Herding of Institutional Traders

Stephanie Kremer

Freie Universität Berlin
Teilprojekt C 14

SFB 649

Motzen, June 2010

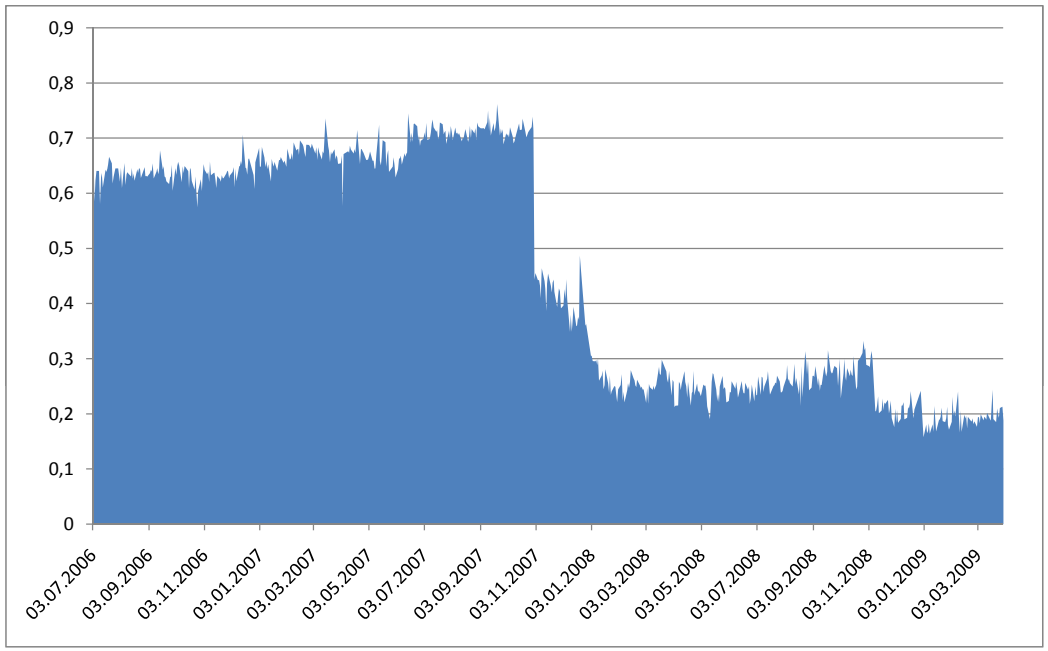
Herding

- Economic risk inherent in non-fundamental stock price movements $\rightarrow$ contesting the efficient markets hypothesis
- "Understanding the behavior of stock prices requires an understanding of the investment strategies of active investors", Lakonishok et. al (1992)
- **Herding** = Accumulation of investors on the same side of the market
- Exacerbate price movements, destabilization of stock prices, increasing volatility, threatening of financial market stability, e.g. Scharfstein and Stein (1990), Hirshleifer and Teoh (2003) or Hwang and Salmon (2004)

Institutional Investors: Dominance in the stock market

- **Institutional investors**: Banks and other financial institutions

Figure 1: Share in Trading Volume DAX 30



- Daily average trading share in DAX 30 stocks over whole period: **46%**
- Pre crisis: 66%
- Post crisis: 32%

Earlier Herding Evidence

- First herding evidence: Lakonishok et al. (1992)
- Little evidence on why institutions herd
- Herding more intense in small stocks, e.g. Wermers (1999), Sias (2004), Barber (2009)
- Herding more intense in less developed markets, e.g. Lobao and Serra (2007), Voronkova and Bohl (2005)
- Herding due to common procyclical behavior, e.g. Sias, Starks and Titman (2001)

Data Problems of the Literature

Previous literature on institutional flows is handicapped

1. Low frequency (e.g. Walter and Weber (2006))
   - Reports if at all quarterly or semi-annually
   - Rapid changing stock market environment
2. No identification of trader (e.g. Barber (2009))
   - Using naive cutoff approach
   - Huge loss of information

$\Rightarrow$ No thorough test of institutional trading

Contribution of This Paper

This paper:

- Comprehensive data set
  - High frequency
  - Transaction data
  - Direct identification of the trader
- Determinants of herding
  - Capture changing stock characteristics
  - Resolution on covariances

Preview of Main Results

- Significant herding
- More herding for larger institutions
- Overestimation in previous studies
- More herding in large stocks
- No positive feedback trading
- Herding mainly due to common risk models

Outline

Herding Measure: Lakonishok et al. (1992)

Herding = Accumulation on same side of the market relative to what would be expected if trades were independent

$$HM_{it} = |br_{it} - \bar{br}_t| - E_t[|br_{it} - \bar{br}_t|]$$

- No. of trader relevant (not volume)
- br_{it}: Fraction of buyers in a specific stock i in time t
- $\bar{br}_t$: Average buyers ratio $\hat{=} E_t[br_{it}]$: Overall probability to buy in t for all stocks
- $\overline{HM}$: Mean herding measure

Data Problems of Earlier Literature:
Low Frequency

- Transactions approximated by changes in reported positions
- Positions/holdings of institutions, if at all, reported only quarterly
- Trades completed within the period are not captured
- Trades diverging in time are regarded as herding
- No resolution on determinants of herding, e.g. intra-quarter covariances of trades and returns

Data Problems of Earlier Literature:
Identification of Trader

- Using transaction data: no identification of trader
- Separate trades by size (upper cutoff), Lee and Radhakrishna (2000)
- Proxy e.g. $50,000 = institutional, $5,000 = retail
- Huge number of unclassified transactions, loss of information
- Institutions with superior information will break up trades to hide informational advantage

BaFin Dataset solves these Problems

- Transactions carried out on German stock exchange
- Provided by the German Federal Supervisory Authority (BaFin)
- Section 9 Securities Trading Act
- Credit Institutions and Financial Services Institutions
- Identification of *all* relevant trade characteristics
- Transactions for own account (proprietary) or on behalf of a client

BaFin Dataset: Trade Information

Fictitious Example

share	trader	date	time	size	volume	price	S/B	exchange
Adidas	Deutsche Bank	03/03/08	15:14:13	1,000	41,500	41,5	S	Ffm
Adidas	Deutsche Bank	03/03/08	15:15:16	200	8,200	41,0	S	Ffm
.	.	.	.	.	.	.	.	.
Adidas	Societe Generale	03/03/08	15:14:14	5,000	20,000	40,0	B	Xetra
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
Siemens	Morgan Stanley	05/03/08	16:17:18	100	8,340	83,4	S	Xetra
.	.	.	.	.	.	.	.	.

Sample Period: Covers Up- and Downturn

July 2006 - March 2009 $\longrightarrow$ t=697

Figure 2: Dax 30

Notes: Daily Dax returns, 01.07.06-31.03.09, Source: finanzen.net.

Has trading behavior changed since to the market turmoil?

Sample Stocks: Large and Small Stocks

- DAX30, MDAX, SDAX $\rightarrow$ 130 stocks
  $\Rightarrow$ 88,435 observations, unbalanced panel
- 1,120 institutions (1,044 in DAX30, 742 in MDAX and 512 in SDAX stocks)
- 167,422,502 records of proprietary transactions
- Following literature using higher frequency data (e.g. Dorn et al. (2006), Campbell et. al (2005)): Calculation of daily trade imbalance for each institution

Daily Trades

Quarterly or semi-annually data provide only a crude basis in a rapid changing stock market environment!

Table 1: Average daily number of traders active

	All	DAX 30	MDAX	SDAX
07/06-03/09	25.14	50.79	23.41	10.78
$<$08/09/07	31.96	65.26	28.80	13.10
$\geq$08/09/07	20.80	41.01	20.00	9.34

Trade Size

Cuttoff approaches to identify institutional transactions lead to a huge loss of information!

- Lee and Radhakrishna (2000): \$50,000, \$20,000 and \$10,000 for large, medium and small stocks
- €34,000, €14,000 and €7,000 for DAX 30, MDAX and SDAX stocks
- Identification of trader is ignored
- Out of 167,422,502 records, 118,307,150 are lost

Herding Results: Data Limitations and Size Effect

Table 2: Mean Herding Measures

	Daily Herding		Quarterly Herding		Cuttoff	
	AllStocks	*DAX*30	*AllStocks*	*DAX*30	*AllStocks*	*DAX*30
07/06-03/09	1.40	3.65	2.29	3.59	4.58	4.39
	(0.02)	(0.04)	(0.15)	(0.26)	(0.02)	(0.04)
Observations	83,842	20,901	1,395	331	80,012	20,865
$<$08/09/07	1.32	4.35	1.63	2.98	2.54	2.47
	(0.04)	(0.06)	(0.20)	(0.41)	(0.03)	(0.03)
Observations	33,257	8,427	523	123	32,751	8,426
$\geq$08/09/07	1.60	3.17	2.69	3.95	5.99	5.68
	(0.03)	(0.06)	(0.20)	(0.35)	(0.04)	(0.05)
Observations	50,585	12,474	872	208	47,261	12,439

▸ To MDAX and SDAX results

Building Subgroups of Traders

- 1,120 institutions = large heterogeneous group
- Theory: Herding more intense among more homogeneous institutions
- 30 most active trader = 80% of trading volume over all institutions
- Detection of intentional herding or procyclical behavior would suggest a high potential hazard for financial stability
- 40 most active German banks
- Ensuring same risk models (VaR-limits) are applied

Results for the Subgroup

Table 3: Daily Herding Measures of Subgroups

	30 Most Active Traders		40 Most Active German Banks	
	AllStocks	*DAX*30	*AllStocks*	*DAX*30
07/06-03/09	2.48 (0.03)	5.18 (0.06)	2.16 (0.03)	5.21 (0.05)
Observations	68,963	20,853	69,274	20,897
$<$08/09/07	2.93 (0.05)	5.84 (0.08)	1.96 (0.05)	4.78 (0.08)
Observations	30,362	8,427	27,635	8,425
$\geq$08/09/07	2.14 (0.05)	4.73 (0.08)	2.39 (0.04)	5.48 (0.04)
Observations	38,601	12,426	41,639	12,472

▸ To MDAX and SDAX results

Summary of First Results

- Significant herding in institutional trades
- More herding for homogeneous and most professional subgroup of institutions
- More herding in DAX 30
- Lower frequency and cuttoff approach overstates herding levels
- Herding in market up- and downturns

Two Types of Herding

1. **Unintentional Herding:** Correlated information
   - Traders examine same factors and signals
   - Similar background, qualification, interpretation (Hirshleifer, Subrahmanyam and Titman (1994))

- Efficient: If driven by fundamentals
- Inefficient: Positive feedback trading

Two Types of Herding

2. **Intentional Herding**: Less information, information uncertainty and asymmetry
   - Sentiment driven
   - Information Cascade Model (Bikhchandani et. al (1992), Avery and Zemsky (1998))
   - Reputation Based Model (Scharfstein and Stein (1990))

- Inefficient

How to Reveal Determinants of Herding

- **Information quantity and quality**
  - Market capitalization
  - Liquidity
  - Uncertainty

  $\Rrightarrow$ Intentional herding in small cap stocks

- **Reliable information, signals**
  - Price signals
  - Risk management systems

  $\Rrightarrow$ Unintentional herding

Previous Evidence: Descriptive Approaches

- Herding and stock size: Intentional herding
  - More herding in small stocks: Wermers (1999) and Lakonishok et al. (1992)
- Herding and past performance: Unintentional herding
  - Positive feedback: Grinblatt et al. (1995), Wermers (1999)
  - Negative feedback: Wylie (2005)
  - No: Lakonishok et al. (1992)
- Low frequency: Only crude resolution on determinants of herding
- Problem of intra-quarter covariances

Revealing the Determinants of Herding

- Empirical proxies to measure information availability, information asymmetry or uncertainty in the market
- Determinants that may imply a destabilizing procyclicality

1. Market capitalization = Information availability (Sias (2004))
2. Trading volume = Information quality, asymmetry (Suominen (2001))
3. Volatility = Uncertainty, risk models (Persaud (2002)
4. Stock returns = Trading on price signals, procyclicality (De Long et al. (1990))

Determinants of Herding: A Panel Approach

$$HM_{it} = a + b|r_{i,t-1}| + cStd_{it} + dSize_{i,t-1} + eVol_{it} + \alpha_i + \gamma_t + \epsilon_{it}$$

- $r_{i,t-t}$: Return of stock i measured from the closing prices on day $t-1$ and $t-2$
- $Size_{i,t-1}$: Logarithm of previous day's closing market capitalization of stock i
- Vol_{it}: Logarithm of the trading volume of stock i during t
- Std_{it}: Standard deviation of past 250 daily stock returns
- α_i, γ_t: Fixed effects, time dummies

Estimation Results

Table 4: Fixed Effects Panel Regression - Herding of 30 Most Active Trader

	HM_{it}	BHM_{it}	SHM_{it}
$Size_{i,t-1}$	0.0020	0.0014	−0.0039*
	(0.0027)	(0.0046)	(0.0023)
Vol_{it}	0.0069***	0.0067***	0.0087***
	(0.0012)	(0.0017)	(0.0009)
$\lvert r_{i,t-1} \rvert$	−0.0001		
	(0.0003)		
$r_{i,t-1}$		−0.0014***	0.0008***
		(0.0002)	(0.0002)
Std_{it}	0.0031***	−0.0011	0.0048***
	(0.0012)	(0.0012)	(0.0012)
Observations	65,846	34,130	31,691

Notes: The variable $Size_{i,t-1}$ is the logarithm of market capitalization, Vol_{it} is the logarithm of the trading volume of stock, $r_{i,t-1}$ is the daily stock return and $\lvert r_{i,t-1} \rvert$ is its absolute value. Std_{it} measures the standard deviation of past 250 daily stock returns. The statistical significance at 1%, 5% and 10% is represented as ***, **, and * respectively.

Results on the Symmetric Herding Measure

- Size / market cap does not play an important role
- Volume highly significant
  $\longrightarrow$ More herding in more liquid markets
  $\Rightarrow$ Unintentional herding
- Volatility highly significant
  $\longrightarrow$ More herding due to increased uncertainty?
  $\Rightarrow$ Intentional herding?
- No resolution on returns

Signed Herding Measure: Capture Asymmetry

- Uncertainty would equally effect buy and sell side
- **Asymmetry** in behavior on buy and sell side?
- Positive feedback trading?
- Distinguish between buy and sell herding:
  - $BHM_{it} = HM_{it}$ if $br_{it} > \bar{br}_t$
  - $SHM_{it} = HM_{it}$ if $br_{it} < \bar{br}_t$

$$BHM_{it} = a^b + b^b r_{i,t-1} + c^b Std_{it} + d^b Size_{i,t-1} + e^b Vol_{it} + \alpha_i^b + \gamma_t^b + \epsilon_{it}^b$$

$$SHM_{it} = a^s + b^s r_{i,t-1} + c^s Std_{it} + d^s Size_{i,t-1} + e^s Vol_{it} + \alpha_i^s + \gamma_t^s + \epsilon_{it}^s$$

Results for the Signed Herding Measures

Table 5: Fixed Effects Panel Regression - Herding of 30 Most Active Trader

	HM_{it}	BHM_{it}	SHM_{it}
$Size_{i,t-1}$	0.0020	0.0014	-0.0039^{*}
	(0.0027)	(0.0046)	(0.0023)
Vol_{it}	0.0069^{***}	0.0067^{***}	0.0087^{***}
	(0.0012)	(0.0017)	(0.0009)
$\lvert r_{i,t-1} \rvert$	-0.0001		
	(0.0003)		
$r_{i,t-1}$		-0.0014^{***}	0.0008^{***}
		(0.0002)	(0.0002)
Std_{it}	0.0031^{***}	-0.0011	0.0048^{***}
	(0.0012)	(0.0012)	(0.0012)
Observations	65,846	34,130	31,691

Notes: The variable $Size_{i,t-1}$ is the logarithm of market capitalization, Vol_{it} is the logarithm of the trading volume of stock, $r_{i,t-1}$ is the daily stock return and $\lvert r_{i,t-1} \rvert$ is its absolute value. Std_{it} measures the standard deviation of past 250 daily stock returns. The statistical significance at 1%, 5% and 10% is represented as ***, **, and * respectively.

Summary of Results on Signed Herding Measures

- Volatility highly significant but only for the sell side
  - Unlikely that uncertainty induces intentional herding
  - Higher sell herding due to risk models
- Return highly significant but inverse relation
  - Common reaction on price signals
  - No positive feedback trading
  - No evidence for higher sensitivity on sell side

$\Rightarrow$ **Unintentional herding** due to same risk models and common negative feedback trading

Conclusion

- High frequent investor level data
- Higher herding for homogeneous and most professional subgroup of institutions
- More herding in DAX 30
- Buy herding negatively related to past return
- Sell herding positively related to past return and volatility
- Herding more unintentionally
- Herding due to common risk models, that reduce diversity of decision rules

$\Rightarrow$ Regulators should incentive diversity of behavior through the use of different risk management systems

More Details on the Herding Measure

- Herding = Accumulation on same side of the market relative to what would be expected if trades are independent
- Buy / sell decision = Bernoulli distributed with equal success probability
  $\rightarrow$ No short selling constrains!
- n_{it} institutions trade stock i on time t
- b_{it} buy transactions, binomially distributed
- $br_{it} = \frac{b_{it}}{n_{it}}$ = Buyers ratio
- $\bar{br}_t = \frac{\sum_{i=1}^{I} b_{it}}{\sum_{i=1}^{I} n_{it}}$ = Overall probability to buy in t for all stocks
- Herding = Deviation from $\bar{br}_t$, i.e. excess dispersion of what would be expected for that time

More Details on the Herding Measure

$$HM_{it} = |br_{it} - \bar{br}_t| - E_t[|br_{it} - \bar{br}_t|]$$

- First term captures the deviation form the overall buy probability
- $E_t[|br_{it} - \bar{br}_t|]$ = Adjustment factor because buy decision is stochastic
  $\rightarrow$ More variation in br_{it} if only a view traders
- b_{it} binomially distributed with probability $\bar{br}_t$ and n_{it} independent draws

$$E_t[|br_{it} - \bar{br}_t|] = \sum_{k=0}^{n_{it}} \binom{n_{it}}{k} \bar{br}_t^k (1 - \bar{br}_t)^{n_{it}-k} |\frac{k}{n_{it}} - \bar{br}_t|$$

Herding Results for Mid and Small Caps

Table 6: Mean Herding Measures: MDAX and SDAX

	Daily Herding		Quarterly Herding		Cuttoff	
	MDAX	*SDAX*	*MDAX*	*SDAX*	*MDAX*	*SDAX*
07/06-03/09	1.24	−0.03	2.14	1.63	5.27	3.90
	(0.04)	(0.05)	(0.23)	(0.27)	(0.04)	(0.06)
Observations	33,616	29,325	534	530	32,438	26,709
$<$08/09/07	0.99	−0.59	1.62	0.82	2.54	2.47
	(0.05)	(0.07)	(0.32)	(0.35)	(0.03)	(0.07)
Observations	13,005	11,825	200	200	12,857	11,468
$\geq$08/09/07	1.41	0.34	2.46	2.12	5.99	4.97
	(0.05)	(0.07)	(0.31)	(0.38)	(0.04)	(0.08)
Observations	20,611	17,500	334	330	19,581	15,241

Back

MDAX and SDAX Results for the Subgroup

Table 7: Daily Herding Measures of Subgroups: MDAX and SDAX

	30 Most Active Traders		40 Most Active German Banks	
	MDAX	*SDAX*	*MDAX*	*SDAX*
07/06-03/09	1.18	1.59	1.22	0.22
	(0.05)	(0.09)	(0.05)	(0.08)
Observations	31,668	16,442	31,630	16,747
$<$08/09/07	1.78	1.85	1.25	0.14
	(0.07)	(0.12)	(0.07)	(0.12)
Observations	12,749	9,186	12,072	7,138
$\geq$08/09/07	0.76	1.25	1.21	0.50
	(0.07)	(0.14)	(0.07)	(0.11)
Observations	18,919	7,256	19,558	9,609

Back

Buy and Sell Herding in the Subgroup

Table 8: Daily Signed Herding Measures for 30 Most Active Traders

	All Stocks			DAX 30		
	HM	*BHM*	*SHM*	*HM*	*BHM*	*SHM*
07/06-03/09	2.48 (0.03)	2.67 (0.05)	2.30 (0.05)	5.18 (0.06)	5.28 (0.08)	5.08 (0.08)
Observations	68,963	35,806	33,130	20,853	10,692	10,154
$<$08/09/07	2.93 (0.05)	3.55 (0.07)	2.15 (0.08)	5.84 (0.08)	6.26 (0.12)	5.35 (0.12)
Observations	30,362	16,868	13,494	8,427	4546	3,881
$\geq$08/09/07	2.14 (0.05)	1.87 (0.07)	2.41 (0.07)	4.73 (0.08)	4.55 (0.12)	4.92 (0.12)
Observations	38,601	18,938	19,636	12,426	6,146	6,273

Diagnostic Tests: Panel Regression

Table 9: Fixed Effects Panel Regression - Diagnostics: 30 Most Active Trader

	HM_{it}	BHM_{it}	SHM_{it}
Wooldridge	$F = 0.346$ ($Prob > F = 0.5573$)	$F = 0.377$ ($Prob > F = 0.5402$)	$F = 0.385$ ($Prob > F = 0.5359$)
Cook − Weisberg	$\chi^2 = 3383.14$ ($Prob > \chi^2 = 0.0000$)	$\chi^2 = 4924.52$ ($Prob > \chi^2 = 0.0000$)	$\chi^2 = 1290.95$ ($Prob > \chi^2 = 0.0000$)
Sargan − Hansen	$\chi^2 = 10.343$ ($Prob > \chi^2 = 0.0350$)	$\chi^2 = 11.122$ ($Prob > \chi^2 = 0.0252$)	$\chi^2 = 14.026$ ($Prob > \chi^2 = 0.0072$)
Observations	65,846	34,130	31,691

Notes: The table reports test statistics and p-values in parentheses. *Wooldridge* and *Cook − Weisberg* are tests on serial correlation and heteroscedasticity of error terms. *Sargan − Hansen* displays the overidentification test on the independence of random effects.

- Fixed effects model, within estimator (OLS)
- No endogeneity, no serial correlation
- Heteroscedasticity → robust standard errors

Estimation Results for the Signed Herding Measures

Table 10: Fixed Effects Panel Regression - Herding of 40 Most Active German Banks

	HM_{it}	BHM_{it}	SHM_{it}
$Size_{i,t-1}$	0.0028^{*}	0.0058	0.0104^{***}
	(0.0016)	(0.0040)	(0.0032)
Vol_{it}	0.0122^{***}	0.0170^{***}	0.0083^{***}
	(0.0006)	(0.0018)	(0.0015)
$\lvert r_{i,t-1} \rvert$	0.0006^{**}		
	(0.0002)		
$r_{i,t-1}$		-0.0004^{**}	0.0003^{*}
		(0.0002)	(0.0001)
Std_{it}	0.0015^{**}	-0.0018	0.0022^{**}
	(0.0007)	(0.0012)	(0.0010)
Observations	65,846	34,130	31,691

Notes: The variable $Size_{i,t-1}$ is the logarithm of market capitalization, Vol_{it} is the logarithm of the trading volume of stock, $r_{i,t-1}$ is the daily stock return and $\lvert r_{i,t-1} \rvert$ is its absolute value. Std_{it} measures the standard deviation of past 250 daily stock returns. The statistical significance at 1%, 5% and 10% is represented as ***, **, and * respectively.