The convergence and divergence of investors' opinions around earnings news: Evidence from a social network

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Motivation

- Investor disagreement has a large influence on trading volume and asset prices. However, it is difficult to measure investor disagreement.
- The most proxies do not directly examine investors' opinions, and change in a timely manner.
- There is increasing evidence that the tone or sentiment of news articles affects stock returns.
- Therefore, we use text analysis techniques to measure investor disagreement around earnings news and its impact for returns.

Contribution

- Our study has implications for measuring investor disagreement. The measure we introduce is often significantly related to existing disagreement measures when they are considered in isolation.
- The findings deepen our understanding of how investor disagreement impacts trading volume and asset prices, which is consistent with the models of prior investor disagreement and the models of “belief jumbling”.

Research Question

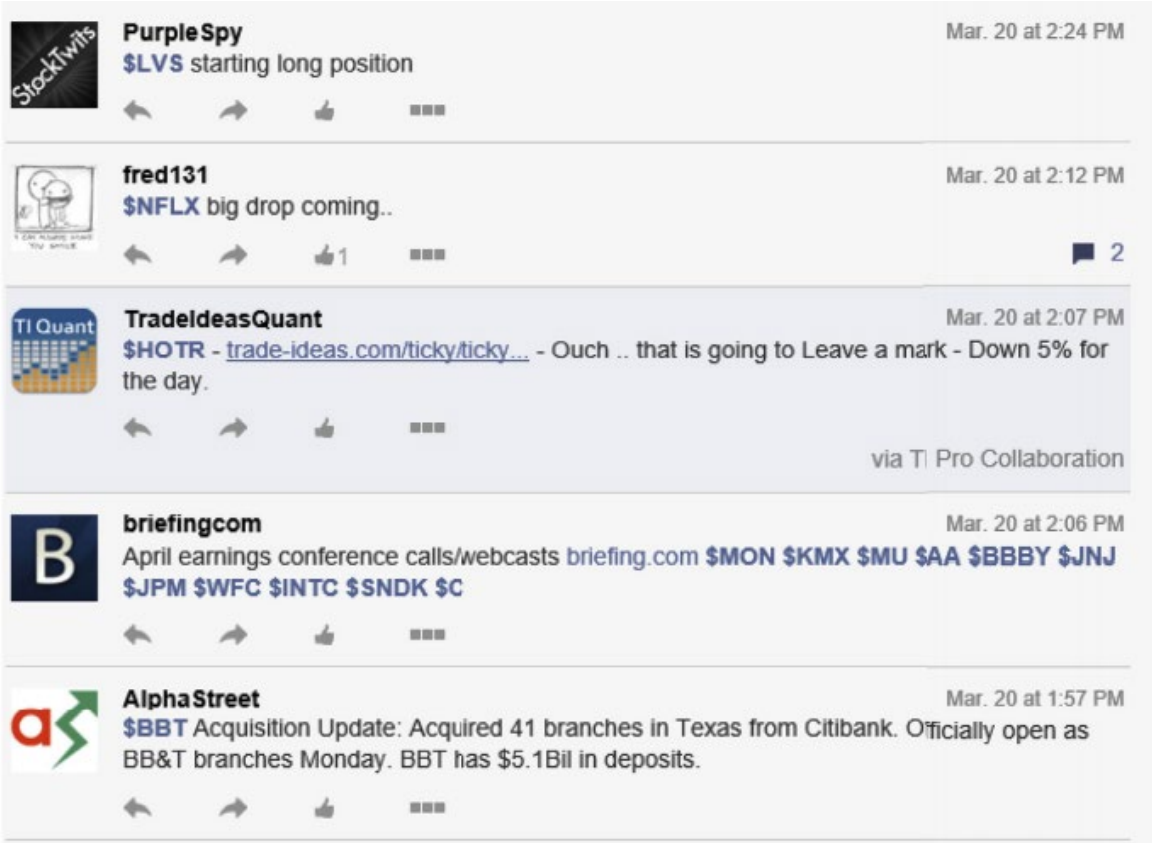
- Hypothesis 1
  - Investor disagreement prior to earnings announcements is associated with a greater trading volume reaction. (Atiase and Bamber, 1994; Bamber et al., 1997)
- Hypothesis 2
  - Di/Convergence of opinion around earnings announcements come with a greater volume reaction to earnings announcements (Banerjee and Kremer, 2010)

Research Question

- Hypothesis 3
  - Investor disagreement before earnings announcements will cause negative abnormal returns after them. (Miller, 1977)
- Hypothesis 4
  - Earnings announcement returns will be negative when the announcement reduces investor disagreement but positive when the announcement generates investor disagreement.(Miller, 1977)

Data

- Collection of stock tweets



Data

- Collection of stock tweets
  - We obtain comprehensive messages from Stocktwits.com from July 10, 2009 to June 10, 2011
  - For each post, we have the content, the associated ticker symbol(s), the date and the time of the post, the blogger's ID, and the number of followers.
  - The initial sample contains 1,048,575 posts covering 7757 security symbols

Data

- Collection of stock tweets

Process	stock tweets	Stock tickers
Original sample	1,048,575	7757
Matching to stock tickers in CRSP	782,904	5927
Match stock tickers to PERMNOs	778,764	5806

- Collection of news stories
  - We include articles from PR News Wire, Dow Jones News Wire, and Reuters News for firms covered by the Stocktwits sample.

Data

- Collection of news stories
  - We match tickers of the news stories to PERMNOs to create our final sample of 615,637 news stories covering 5096 unique firms
- Construction of the earnings announcement sample
  - We drop the firms with prices below $2 or market capitalization below $100 million at the end of the year y - 1.
  - Our final sample contains 19,751 earnings announcements by 2983 firms during the sample period. (CRSP-Compustat)

Sentiment classification

- We use the maximum entropy (ME) approach to classify the information in Twitter posts.

  "You would be crazy to sell $GOOG right now"

- Deriving meaning from the posts by applying a maximum likelihood algorithm ME classification controls for the conditional dependence of words and (Pang et al., 2002).

- ME classification also avoids the misidentification issue associated with alternative approaches that simply rely on keyword frequencies (e.g., tax, cost, capital, board, liability, mine, cancer or crude)

ME procedure

"You would be crazy to sell $GOOG right now"

- Let $F = (f_1, \ldots f_m)$ be a set of predefined features that can appear in a Twitter post

$$F_{i,c}(d,c) = \begin{cases} 1, & if\ n_i(d) > 0\ and\ c_i = c_0 \\ 0, & otherwise \end{cases}$$

- $n_i(d)$ is the number of times that the feature f_i occurs in a post d.
- Let c be a post category that takes the value of c_0 (1, 0, -1)
- $\lambda_{i,c}$ is a weighting parameter for the relative strength of each of the features and Z(d) is a normalization function

$$P_{ME}(c = c_0 | \bar{d}) = \frac{1}{Z(d)} \left(\sum_i \lambda_{i,c} F_{i,c}(d,c) \right)$$

Disagreement measure

- We construct IMPACT to measure the social network impact based on the number of followers of the Twitter poster and the Sentiment measure of the post:

$$IMPACT = (1 + Followers) \times Sentiment$$

- We aggregate the sentiment of all news articles that pertain to earnings to a daily frequency to create the variable NEWS.
- Finally, we cumulate daily values of IMPACT and NEWS over the two-week window prior to the earnings announcement.

Disagreement measure

- We create a dummy variable to explicitly define the divergence of opinion. The specific form of DIVOP is as follows:

$$DIVOP = \begin{cases} 0 & \text{if } (IMPACT > 0, NEWS > 0) \text{ or } (IMPACT = 0, NEWS = 0) \text{ or } (IMPACT < 0, NEWS < 0) \\ 1 & Otherwise / \end{cases}$$

- $DIVOP = 1$ indicates disagreement between Stocktwits sentiment and news sentiment, and $DIVOP = 0$ indicates sentiment agreement

$$DISP = \left[\sum_{K=1}^{k} \left(forcast_k - \overline{forcast} \right)^2 \right]^{1/2} / \overline{forcast}$$

Common measure

Empirical Analysis

- Regressions of DIVOP on existing disagreement measures and firm characteristics

	Dependent Variable: DIVOP					
	(1)	(2)	(3)	(4)	(5)	(6)
DISP	0.057				0.037	
	(1.39)				(0.72)	
INCVOL		5.578***			1.340	3.058***
		(7.87)			(0.90)	(2.95)
RETVOL		19.108***			−7.714*	−0.778
		(9.64)			(-1.74)	(-0.28)
log(1/AGE)			0.064***		−0.056	0.002
			(3.49)		(-1.11)	(0.04)
TURN			42.226***		37.183***	40.986***
			(20.75)		(9.42)	(13.72)
ln(1+#Inst.)				0.485***	0.048	0.251***
				(7.59)	(0.65)	(4.42)
Earnings Persistence				−0.051	−0.054	−0.064
				(-1.33)	(-0.98)	(-1.63)
|Accrual|				1.520***	0.107	0.589***
				(6.49)	(0.27)	(2.26)
ln(ME)	0.241***	0.416***	0.302***	0.138***	0.215***	0.206***
	(15.32)	(31.30)	(26.02)	(4.26)	(5.46)	(6.80)
ln(B/M)	0.019	−0.008	−0.042**	−0.009	0.049	−0.004
	(0.65)	(-0.37)	(-2.09)	(-0.35)	(1.19)	(-0.16)
Ret[-12,-2]	0.231***	0.128***	0.128***	0.125***	0.165***	0.084***
	(6.34)	(5.92)	(6.31)	(4.95)	(3.32)	(3.33)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8511	16,444	18,489	12,989	6014	12,611
Pseudo-R^2	0.031	0.057	0.064	0.065	0.049	0.082

Empirical Analysis

- We compute the DIVOP measure in a two-week window after earnings announcements and divide into four groups:

1. Investors disagree before announcement but agree after (DA);
2. Investors disagree both before and after announcement (DD);
3. Investors agree before announcement but disagree after (AD);
4. Investors agree both before and after the announcement (AA).

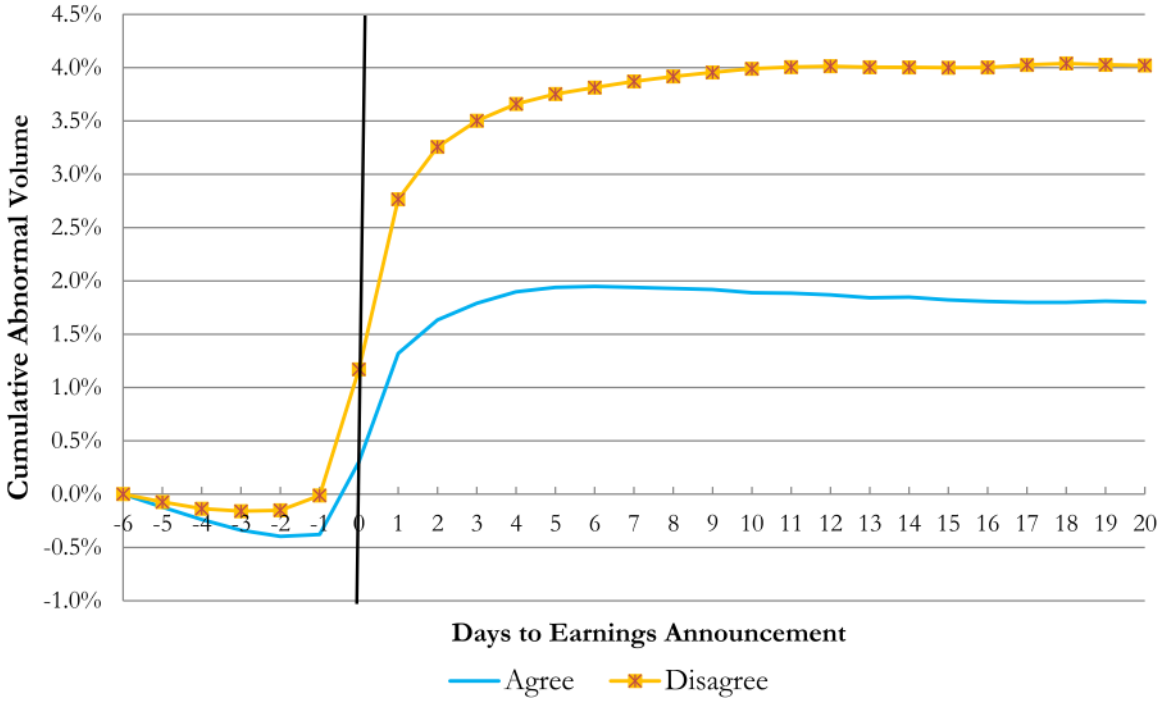
Empirical Analysis

- Determinants of divergence and convergence of opinion

	Panel A: Divergence of Opinions			Panel B: Convergence of Opinions		
	(1)	(2)	(3)	(4)	(5)	(6)
Low|Ret|/HighVol	0.532***	0.538***	0.289***	−0.168**	−0.160*	−0.073
	(5.96)	(6.00)	(2.59)	(-2.01)	(-1.91)	(-0.69)
ΔTURN		5.607	8.271		−1.116	−0.422
		(1.29)	(1.38)		(-0.27)	(-0.07)
ΔRETVOL		1.328	−0.544		4.093	3.775
		(0.53)	(-0.15)		(1.35)	(0.87)
ln(ME)			0.073			−0.266***
			(1.54)			(6.72)
ln(B/M)			−0.029			−0.043
			(-0.78)			(-1.17)
Ret[-12,-2]			0.084**			−0.014
			(2.15)			(-0.41)
Idiosyncratic Vol.			16.762***			−23.964***
			(5.83)			(-7.42)
ln(1+#Inst.)			0.607***			−0.193***
			(6.80)			(-2.72)
Earnings Persistence			0.063			−0.004
			(1.26)			(-0.06)
|Accrual|			0.295			−0.350
			(0.91)			(-0.96)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,762	10,747	7045	8989	8970	5923
Pseudo-R^2	0.013	0.013	0.053	0.001	0.001	0.038

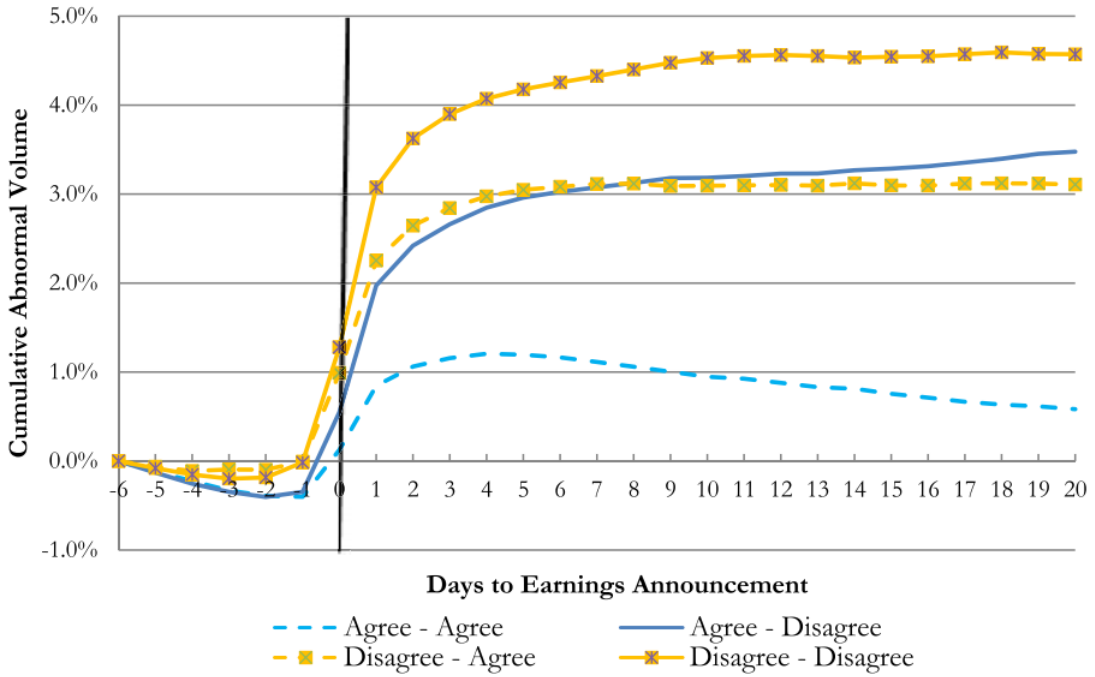
Empirical Analysis

- Hypothesis 1. Investor disagreement and trading volume



Empirical Analysis

- Hypothesis 2. abnormal trading volume across announcement



we calculate daily abnormal trading volume where the coefficients are estimated in the 200-day window ending 45 days prior to the earnings announcement [-245,-45] (Campbell and Wasley, 1996)

Empirical Analysis

- Hypothesis 1. Investor disagreement and trading volume
- Hypothesis 2. abnormal trading volume across announcement

	#obs	CAV [0,1]	CAV [2,10]	CAV [2,20]	CAV [0,20]
Panel A: Cumulative Abnormal Volume Across Groups of Disagreement (%)					
Agree	10,754	1.70	0.57	0.48	2.18
Disagree	8977	2.78	1.22	1.25	4.03
D − A		1.08***	0.66***	0.77***	1.85***
t-stat		14.11	4.87	3.24	6.53
Panel B: Cumulative Abnormal Volume Across Groups of Change in Disagreement (%)					
(1) Agree → Agree	6224	1.25	0.10	−0.26	0.99
(2) Agree → Disagree	4530	2.32	1.21	1.50	3.82
(2)–(1)		1.07***	1.11***	1.77***	2.84***
t-stat		12.01	8.10	6.38	8.72
(3) Disagree → Agree	3370	2.26	0.84	0.85	3.11
(3)–(1)		1.01***	0.74***	1.12***	2.13***
t-stat		9.43	3.99	3.47	5.52
(4) Disagree → Disagree	5607	3.09	1.45	1.49	4.59
(4)–(1)		1.84***	1.35***	1.76***	3.60***
t-stat		19.25	7.75	5.80	9.99

Empirical Analysis

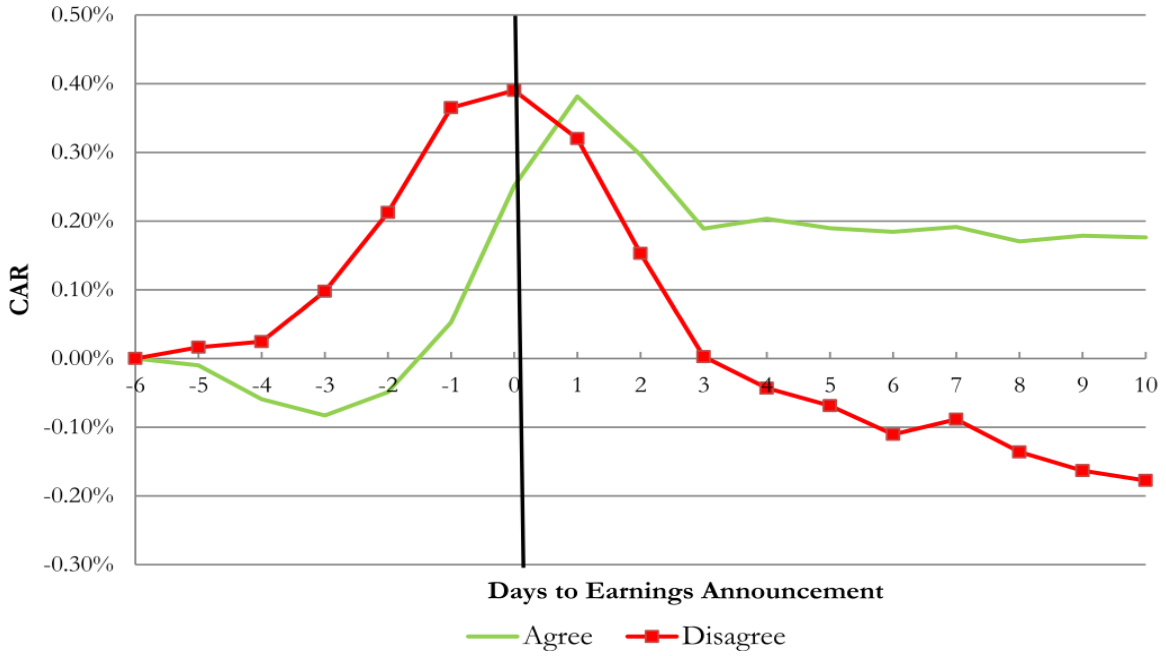
- We next investigate the effects of investor disagreement in a multivariate regression framework

	Dependent Variables						
	CAV [0,1]				CAV[2,10]	CAV[2,20]	CAV[0,20]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
DIVOP	1.080***	0.856***	0.187***				
	(11.14)	(9.78)	(2.96)				
Agree → Disagree				0.492***	0.996***	1.847***	2.339***
				(7.58)	(5.92)	(5.17)	(6.04)
Disagree → Agree				0.311***	0.447**	0.902**	1.212***
				(3.00)	(2.19)	(2.39)	(2.77)
Disagree → Disagree				0.519***	0.728***	1.255***	1.774***
				(6.11)	(3.68)	(2.90)	(3.74)
SUE		−0.054	−0.015	−0.013	−0.136	−0.284*	−0.298*
		(-0.96)	(-0.48)	(-0.42)	(-1.50)	(-1.87)	(-1.79)
IMPACT		0.239***	0.062**	0.062**	0.001	−0.029	0.033
		(5.52)	(2.26)	(2.27)	(0.14)	(-0.37)	(0.36)
NEWS		0.012	0.028**	0.027**	0.061**	0.131**	0.158***
		(1.64)	(2.48)	(2.39)	(2.03)	(2.29)	(2.58)
Lagged Volumes	No	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	No	No	Yes	Yes	Yes	Yes	Yes
Observations	19,735	18,570	18,570	18,570	18,568	18,568	18,568
R-square	0.011	0.187	0.234	0.235	0.341	0.352	0.382

Empirical Analysis

- Hypothesis 3. Investor disagreement and earnings announcement returns. We construct daily abnormal returns based on FFC model:

$$AR_{it} = R_{it} - \left(\widehat{\alpha}_{it} + \widehat{\beta}_{1i}\left(R_{mt} - r_f\right) + \widehat{\beta}_{2i}SMB_t + \widehat{\beta}_{3i}HML_t + \widehat{\beta}_{4i}UMD_t\right)$$



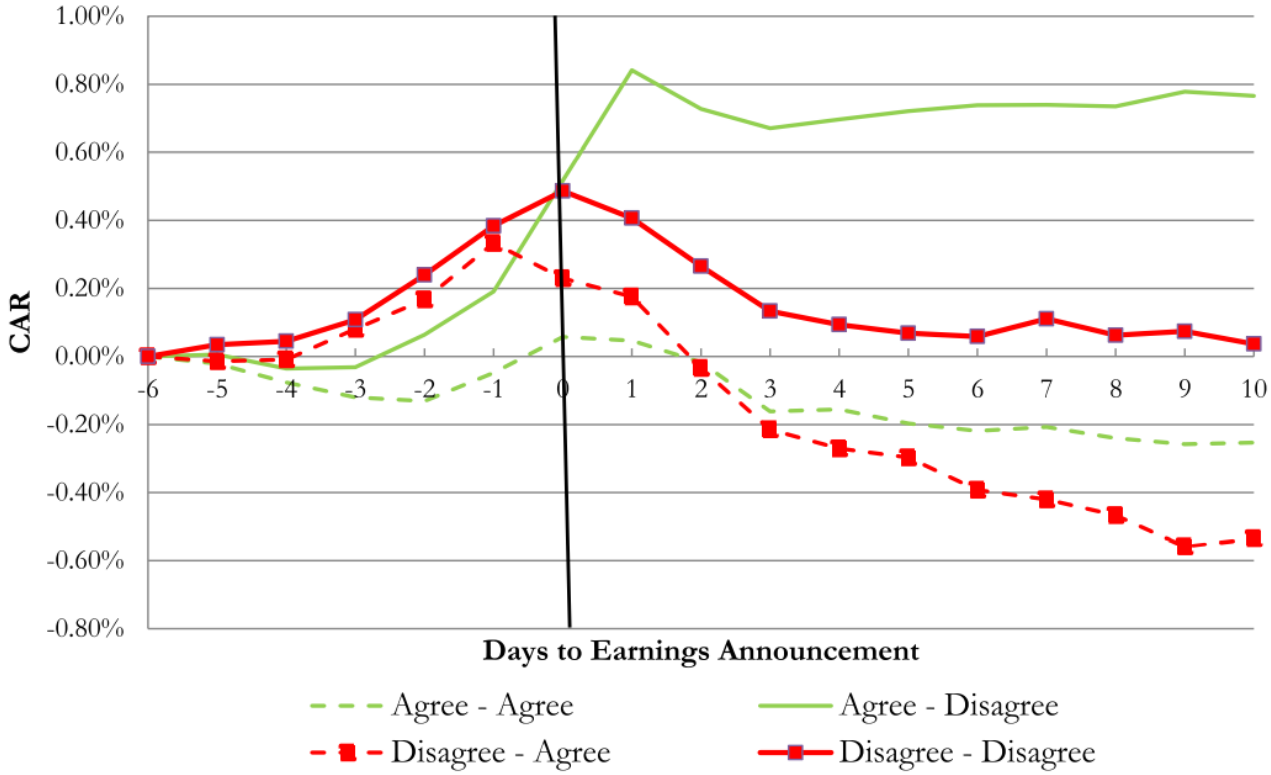
Empirical Analysis

- Hypothesis 3. Investor disagreement and announcement returns.

	#obs	CAR [0,1]	CAR [-1,1]
Panel A: Earnings Announcement Returns Across Groups of Disagreement (%)			
Full Sample			
Agree	10,762	0.33	0.43
Disagree	8989	−0.05	0.11
Disagree − Agree		−0.37***	−0.32***
t-stat		−3.40	−2.85
Low Institutional Ownership			
Agree	5784	0.25	0.39
Disagree	4089	−0.38	−0.18
Disagree − Agree		−0.64***	−0.57***
t-stat		−3.90	−3.38
High Institutional Ownership			
Agree	4978	0.42	0.48
Disagree	4900	0.24	0.35
Disagree − Agree		−0.18	−0.13
t-stat		−1.22	−0.86

Empirical Analysis

- Hypothesis 4. Earnings announcement returns will change when the announcement reduces or generates investor disagreement



Empirical Analysis

- Hypothesis 4. Investor disagreement change and announcement returns

	#obs	CAR [0,1]	CAR [-1,1]
Panel B: Earnings Announcement Returns Across Groups of Change in Disagreement (%)			
Full Sample			
Agree → Disagree	4532	0.65	0.78
Agree → Agree	6230	0.09	0.18
Disagree → Disagree	5616	0.02	0.17
Disagree → Agree	3373	−0.16	0.01
DA − AD		−0.81***	−0.77***
t-stat		−4.48	−4.14
Low Institutional Ownership			
Agree → Disagree	2155	0.61	0.77
Agree → Agree	3629	0.04	0.16
Disagree → Disagree	2415	−0.30	−0.04
Disagree → Agree	1674	−0.50	−0.39
DA − AD		−1.11***	−1.16***
t-stat		−4.05	−4.08
High Institutional Ownership			
Agree → Disagree	2377	0.69	0.79
Agree → Agree	2601	0.18	0.20
Disagree → Disagree	3201	0.27	0.32
Disagree → Agree	1699	0.19	0.40
DA − AD		−0.50***	−0.39
t-stat		−2.14	−1.60

Empirical Analysis

- Regressions of earnings announcement returns

Dependent Variables: CAR [0,1]								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DIVOP	−0.369***	−0.379***	−0.230*	−0.255**	−0.378***	−0.213*	−0.373***	−0.271**
	(-3.21)	(-3.33)	(-1.72)	(-2.05)	(-3.31)	(-1.69)	(-3.24)	(-2.42)
SUE		1.289***	1.312***	1.297***	1.289***	1.216***	1.290***	1.283***
		(18.97)	(20.04)	(16.88)	(18.55)	(11.18)	(18.92)	(18.86)
IMPACT		−0.032	−0.136***	−0.024	−0.032	−0.021	−0.033	−0.012
		(-1.00)	(-3.45)	(-0.72)	(-1.00)	(-0.67)	(-1.02)	(-0.36)
NEWS		0.014	−0.012	0.015	0.014	0.012	0.013	0.009
		(1.61)	(-0.69)	(1.58)	(1.62)	(1.47)	(1.53)	(0.98)
INCVOL				−8.115***				
				(-2.76)				
RETVOL					0.341			
					(0.05)			
DISP						−0.129		
						(-0.85)		
Ln(1/AGE)							0.072	
							(0.97)	
TURN								−0.364***
								(-3.84)
Lagged Returns	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	No	No	Yes	No	No	No	No	No
Observations	19,751	18,584	18,584	16,158	18,584	8957	18,584	18,584
R-square	0.001	0.054	0.061	0.061	0.061	0.052	0.061	0.062

Subsample: We follow Akbas (2016) and calculate unusual volume as the average daily turnover in the [-6,-2] window minus average daily turnover in the [-61,-12] window

Panel A: Earnings Announcement Returns (%) across Groups of Unusual Volume

	#obs	CAR [0,1]	CAR [-1,1]
Low Unusual Volume			
Agree	5489	0.32	0.42
Disagree	4386	−0.31	−0.18
Disagree − Agree		−0.63***	−0.60***
t-stat		−3.95	−3.67
High Unusual Volume			
Agree	5273	0.33	0.44
Disagree	4603	0.21	0.38
Disagree − Agree		−0.12	−0.06
t-stat		−0.84	−0.37

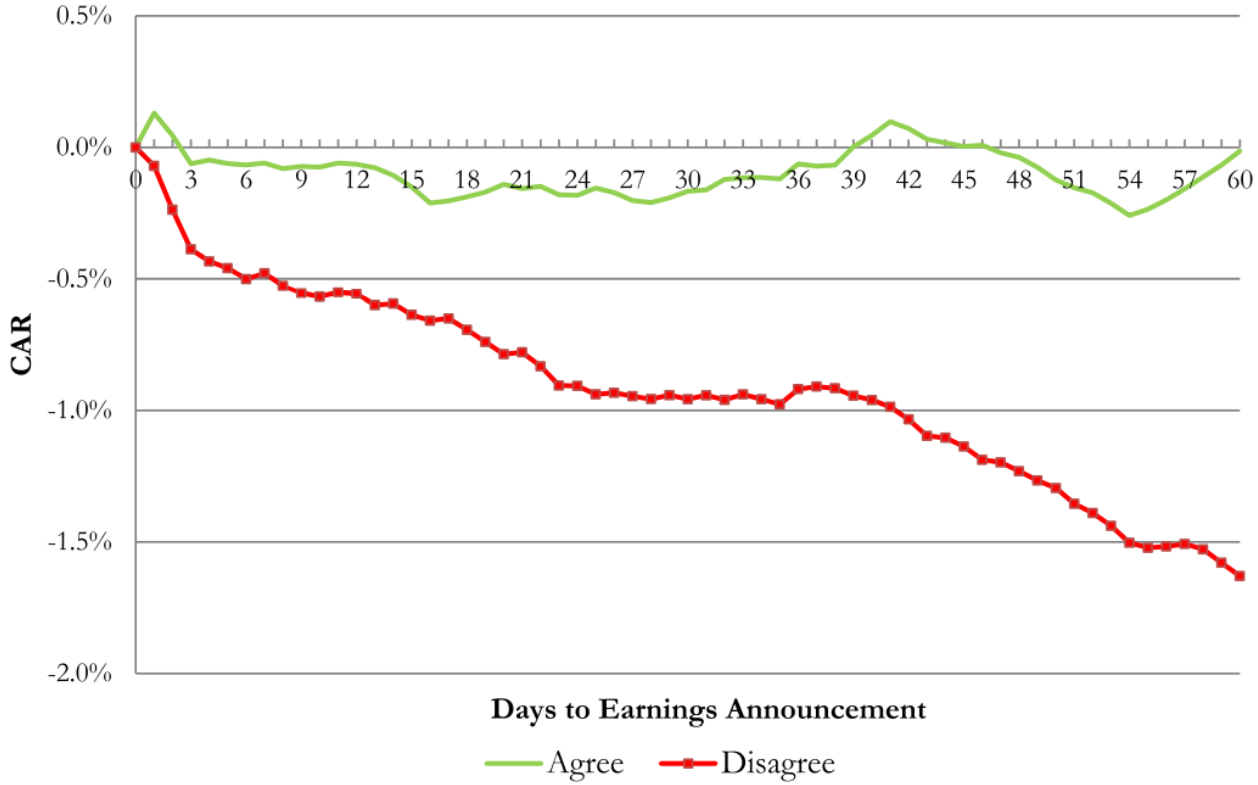
Panel B: Regressions of Earnings Announcement Returns: Groups of Unusual Volume

Dependent Variables: CAR [0,1]

	Low Unusual Volume		High Unusual Volume	
	(1)	(2)	(3)	(4)
DIVOP	−0.634***	−0.570***	−0.126	−0.207
	(-4.16)	(-3.66)	(-0.84)	(-1.38)
SUE		1.308***		1.261***
		(13.65)		(11.60)
IMPACT		−0.072*		0.043
		(-1.83)		(1.12)
NEWS		0.006		0.023*
		(0.58)		(1.82)
Lagged Returns	No	Yes	No	Yes
Observations	9875	9372	9212	9717
R-square	0.002	0.064	0.000	0.058

Robustness

- Classifying sentiment in Twitter posts using the naïve Bayesian approach



Robustness

- Post-earnings announcement returns across disagreement groups using the naïve Bayesian approach

	#obs	CAR [2,10]	CAR [2,20]	CAR [2,60]
Panel A: Post-Earnings Announcement Returns Across Groups of Disagreement (%)				
Agree	10,760	−0.21	−0.27	−0.15
Disagree	8987	−0.50	−0.72	−1.55
D−A		−0.29***	−0.45***	−1.41***
t-stat		−2.82	−2.90	−4.40
Panel B: Post-Earnings Announcement Returns Across Groups of Change in Disagreement (%)				
Agree → Disagree	4532	−0.08	−0.03	0.23
Disagree → Agree	3372	−0.71	−0.95	−1.46
DA − AD		−0.63***	−0.92***	−1.69***
t-stat		−3.91	−3.80	−3.39

	Dependent Variables: CAR [2,60]			Dep: CAR[2,20]	Dep: CAR[2,10]
	(1)	(2)	(3)	(4)	(5)
DIVOP	−1.795***	−1.644***	−1.470***	−0.332*	−0.299***
	(-3.88)	(-3.52)	(-3.21)	(-1.90)	(-2.80)
SUE		−0.348**	−0.232	0.234**	0.247***
		(-1.99)	(-1.30)	(2.47)	(3.44)
IMPACT		−0.378***	−0.472***	−0.146***	−0.079***
		(-3.92)	(-4.73)	(-3.40)	(-2.82)
NEWS		−0.038	−0.095	−0.011	−0.013
		(-1.03)	(-1.59)	(-0.40)	(-0.57)
Lagged Returns	No	Yes	Yes	Yes	Yes
Firm Fixed Effects	No	No	Yes	Yes	Yes
Observations	19,746	18,582	18,582	18,582	18,582
R-square	0.073	0.077	0.080	0.064	0.032

Conclusion

- In this paper, we use a unique data from Stocktwits to examine the impact of disagreement on the price and volume reactions to earnings announcements.
- We find support for the theoretical predictions of the models with prior investor disagreement and the models of “belief jumbling”
- Divergence and convergence of opinion generate abnormal trading volume on and after earnings announcements.
- Earnings announcements where opinions change from prior agreement to disagreement produce positive abnormal returns.

Consideration

- Did not consider the joint influence other than size, and the correlation between the factors was not considered sufficiently
- Time varying problems need to be investigated further