is Costly?

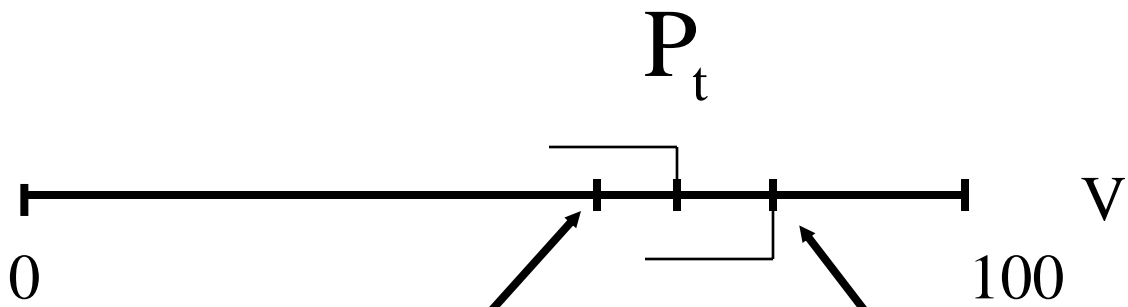
## Transaction Costs and Informational Cascades in Financial Markets: Theory and Experimental Evidence

- Because of trade costs.
- Because of a tax on securities transactions (e.g., like the Tobin tax).

Theory predicts that:

- No-trade Informational cascades arise.
- The price may not be able to aggregate information dispersed across market participants.

## *A Heuristic Argument*



Expected value of  
a trader with a  
negative signal.

$$P_t - t < E_t$$

Expected value of  
a trader with a  
positive signal.

$$E_t - t < P_t$$

# Implementation

- ✓ All parameters are the same as in our first treatment.
- ✓ No financial market professionals.
- ✓ Trade cost  $t=9$ .

## *Cascades and Trade Costs*

	Flexible Price	Trade Cost	
Following	65%	43%	
No Trade	22%	51%	79%
			21%
Not Following	13%	6%	

- 79% of the no trade decisions were made when the theory predicts that a rational agent should not trade.

## *No Trade and Trade Imbalance*

Trade Imbalance	No Trades
0-1	21%
2-3	67%
>3	78%

Proportion of no-trade decisions for different levels of the absolute value of the trade imbalance

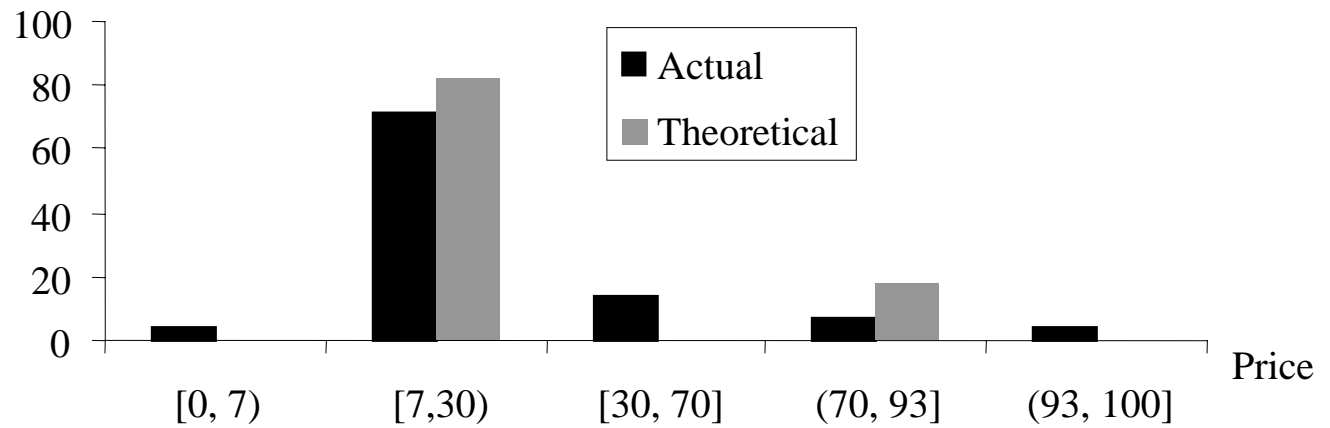
**Table 4: No Trade Cascades**

Session I												
IV	S	B	B	B	S	S	B	B	S	B	S	S
V	NT	S	S	NT	NT	B	S	B	S	B	B	B
VI	B	B	NT	S	S	NT	B	B	NT	NT	B	NT
VII	B	B	B	NT	NT	NT	NT	NT	NT	NT	NT	NT
VIII	B	NT	B	B	B	S	S	NT	B	NT	NT	S
IX	NT	B	S	B	B	S	NT	S	B	B	NT	NT
X	NT	B	B	B	S	B	NT	B	NT	NT	NT	NT
Session II												
IV	B	NT	NT	B	S	NT	S	NT	S	S	NT	NT
V	B	B	B	NT	NT	NT	NT	NT	NT	NT	NT	NT
VI	B	B	B	NT	NT	NT	NT	NT	NT	NT	NT	NT
VII	B	S	NT	NT	S	S	S	NT	NT	NT	NT	NT
VIII	S	S	NT	S	NT	NT	NT	NT	NT	NT	NT	NT
IX	B	B	B	NT	NT	NT	NT	NT	NT	NT	NT	NT
X	B	B	B	NT	NT	NT	NT	NT	NT	NT	NT	NT
Session III												
IV	S	S	S	NT	NT	NT	NT	NT	NT	B	B	B
V	S	B	S	S	S	NT	B	S	NT	NT	NT	NT
VI	S	S	B	S	B	S	S	NT	NT	NT	NT	NT
VII	S	S	S	NT	NT	B	NT	S	NT	NT	NT	NT
VIII	B	B	B	NT	S	B	NT	NT	NT	NT	NT	NT
IX	S	S	S	B	S	NT	NT	NT	S	NT	NT	NT
X	S	S	NT	S	NT	NT	NT	NT	NT	B	NT	S
Session IV												
IV	NT	B	B	B	NT	S	B	S	NT	NT	NT	NT
V	S	S	S	S	B	B	NT	NT	NT	S	NT	NT
VI	NT	NT	NT	NT	S	S	B	S	S	NT	NT	NT
VII	S	B	NT	B	NT	S	S	S	NT	NT	B	NT
VIII	B	B	NT	NT	NT	NT	NT	NT	NT	B	NT	NT
IX	B	NT	S	NT	NT	B	NT	B	B	S	NT	B
X	NT	B	S	B	B	B	S	NT	NT	B	S	B

# *Price Convergence*

*Price Convergence*

*(Distance from Realized Value)*



## Conclusion

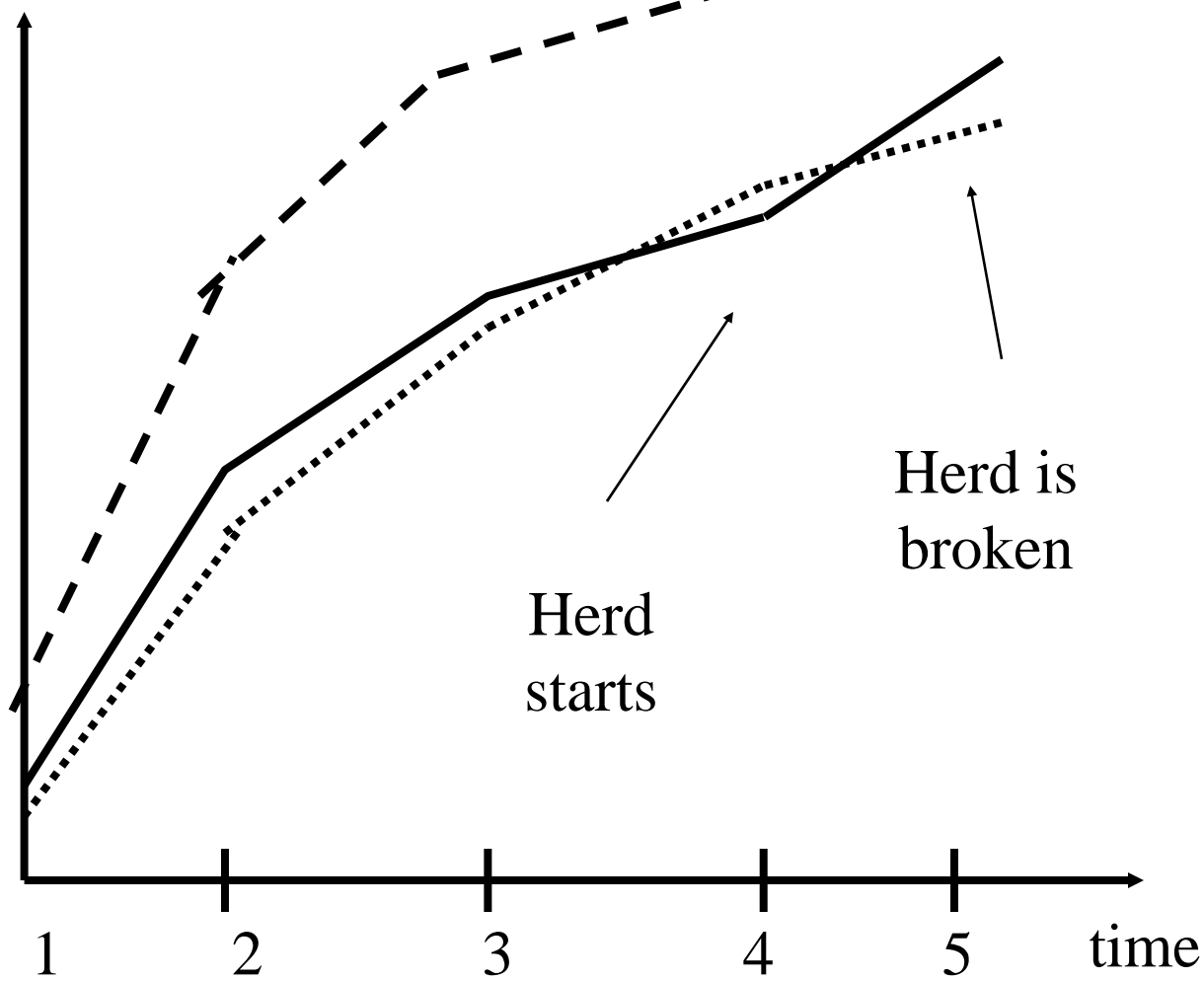
- Prediction on herding behavior broadly in line with what theory suggests.
- Herding less pronounced than suggested by theory when there is information uncertainty.
- When there is no information uncertainty we observe contrarian behavior, something that theory cannot account for.
- Trade costs generate no-trade cascades. The overall effect on information aggregation of which, however, is ambiguous.

# “Learning While Herding”

- ✓ During an herd, all informed traders buy (sell).
- ✓ Therefore, the proportion of buys (sells) is higher than it would be if the market were uninformed.
- ✓ Over time, the market maker learns that the market is informed.
- ✓ After some time, both the traders and the market maker will interpret the past history of trades in the same fashion and traders will resume trading according to their signal. The herd is broken.

# Broken Herd

Expectations



—  
Market  
Maker

- - -  
Traders  
with  
positive  
signal

.....  
Traders with  
negative  
signal

# Convergence

## Proposition:

- **The price converges** almost surely to the true value of the asset

And, if  $a < 1$ ,

- **The market maker's belief** on whether the market is informed **converges** almost surely to 1.

## *Gains From Trade*

Similar results can be obtained when there are gains from trade in the economy, i.e., traders are heterogeneous and trading can be mutually beneficial.

Gains from trade also introduce a wedge between the market maker's and the traders' evaluations. As a result all agents of the same type may choose the same action (herd) and the price may fail to converge to the fundamental.

However, gains from trade are difficult to implement in a laboratory.

Cipriani and Guarino, 2001, mimeo.