The impact of internet stock message boards on cross-sectional returns of small-capitalization stocks

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1.Background

- Messages posted on internet stock message boards have become one of the many sources of information for investors and traders alike.
- Whether the activity of internet stock message boards quickly reflects itself into prices?
  - Tumarkin and Whitelaw (2001) show that message boards improve the speed of information being reflected in stock prices.
  - The Securities and Exchange Commission in the US has prosecuted people for the manipulation of stock prices via the misuse of internet messages.

1.Literatures

- Aggarwal and Wu (2006): study 142 manipulation cases prosecuted by the SEC from 1990 to 2001——these cases are associated with higher stock prices, volatility and liquidity and occur more often in markets characterized by low levels of regulation and disclosure requirements.
- Message board-related study: Wysocki (1999) finds that short-sellers are highly active on message boards with preferences for stocks with the largest information asymmetry, weak fundamentals, and high risks.

1.Literatures

- The prices of small and large stocks reflect public information quickly:
- Tumarkin and Whitelaw (2001): message board activity is linked to contemporaneous stock returns but not to future stock returns.
- Das and Chen (2007): a rapid reflection of market activity in board messages, but no predictive power for subsequent returns.
- Antweiler and Frank (2004): negative significant returns on the following day after higher message posting volume, but of small economic impact.
- Das and Chen (2007): the aggregated high-tech sector sentiment predicts high-tech sector index returns, but not for individual stocks.

1.Motivations

- Q1: Whether the activity of message boards can quickly reflect itself into prices in highly regulated market places, especially for small growth stocks with low media coverage and analyst followings?
  - Yes
- Q2: Whether the effect of message board activity on small stocks is different to the effect on large stocks?
  - Yes

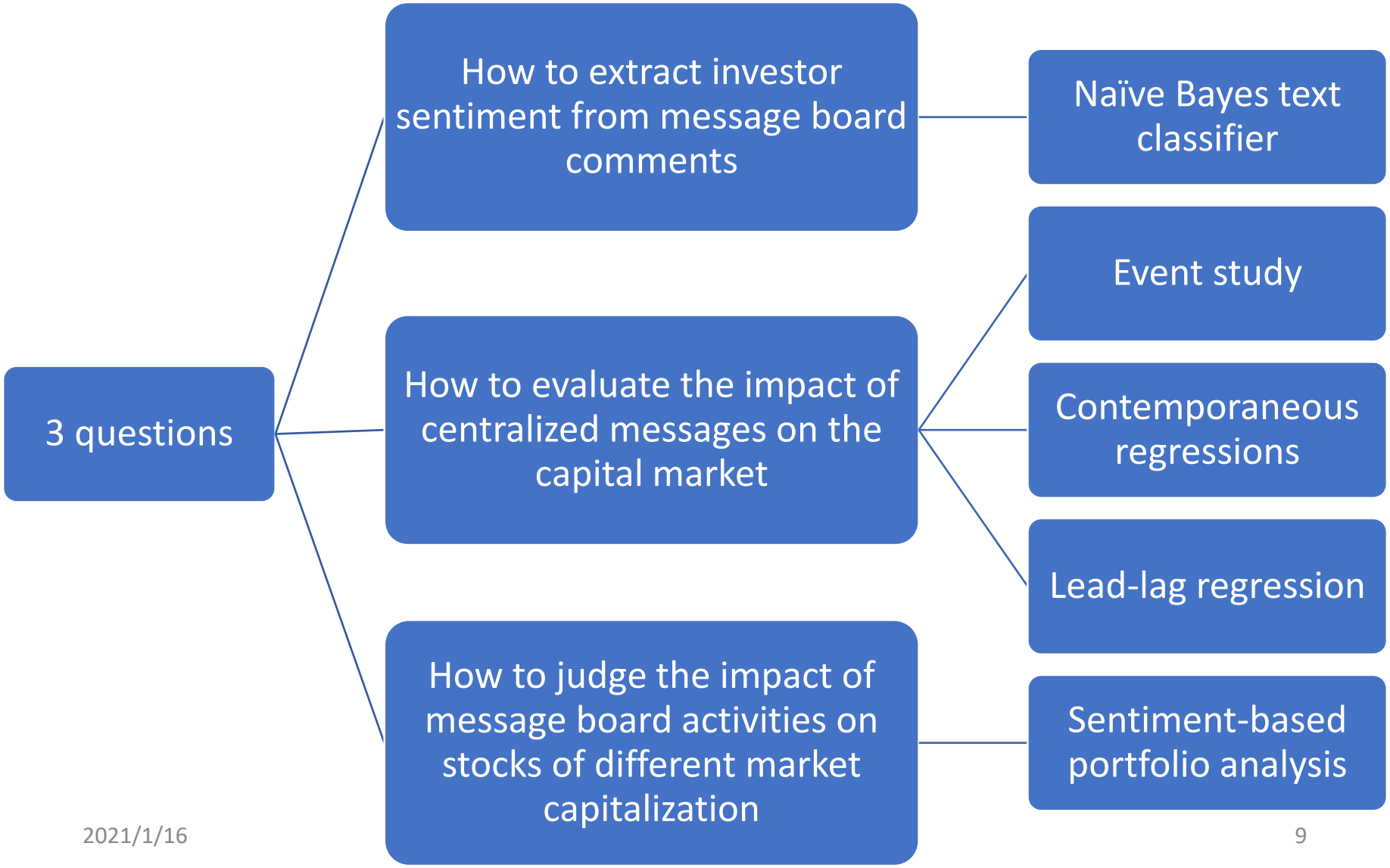
1.Contributions

- The author conducts a comprehensive test of the Australian stock market
- The author analyzes the impact of message boards on stocks with different market capitalization for the first time

2.Data

- Time: January 2003 to December 2008
- Stock: 2,608,343 messages and 2142 firms listed on the ASX(discussed in HotCopper)
- Database: Securities Industry Research Centre of Asia–Pacific (SIRCA)
  - transaction: timestamp, ticker, price, and bid and ask quotes just prior to each transaction.
  - daily and monthly closing prices
- Market performance: the S&P All Ordinaries index(it includes almost all Australian ASX listed companies)

3.Method


3 questions
How to extract investor sentiment from message board comments
Naïve Bayes text classifier
How to evaluate the impact of centralized messages on the capital market
Event study
Contemporaneous regressions
Lead-lag regression
How to judge the impact of message board activities on stocks of different market capitalization
Sentiment-based portfolio analysis

3.Method_Naïve Bayes text classifier

- $\{W_k\}$(k=1,…,K): a sequence of words where each word W_k is indexed by k
- class C ; counter class $\tilde{C}$
- m_k; $\widetilde{m_k}$: the number of occurrences of word W_k in all messages of class C and $\tilde{C}$
- n; $\tilde{n}$: the total number of words in all messages of class C and $\tilde{C}$

3.Method_Naïve Bayes text classifier

- the conditional probabilities of words found in messages from the training set:
- $P(W_k|\mathrm{C}) = (1+m_k)/(1+n)$
- $P\left(W_k\middle|\tilde{C}\right) = (1+\widetilde{m_k})/(1+\tilde{n})$
- posterior probability:
- $P(\mathrm{C}|W_k) = \frac{P(W_k|\mathrm{C})P(\mathrm{C})}{P(W_k)} = \frac{P(W_k|\mathrm{C})P(\mathrm{C})}{P(W_k|\mathrm{C})P(\mathrm{C})+P(W_k|\tilde{C})P(\tilde{C})}$
- Log: $\frac{P(C|W_k)}{P(\tilde{C}|W_k)} = \frac{P(\mathrm{C})}{P(\tilde{C})} \times \frac{P(W_k|\mathrm{C})}{P(W_k|\tilde{C})}$
- $P(\mathrm{C}|W_K) = P(C)\exp[\sum_{k=1}^{K} \ln(\frac{P(W_k|\mathrm{C})}{P(W_k|\tilde{C})})]$

	Message	Words	Class
Training	1	Buy BHP. Looks like a buy	Buy (B)
	2	Buy ANZ. Hot stock	Buy (B)
	3	Sell XYZ now. Certainly a sell	Sell (S)
Test	4	Buy buy buy CBA	?

Priors of the probability:

$$P(B) = 2/3$$
$$P(C) = 1/3$$

Conditional probability:

$$P(Buy|B) = (1+3)/(1+10) = 4/11$$
$$P(Buy|B) = P(Looks|B) = P(like|B) = P(a|B) = P(ANZ|B) = P(Hot|B) = P(stock|B) = (1+1)/(1+10) = 2/11$$
$$P(CBA|B) = (1+0)/(1+10) = 1/11$$

$$P(Sell|S) = (1+2)/(1+6) = 3/7$$
$$P(XYZ|S) = P(now|S) = P(Certainly|S) = P(a|S) = (1+1)/(1+6) = 2/7$$
$$P(Buy|S) = P(CBA|S) = (1+0)/(1+6) = 1/7$$

	Message	Words	Class
Training	1	Buy BHP. Looks like a buy	Buy (B)
	2	Buy ANZ. Hot stock	Buy (B)
	3	Sell XYZ now. Certainly a sell	Sell (S)
Test	4	Buy buy buy CBA	?

$$P(B|message4)$$
$$= P(B) \cdot \exp\{3 \cdot \ln[\frac{P(\text{Buy}|\text{B})}{P(\text{Buy}|S)}] + \ln[\frac{P(\text{CBA}|\text{B})}{P(\text{CBA}|S)}]\}$$
$$= 2/3 \cdot \exp\{3 \cdot \ln[(4/11)/(1/7)] + \ln[(1/11)/(1/7)]\}$$
$$= 7.00$$
$$P(S|message4)$$
$$= P(S) \cdot \exp\{3 \cdot \ln[\frac{P(\text{Buy}|\text{S})}{P(\text{Buy}|B)}] + \ln[\frac{P(\text{CBA}|\text{S})}{P(\text{CBA}|B)}]\}$$
$$= 1/3 \cdot \exp\{3 \cdot \ln[(1/7)/(4/11)] + \ln[(1/7)/(1/11)]\}$$
$$= 0.03$$

Result: Buy

3.Method_Naïve Bayes text classifier

- Investors attitude: {buy, hold, sell}
- $M_{i,t}^{C} = \sum_{j \to D(T)} x_{i,j}^{C}$: the sum of messages of class C for stock i in time interval $D(t)$
- $x_{i,j}^{C}$: a dummy variable which is one when message j for stock i is of type C, and zero otherwise
- $M_{i,t} = M_{i,t}^{BUY} + M_{i,t}^{SELL}$
- The degree of investor optimism:
- $Bullishness_{i,t} = \frac{M_{i,t}^{BUY} - M_{i,t}^{SELL}}{M_{i,t}} \cdot \ln(1 + M_{i,t})$

3.Method_Naïve Bayes text classifier

- The disagreement index:
- $A_{i,t} = 1 - \sqrt{1 - \left(\frac{M_{i,t}^{BUY} - M_{i,t}^{SELL}}{M_{i,t}}\right)^2}$
- Rank stocks into: rank 1– 100 (Large cap), rank 101–299(Mid cap), and rank 300–2000 (Small cap)

	$Bullishness$
Small stocks	0.03
Large stocks	-0.02

3.Method_Event Study

- **Event day:** comparing the standard deviation of the previous five days' numbers of messages with the actual number of messages posted on the event day. When the message number exceeded two times the standard deviation of the previous five days, with a minimum of ten message postings, an event took place.

——Tumarkin and Whitelaw (2001)

3.Method_Event Study

- Controlling for public information
- Clean only ASX company announcements: All observations within a range of three days of ASX price-sensitive company announcements were removed in order to focus on private information disseminated via *HotCopper*.
- Signal G, also called the Australian Company Announcements (ACA) database, flags whether ASX company announcements are price sensitive.

3.Method_Event Study

- Heavily discussed large stocks in the event study sample show strong financial performances (e.g. positive ROE, EBIT margin, or EPS).
- Target small stocks of online investors exhibit weak financial performances.

Financial aspects of event study sample.

Financial aspect	Stock capitalization	Mean	Median	Std. dev.	Min.	Max.	*N*
Market-to-book	Large	4.85	1.11	16.12	0.21	93.69	33
	Small	2.93	0.57	21.58	0.00	319.23	308
ROE	Large	0.15	0.15	0.12	−0.27	0.44	38
	Small	−0.27	−0.11	1.03	−11.35	9.18	411
EBIT margin	Large	11.58	0.17	60.39	−0.67	319.74	28
	Small	−1565.44	−1.78	16,749.74	−269,433.27	1435.71	286
P/*E* ratio	Large	22.07	16.54	35.22	−7.47	202.82	33
	Small	−13.76	−6.49	60.91	−801.89	200.00	308
EPS	Large	0.55	0.49	1.16	−4.00	2.79	38
	Small	−0.03	−0.01	0.23	−3.38	0.60	405

3.Method_Event Study

- MacKinlay (1997):
- Abnormal returns and volumes were computed in order to examine the impact of message board activity on financial market reactions
- Event period: t-5 ~ t+5
- For small & large stocks

Day t		t-5	t-4	t-3	t-2	t-1	t0	t+1	t+2	t+3	t+4	t+5
Abnormal Average Returns	*Small*	0.4% ***	0.1%	0.0%	0.3% **	0.5% ***	3.6% ***	0.2%	-0.2%	0.2%	0.1%	0.2%
	Mid	-0.2%	0.1%	-0.1%	-0.2%	-0.3% *	0.8% **	0.3%	0.1%	0.2%	-0.2%	0.0%
	Large	-0.1%	0.0%	0.1%	0.3%	0.0%	0.1%	0.2% *	0.1%	0.1%	0.2% *	-0.1%
	$\Delta S, L$	0.5%	0.1%	0.0%	-0.1%	0.5%	3.4% ***	0.0%	-0.3%	0.1%	-0.2%	0.2%

- Average Abnormal Returns (AARs) are only significantly high for small stocks
- The AARs are significant two days prior the event day and on day t + 1
- Future returns are not predicted by high posting activity
- Price sensitive information quickly reflects itself in the prices of Australian large capitalization stocks

Day t		t-5	t-4	t-3	t-2	t-1	t0	t+1	t+2	t+3	t+4	t+5
Abnormal Average	*Small*	122%	80%	50%	46%	56%	275%	158%	103%	81%	76%	70%
Volume		***	***	***	***	***	***	***	***	***	***	***
	Mid	2%	3%	-8%	-3%	13%	89%	42%	18%	9%	16%	11%
							***	***	**			
	Large	1%	12%	5%	0%	0%	35%	17%	7%	5%	1%	2%
							***	**				
	$\Delta S, L$	120%	67%	44%	46%	56%	240%	141%	95%	75%	75%	68%
				*	*	**	***	***	***	***	**	***

- High posting activity particularly impacts on AAVs for small stocks compared to large stocks on the event day
- For small stocks, trading volume is significantly higher during the whole event period
- Message board activity might sustainably increase trading volume, especially for small stocks.

3.Method_Contemporaneous regressions

- Former studies did not assess the interdependence between message board postings or sentiment and size-dependent stock portfolios.
- Antweiler and Frank (2004)
- $R_{i,t} = \alpha + \beta_1 LogMessages_{i,t} + \beta_2 Bullishness_t + \beta_3 Agreement_{i,t} + \beta_4 MarketRet_t + \beta_5 R_{i,t-1}$
- $Volatility_{i,t} = \alpha + \beta_1 LogMessages_{i,t} + \beta_2 AbsSentiment_{i,t} + \beta_3 Agreement_{i,t} + \beta_4 Market_t + \beta_5 TradeVolume_{i,t} + \beta_6 Volatility_{i,t-1}$

3.Method_Contemporaneous regressions

- $BAS_{i,t} = \alpha + \beta_1 LogMessages_{i,t} + \beta_2 AbsSentiment_{i,t} + \beta_3 Agreement_{i,t} + \beta_4 Market_t + \beta_5 BAS_{i,t-1}$
- $TradeSize_{i,t} = \alpha + \beta_1 LogMessages_{i,t} + \beta_2 AbsSentiment_{i,t} + \beta_3 Agreement_{i,t} + \beta_4 Market_t + \beta_5 TradeSize_{i,t-1}$
- $TradeVolume_{i,t} = \alpha + \beta_1 LogMessages_{i,t} + \beta_2 AbsSentiment_{i,t} + \beta_3 Agreement_{i,t} + \beta_4 Market_t + \beta_5 TradeVolume_{i,t-1}$

Dependent variable	$Return_t$						$Volatility_t$						BAS_t					
Market capitalization	Small		Medium		Large		Small		Medium		Large		Small		Medium		Large	
	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat
Msg. board variables																		
$LogMessages_t$	0.011***	23.64	0.004***	8.26	0.001***	3.73	0.101***	7.58	0.109***	6.79	0.024**	2.85	0.000	0.13	0.000	−1.11	0.000	0.23
$Bullishness_t$	0.008***	22.26	0.005***	10.99	0.002***	6.33												
$AbsSentiment_t$							0.003**	2.68	0.006*	2.53	0.003***	3.81	0.000	−0.37	0.000	1.18	0.000	0.81
$Agreement_t$	0.001	1.29	0.001	1.63	0.001**	2.96	0.039***	4.03	−0.012	−1.15	0.013*	2.04	0.000*	−1.97	0.000***	−3.51	−0.001	−1.45
Control variables																		
Market return$_t$	0.766***	10.80	0.795***	25.03	0.909***	32.98												
$Market_t$							−0.138***	−4.77	−0.062**	−3.07	−0.001	−0.1	0.004***	3.89	0.003	1.47	0.025	1.37
Log trade volume$_t$							0.273***	54.11	0.068***	19.22	0.074***	14.99						
Lagged dependent variables																		
$Return_{t-1}$	−0.135***	−28.24	−0.037***	−5.26	−0.043***	−4.72												
$Volatility_{t-1}$							0.129***	27.15	0.244***	22.80	0.223***	12.57						
BAS_{t-1}													0.469***	9.42	0.569***	9.64	0.545***	6.97
R-square	0.05		0.10		0.19		0.19		0.26		0.24		0.47		0.61		0.63	
Number of observations	849,675		209,692		103,158		849,675		209,692		103,158		849,675		209,692		103,158	

- Returns:
  - Contemporaneous raw returns are, in particular, higher for small stocks with more message postings and higher sentiment relative to large stocks.
  - Small stocks are more affected by message board activity
- Volatility:
  - the volatility is particularly high for small stocks with higher posting activity and high trading volumes relative to large stocks.
- BAS:
  - internet stock message boards help to quicken the speed of information being reflected in the prices of small stocks.

Dependent variable	*Log trade small*$_t$						*Log trade large*$_t$						*Log trade volume*$_t$					
Market capitalization	Small		Medium		Large		Small		Medium		Large		Small		Medium		Large	
	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat
Msg. board variables																		
LogMessages$_t$	0.302***	35.18	0.150***	12.69	0.058***	5.70	0.000	0.95	0.006**	2.56	0.047***	3.27	0.459***	32.98	0.255***	13.62	0.122***	8.64
Bullishness$_t$																		
AbsSentiment$_t$	0.003***	4.95	0.002*	2.01	0.001	1.70	0.000	−0.25	0.000	−1.68	0.001	0.44	0.002**	2.17	0.002	1.20	0.001	1.34
Agreement$_t$	0.021***	4.09	0.019*	2.18	0.009	1.14	0.000	0.31	0.001	0.48	−0.014	−1.08	0.083***	9.12	0.059***	4.58	0.035**	2.66
Control variables																		
Market$_t$	0.265***	10.53	1.068***	16.78	0.832***	12.11	0.002***	9.43	0.071***	9.85	0.459***	12.60	0.343***	7.37	0.947***	11.18	0.685***	11.55
Lagged dependent variables																		
Log trade small$_{t-1}$	0.541***	98.96	0.646***	51.18	0.672***	27.31												
Log trade large$_{t-1}$							0.101***	6.52	0.219***	11.43	0.356***	15.93						
Log trade volume$_{t-1}$													0.373***	53.89	0.464***	29.15	0.492***	22.17
R-square	0.64		0.85		0.92		0.03		0.14		0.43		0.56		0.78		0.90	
Number of observations	849,675		209,692		103,158		849,675		209,692		103,158		849,675		209,692		103,158	

- Trade small/large:
  - message board activity particularly influences individual investor trades with low volumes. Messages that refer to large stocks strongly correlate with the number of large trades, suggesting institutional investor activity on message boards.
- Trade Volume:
  - the trading volume is especially sensitive to the number of messages for small stocks.

3.Method_Lead-Lag regressions

1 day lead-lag regression: return, volatility and bid-ask spread by market capitalization.

Dependent variable	$Return_{t+1}$						$Volatility_{t+1}$						BAS_{t+1}					
Market capitalization	Small		Medium		Large		Small		Medium		Large		Small		Medium		Large	
	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat
Msg. board variables																		
$LogMessages_t$	0.002***	7.87	0.001***	3.50	0.000	0.96	−0.026*	−2.42	0.017	1.37	−0.018***	−3.62	−0.000**	−3.04	0.000***	−3.18	0.000	0.15
$Bullishness_t$	0.001***	5.71	0.000	1.01	0.000	−0.63												
$AbsSentiment_t$							0.000	0.09	0.001	0.55	0.002**	3.15	0.000*	2.09	0.000**	2.50	0.000	0.55
$Agreement_t$	0.000	1.44	0.000	1.01	0.000*	1.95	0.010	1.27	−0.011	−1.50	0.004	0.95	0.000***	−3.36	0.000**	−2.75	−0.001	−0.92
Control variables																		
$Market\ return_{t+1}$	0.790***	11.04	0.799***	24.99	0.912***	32.92												
$Market_{t+1}$							−0.106***	−3.7	−0.066***	−3.24	−0.005	−0.34	0.004***	3.87	0.003	1.41	0.022	1.40
$Log\ trade\ volume_t$							0.280***	56.72	0.073***	19.33	0.077***	14.93						
Lagged dependent variables																		
$Return_t$	−0.133***	−26.27	−0.037***	−5.09	−0.043***	−4.64												
$Volatility_t$							0.134***	27.33	0.255***	23.24	0.223***	11.69						
BAS_t													0.486***	9.07	0.522***	16.32	0.579***	7.76
R-square	0.04		0.09		0.19		0.19		0.25		0.23		0.44		0.60		0.63	
Number of observations	817,213		207,648		102,292		817,213		207,648		102,292		817,213		207,648		102,292	

1 day lead-lag regression: small and large trades and trade volume by market capitalization.

Dependent variable	$Log\ trade\ small_{t+1}$						$Log\ trade\ large_{t+1}$						$Log\ trade\ volume_{t+1}$					
Market capitalization	Small		Medium		Large		Small		Medium		Large		Small		Medium		Large	
	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat	Est.	*t*-Stat
Msg. board variables																		
$LogMessages_t$	0.139***	20.87	0.038***	4.06	−0.007	−0.91	0.000	−0.80	0.002	1.26	0.023	1.90	0.255***	22.73	0.113***	6.99	0.035***	3.66
$Bullishness_t$																		
$AbsSentiment_t$	0.003***	4.80	0.000	−0.64	0.001*	2.31	0.000	−0.31	0.000	−0.2	0.000	0.40	0.004***	4.37	0.000	0.02	0.001	1.35
$Agreement_t$	0.000	0.00	−0.003	−0.38	0.003	0.42	0.000	−0.38	0.004*	2.30	−0.011	−1.01	0.026***	3.51	0.032**	2.85	0.008	0.92
Control variables																		
$Market_{t+1}$	0.297***	11.63	1.065***	16.82	0.817***	11.80	0.003***	9.42	0.071***	9.85	0.462***	12.68	0.391***	8.29	0.952***	11.25	0.676***	11.18
Lagged dependent variables																		
$Log\ trade\ small_t$	0.560***	99.60	0.651***	51.73	0.678***	27.31												
$Log\ trade\ large_t$							0.100***	6.40	0.220***	11.26	0.355***	15.73						
$Log\ trade\ volume_t$													0.382***	53.84	0.468***	28.96	0.499***	21.77
R-square	0.63		0.85		0.92		0.03		0.14		0.43		0.56		0.78		0.90	
Number of observations	817,213		207,648		102,292		817,213		207,648		102,292		817,213		207,648		102,292	

3.Method_Lead-Lag regressions

- Returns cannot be predicted in subsequent days after message posting activity.
- However, financial trading variables, such as the trade volume and trade sizes, significantly correlate with the corresponding number of messages.

3.Method_Sentiment-based portfolio analysis

Short-term sentiment-based portfolio returns

- All stocks belongs to different quartiles based on the average daily bullishness expressed in corresponding board messages.
- The first quartile represents the ‘Bullish’ portfolio
- The fourth quartile describes the ‘Bearish’ portfolio.
- Stocks are held for one and two days with reported cumulative returns (CRs)

Portfolio	Bullishness	$t = 0$	$t + 1$	$t + 2$
Panel B: cumulative returns for large cap stocks				
Bullish	0.803	0.30%***	0.34%***	0.33%***
		(8.48)	(7.17)	(4.42)
2. Quartile	0.070	0.30%***	0.36%***	0.40%***
		(7.11)	(6.78)	(4.77)
3. Quartile	−0.519	0.13%***	0.21%***	0.26%***
		(3.59)	(4.53)	(3.77)
Bearish	−1.162	0.01%	0.06%	0.08%
		(0.18)	(0.82)	(0.80)
	ΔBullish, Bearish	0.29%***	0.29%***	0.25%*
		(4.83)	(3.55)	(2.01)

- The “Bullish” gets higher returns
- The spread is smaller than that of “small cap stocks”

Portfolio	Bullishness	$t = 0$	$t + 1$	$t + 2$
Panel D: cumulative returns for small cap stocks				
Bullish	0.976	1.56%***	1.75%***	1.64%***
		(48.24)	(38.86)	(24.63)
2. Quartile	0.448	1.38%***	1.52%***	1.38%***
		(25.42)	(21.31)	(13.21)
3. Quartile	−0.279	1.11%***	1.20%***	1.08%***
		(26.92)	(22.26)	(13.48)
Bearish	−0.985	0.39%***	0.46%***	0.34%***
		(7.49)	(6.88)	(3.48)
	ΔBullish, Bearish	1.17%***	1.29%***	1.30%***
		(19.97)	(16.24)	(11.24)

- We do not find negative CRs for bearish small stocks——individual investors hold relatively few stocks in their portfolio and only sell stocks they own, due to resource constraints.
- Buy-trades are easier to realize for individual investors, who cannot devote as much time and resources to search for buy and sell opportunities as institutional investors.

3.Method_Sentiment-based portfolio analysis

Long-term sentiment-based portfolio returns

- Whether message boards contain value-relevant information?
  - constructed small and large stock portfolios
  - assigned each stock into quartiles based on the monthly average bullishness for the formation period J = 0 (same month)
  - the holding periods K = 0, 1–3, and 4–6 months
  - CAPM\FF3\C4

Holding period $K = 0$						Holding period $K = 1–3$						Holding period $K = 4–6$					
	Bullish	2Q	3Q	Bearish	ΔBB		Bullish	2Q	3Q	Bearish	ΔBB		Bullish	2Q	3Q	Bearish	ΔBB
Carhart four factor						Carhart four factor						Carhart four factor					
α	0.008	0.004	−0.004	0.001	0.007	α	−0.001	−0.001	0.000	0.002	−0.003	α	−0.007	0.000	0.000	0.003	−0.009
	(1.72)	(1.03)	(−1.64)	(0.43)			(−0.48)	(−0.29)	(−0.12)	(0.82)			(−1.48)	(−0.00)	(0.07)	(0.93)	
β_{rm}	1.329***	1.066***	1.181***	1.112***	0.217	β_{rm}	1.419***	1.153***	1.182***	1.133***	0.286	β_{rm}	1.742***	1.297***	1.029***	1.096***	0.646
	(8.20)	(7.95)	(14.49)	(11.10)			(12.63)	(11.78)	(13.16)	(20.09)			(9.96)	(14.47)	(12.43)	(18.85)	
β_{HML}	−0.111	0.191	0.206	−0.209	0.098	β_{HML}	0.227	−0.072	0.011	−0.043	0.270	β_{HML}	0.113	−0.076	0.070	−0.110	0.223
	(−0.53)	(1.25)	(1.67)	(−1.52)			(1.77)	(−0.61)	(0.12)	(−0.53)			(0.65)	(−0.52)	(0.82)	(−1.21)	
β_{SMB}	−0.029	0.091	0.033	−0.039	0.010	β_{SMB}	0.092	−0.079	−0.038	0.030	0.062	β_{SMB}	0.047	−0.262**	−0.052	−0.098	0.145
	(−0.21)	(0.74)	(0.50)	(−0.54)			(1.26)	(−1.13)	(−0.73)	(0.65)			(0.59)	(−3.18)	(−1.00)	(−1.19)	
β_{MOM}	0.262	0.150	−0.145	−0.145	0.407	β_{MOM}	0.038	0.071	0.058	−0.106	0.145	β_{MOM}	−0.160	−0.243*	0.069	0.015	−0.176
	(1.52)	(0.93)	(−1.79)	(−1.52)			(0.36)	(0.72)	(0.81)	(−1.87)			(−1.14)	(−2.10)	(1.00)	(0.16)	
R^2	0.17	0.15	0.20	0.16		R^2	0.20	0.15	0.17	0.17		R^2	0.26	0.19	0.14	0.17	

Large cap stocks

- Longer-term returns of this time regression suggest that large stocks with bullish message board sentiment do not significantly and economically meaningfully outperform bearish stocks.
- Message boards do not contain value-relevant information for large stocks.
- Large stocks experience higher media attention and analyst coverage, and are therefore expected to be embedded in an efficient market environment

Holding period $K = 0$						Holding period $K = 1$–3						Holding period $K = 4$–6					
	Bullish	2Q	3Q	Bearish	ΔBB		Bullish	2Q	3Q	Bearish	ΔBB		Bullish	2Q	3Q	Bearish	ΔBB
Carhart four factor						Carhart four factor						Carhart four factor					
α	0.065***	0.017***	0.007	−0.007*	0.072	α	0.017***	0.021***	0.011***	0.002	0.015	α	0.012***	0.024***	0.016***	0.006*	0.005
	(17.07)	(5.80)	(1.88)	(−1.99)			(6.59)	(7.34)	(3.84)	(0.74)			(5.08)	(7.12)	(5.22)	(2.17)	
β_{rm}	1.435***	1.277***	1.283***	1.585***	−0.150	β_{rm}	1.777***	1.758***	1.801***	1.805***	−0.028	β_{rm}	1.835***	1.643***	1.601***	1.524***	0.311
	(11.41)	(13.73)	(12.17)	(14.59)			(27.67)	(23.22)	(26.26)	(26.03)			(30.05)	(22.28)	(20.85)	(19.04)	
β_{HML}	0.100	0.363**	0.215	0.824***	−0.725	β_{HML}	0.098	0.165	−0.145	−0.212	0.310	β_{HML}	0.399***	0.180	0.217	0.164	0.235
	(0.53)	(2.74)	(1.33)	(4.84)			(0.92)	(1.42)	(−1.24)	(−1.96)			(4.08)	(1.40)	(1.81)	(1.28)	
β_{SMB}	1.652***	1.336***	1.213***	1.440***	0.211	β_{SMB}	−0.039	0.091	−0.052	−0.050	0.011	β_{SMB}	0.108	−0.004	0.024	−0.002	0.110
	(18.55)	(18.75)	(13.50)	(15.69)			(−0.64)	(1.34)	(−0.67)	(−0.71)			(1.86)	(−0.05)	(0.32)	(−0.02)	
β_{MOM}	0.505***	0.301**	−0.234*	−0.088	0.593	β_{MOM}	0.084	0.156	0.119	−0.003	0.087	β_{MOM}	−0.059	−0.179	−0.202*	−0.111	0.053
	(4.16)	(3.16)	(−2.00)	(−0.72)			(1.04)	(1.78)	(1.26)	(−0.04)			(−0.80)	(−1.69)	(−2.14)	(−1.09)	
R^2	0.10	0.11	0.10	0.09		R^2	0.05	0.05	0.06	0.05		R^2	0.06	0.04	0.05	0.04	

Small cap stocks

- Bullish stocks significantly and economically outperform bearish stocks with the impact decreasing in subsequent holding periods
- βHML estimates found for bullish and bearish small stocks (0.100 and 0.824, respectively), but with only significance for bearish stocks——bearish stocks are associated with value stocks whereas bullish stocks are considered as growth stocks with higher market perceived growth potential

5.Conclusion

- Higher message board activity reflects itself quickly in the prices of small stocks.
- Message board sentiment is incorporated into the stock price in the same month.
- Bullish stocks significantly and economically outperform bearish stocks in the short term, especially for small stocks.