Trading Volume and Dispersion of Signals

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Motivation

- Disagreement
  - a fundamental motivation to trade
  - E.g. interpret common information differentially
- RE models are limited when it comes to explaining volume
  - RE setting has no role for trading – fully revealing equilibrium
  - Partially revealing equilibrium by adding noise
    - Endowment, liquidity or noise trading shocks
    - Structure of volume determined by noise structure (like autocorrelation)
- DO: investors agree to disagree

Disagreement

- How can investors disagree?
  - Differential information
  - Different preferences and endowments
  - Different priors
  - Different likelihoods (interpretation)

- Unobservable!
  - Only proxies exists
  - Analyst forecast dispersion
    - Limited group of agents
    - Motives: generate more trade/profit for their firm?
    - Biased: hired by sell side brokerage firms
    - Evidence of herding
    - Forecasts of earnings (not asset values).
    - Coverage mostly for large firms
    - Not a market based measure

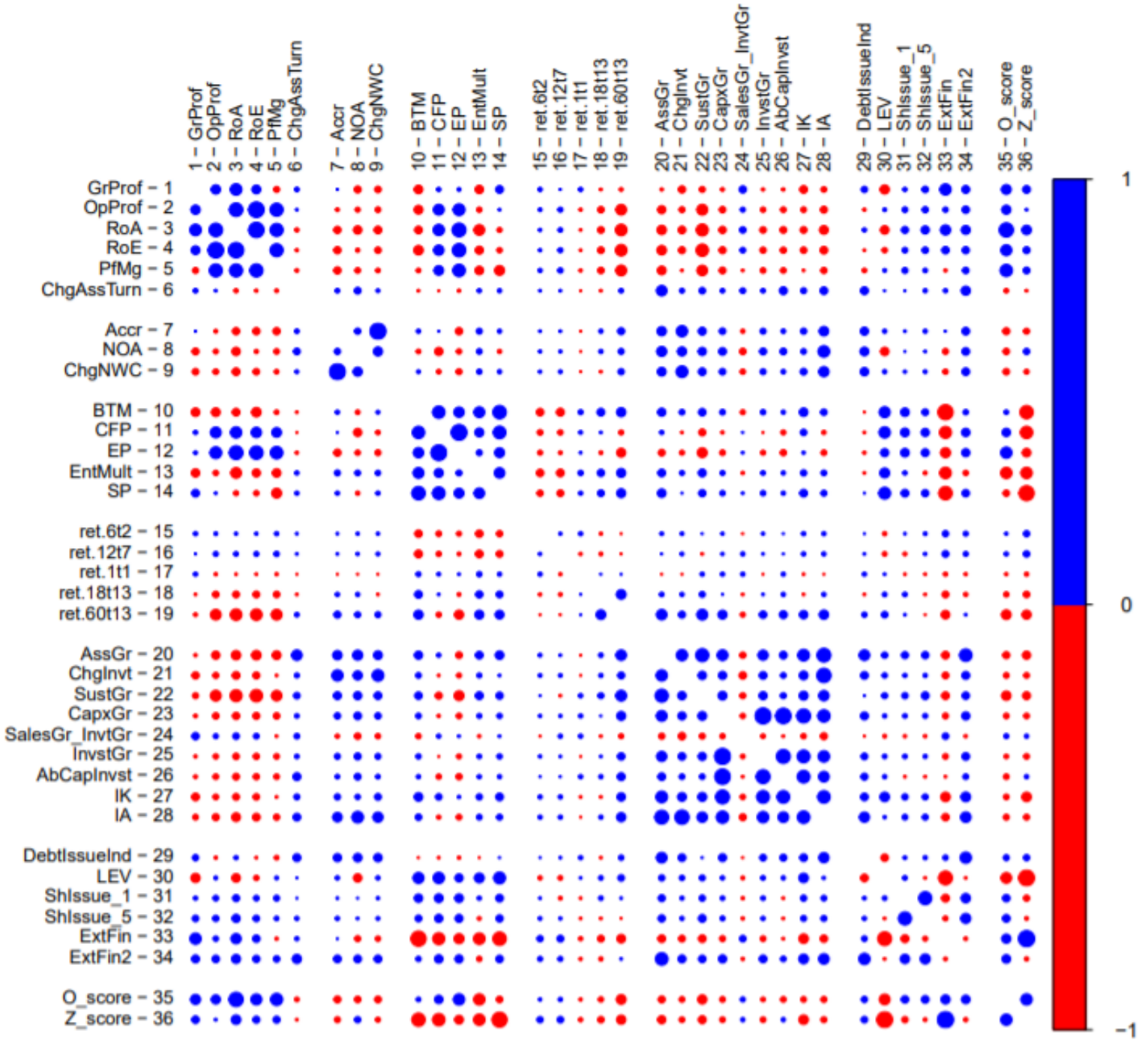
Brief Literature Review

- Kandel and Pearson (1995)
  - In context of EA
  - Documents abnormal volume when $\Delta P = 0$
  - Two factors drive volume:
    - Differential precision of information signals
    - Differential interpretation of those signals (different means)
  - Agree to disagree
    - Investors are naïve about different likelihoods.
  - Identify flips and divergences in analyst revisions as evidence of differential interpretation

- Chordia et al (2006)
  - Comprehensive study: liquidity trading, informed trading, fundamental uncertainty, dispersion of beliefs

Anomalies

- 36 anomalies from two recent research papers. All based on CRSP and COMPUSTAT
- Seven broad categories
  - profitability (6), earnings quality (3), valuation (5), momentum (5), investment (9), financing (6) and, distress (2)



Measuring Disagreement

- Each of the 36 return anomalies is used to cross-sectionally rank stocks based on their expected future performance.
- Top 30% stocks get a buy (+1) signals, bottom 30% get a sell signal (-1)
- Other measures: absolute deviation, principal component deviation

P/E	RoA	ret_t-1	BTM
Intel	Home Depot	Salesforce	JP Morgan
Verizon	Apple	Home Depot	Intel
JP Morgan	Microsoft	United Health	Disney
…	…	…	…
…	…	…	…
Nike	Verizon	Intel	Nike
Salesforce	JP Morgan	Nike	Apple
Disney	Disney	Disney	Home Depot

$$T_{f,t,s} = \begin{cases} -1, & A_{f,t,s} < L_{t,s} \\ 0, & L_{t,s} \le A_{f,t,s} \le H_{t,s} \\ 1, & A_{f,t,s} > H_{t,s} \end{cases}$$

$$\overline{T_{f,t}} = \frac{\sum_s T_{f,t,s}}{|S|} \qquad \frac{\sum_s (T_{f,t,s} - \overline{T_{f,t}})^2}{|T_{f,t}| - 1},$$

Hypothesis

$$Volume_{i,t+1} = \beta_0 + \beta_1 \cdot Signal\_Deviation_{i,t} + \gamma \cdot Controls_{i,t} + u_{i,t+1}$$

- To the extent that investors differ in their model to predict future stock prices by trading on a particular anomaly signal, then higher dispersion across these signals should predict higher trading volume
  - Investors use diff models of asset valuation (i.e. anomalies) →
  - The output (buy/sell trading signals) of these models disagree →
  - This gives rise to (anomaly driven) trading
- The coef. β_1 should be higher for
  - Small firms – investors more likely to use anomalies due to lack of info.
  - Value firms (high BTM) – value investing predominantly uses anomalies
  - Post EDGAR implementation – fundamental info readily available

Data

- Anomalies from CRSP/COMPUSTAT
- FDISP from Thomson Reuters (IBES)
- Data Snooping:
  - First work to study disagreement arising from trading signals generated from return predicting anomalies.
    - Much of the consolidating work on anomalies has been to look at which of them work out of sample and what broad factors can subsume other anomalies (Cochrane: “factor zoo”).
  - Rudimentary disagreement measure – std. deviation of ternary signals (-1/0/1)
    - Unlikely to be greatly affected by inclusion/exclusion of a few anomalies
    - Not using the exact degree of return prediction.
  - Used all factors from a published paper. Hence, no cherry picking.
  - Study covers all firms over entire 1962-2019 period. No p-hacking by sample selection

Correlations

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1)	*NASDAQ*		0.01	−0.05	−0.23	0.00#	−0.09	−0.30	−0.48	−0.41	0.03	0.00#	−0.28	0.06	0.20
(2)	RET^{+}	0.04		0.53	−0.05	−0.00#	−0.10	0.04	−0.03	0.02	0.06	0.04	−0.03	0.03	0.07
(3)	RET^{-}	−0.06	0.26		−0.00#	0.00#	−0.04	0.21	0.08	0.14	−0.08	−0.09	0.06	−0.11	−0.17
(4)	*LEV*	−0.07	−0.01	−0.05		0.01	0.41	−0.07	0.16	−0.01	0.18	0.28	0.01	0.11	−0.09
(5)	$CAPM\_\beta$	−0.00#	−0.01	0.00#	−0.00#		0.01	0.00#	0.01	0.00#	−0.00#	−0.00#	0.01	−0.02	−0.01
(6)	*BTM*	−0.04	−0.04	−0.04	0.38	0.00		−0.21	0.17	−0.25	0.25	0.36	−0.14	0.21	−0.17
(7)	*L_PRC*	−0.28	−0.04	0.24	−0.11	0.00#	−0.12		0.30	0.77	−0.43	−0.55	0.48	−0.36	−0.35
(8)	*L_FAGE*	−0.38	−0.04	0.08	0.03	0.01	0.08	0.21		0.33	−0.01	−0.01	0.26	−0.01	−0.27
(9)	*L_ME*	−0.42	−0.05	0.16	−0.09	0.01#	−0.16	0.76	0.26		−0.11	−0.12	0.75	−0.11	−0.30
(10)	*ESURP*	−0.00	0.03	−0.04	0.12	−0.02	0.05	−0.15	−0.07	−0.38		0.67	−0.17	0.38	0.28
(11)	*EVOL*	−0.01	0.03	−0.03	0.14	−0.02	0.02	−0.16	−0.04	−0.47	0.61		−0.21	0.42	0.31
(12)	*NUMEST*	−0.28	−0.06	0.06	−0.04	0.01	−0.10	0.45	0.29	0.65	−0.06	−0.06		−0.14	−0.13
(13)	*FDISP*	0.02	0.02	−0.05	0.05	−0.00#	0.10	−0.16	−0.08	−0.27	0.10	0.11	−0.06		0.20
(14)	*STD_DEV*	0.21	0.10	−0.18	0.10	−0.01	0.00	−0.37	−0.26	−0.30	0.13	0.13	−0.13	0.09	

- Coef. on STD_DEV is stable and significant.
  - 1 SD increase in STD_DEV_{t-1} predicts 15.5% higher VOL_t
  - Explains parts of variation due to fundamental uncertainty (ESURP) and analyst dispersion (FDISP)
    - ESURP (falls by 13%) and EVOL (falls by 63%)
    - FDISP (falls by 46%)
  - Other Controls: NASDAQ, RET+, RET-, LEV, BTM, CAPM_BETA, PRC, AGE

Results

$ESURP_{t-1}$	0.504***		0.594***	0.440***		0.519***
	(0.071)		(0.076)	(0.061)		(0.064)
$EVOL_{t-1}$	0.371***		0.448***	0.134		0.188**
	(0.091)		(0.098)	(0.084)		(0.087)
$NUMEST_{t-1}$	0.033***	0.034***		0.033***	0.033***	
	(0.002)	(0.002)		(0.002)	(0.002)	
$FDISP_{t-1}$	0.041***	0.047***		0.022***	0.026***	
	(0.008)	(0.008)		(0.008)	(0.008)	
STD_DEV_{t-1}				1.464***	1.507***	1.559***
				(0.065)	(0.065)	(0.070)
Within R^2	0.165	0.161	0.107	0.185	0.184	0.131
Adj. R^2	0.424	0.422	0.384	0.439	0.438	0.401
$\%R^2$ Explained				5.15	5.35	5.86
Observations	672,385	672,385	672,385	672,385	672,385	672,385

Different Turnover Measures

- STD_DEV is consistently positive across diff measures of turnover
- FDISP on the other hand becomes negative in 4 (out of 7) cases

	L_TURN_t	ΔL_TURN_t	$L\_TURN\_GRT_t$	$L\_TURN\_D_t$
$FDISP_{t-1}$	0.023***	-0.003**	0.032***	-0.011**
	(0.008)	(0.001)	(0.008)	(0.004)
STD_DEV_{t-1}	1.464***	0.018**	0.833***	0.450***
	(0.066)	(0.008)	(0.062)	(0.030)

	$L\_TURN\_ILLIQ_t$	$VW\_L\_TURN_t$	$EW\_L\_TURN_t$
$FDISP_{t-1}$	0.008**	-0.014***	-0.012***
	(0.003)	(0.004)	(0.004)
STD_DEV_{t-1}	0.212***	0.509***	0.498***
	(0.025)	(0.032)	(0.033)

Different Disagreement Measures

- The level and significance of association is unchanged by the measure and calculation of disagreement metric.

STD_DEV_{t-1}	1.347^{***}			
	(0.075)			
ABS_DEV_{t-1}		1.107^{***}		
		(0.061)		
PC_DEV_{t-1}			1.411^{***}	
			(0.076)	
$CONT\_DEV_{t-1}$				3.482^{***}
				(0.191)

$^{NYSE}STD\_DEV_{t-1}^{80/20}$	1.038^{***}	
	(0.074)	
$^{NYSE}STD\_DEV_{t-1}^{70/30}$		1.096^{***}
		(0.084)
$^{NASDAQ}STD\_DEV_{t-1}^{80/20}$	1.295^{***}	
	(0.071)	
$^{NASDAQ}STD\_DEV_{t-1}^{70/30}$		1.388^{***}
		(0.084)

- Using $^{NASDAQ}STD\_DEV_{t-1}^{80/20}$ explains 16% of unexplained variation.

Rank Regressions

- Construction
  - At each date all values are ranked and then scaled to [0,1]
- Benefits
  - Safety against outliers
  - Removal of time-series non-stationarity
  - Coef. of different variables can be compared
  - Easy interpretation

	L_TURN_t		$L\_TURN\_R_t$	
	(1)	(2)	(3)	(4)
$ESURP\_R_{t-1}$	0.278^{***}	0.248^{***}	0.076^{***}	0.068^{***}
	(0.013)	(0.013)	(0.004)	(0.003)
$EVOL\_R_{t-1}$	0.316^{***}	0.225^{***}	0.091^{***}	0.067^{***}
	(0.029)	(0.030)	(0.008)	(0.008)
$NUMEST\_R_{t-1}$	1.304^{***}	1.287^{***}	0.366^{***}	0.362^{***}
	(0.058)	(0.058)	(0.016)	(0.016)
$FDISP\_R_{t-1}$	0.186^{***}	0.153^{***}	0.053^{***}	0.044^{***}
	(0.024)	(0.024)	(0.006)	(0.006)
$STD\_DEV\_R_{t-1}$		0.485^{***}		0.130^{***}
		(0.028)		(0.007)

- Observations:
  - Rise in STD_DEV from 25th to 75th percentile predicts 27.8% higher volume.
  - STD_DEV explains more than 3 times the volume as explained by FDISP. It also reduces the effect of FDISP.

Patterns in Disagreement Volume Relation

- Small/Medium Stocks
  - Not enough information other than fundamentals
  - Investors fall back to anomalies

	SMALL		*MEDIUM*		*BIG*	
$FDISP_{t-1}$	0.030***	0.020**	0.044***	0.016*	0.080***	0.060***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.016)	(0.015)
STD_DEV_{t-1}		1.439***		1.748***		1.057***
		(0.105)		(0.076)		(0.099)

- Post EDGAR implementation
  - Ease of availability of accounting fundamentals to general public

	pre EDGAR		*post EDGAR*	
$FDISP_{t-1}$	0.038***	0.026*	0.030***	0.014*
	(0.014)	(0.013)	(0.008)	(0.008)
STD_DEV_{t-1}		0.966***		1.485***
		(0.114)		(0.071)

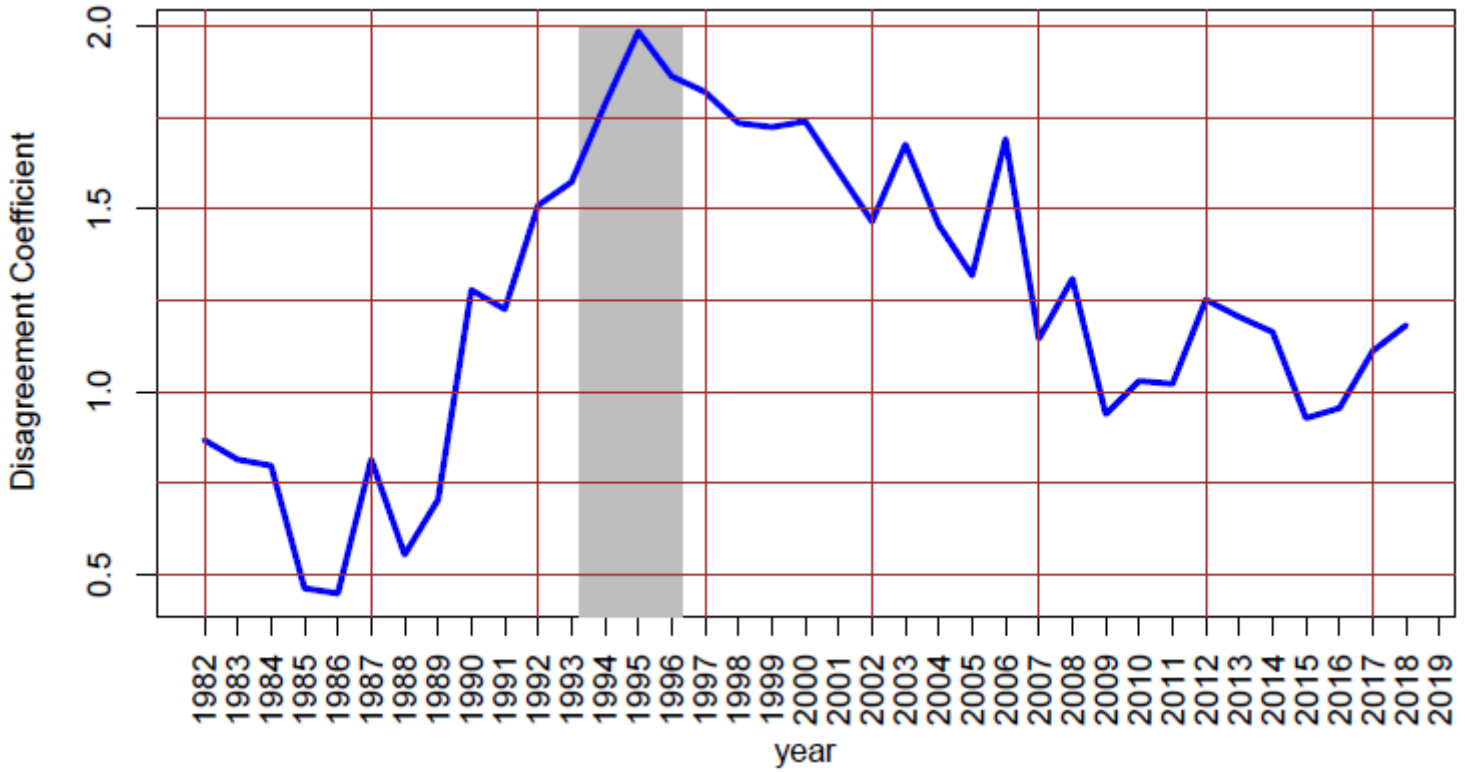
- Value Stocks
  - Value investing primarily depends on fundamental to price ratios (anomalies) for investment

	BTM-1		*BTM-2*		*BTM-3*	
$FDISP_{t-1}$	-0.006	-0.015	0.041***	0.021*	0.057***	0.044***
	(0.017)	(0.017)	(0.011)	(0.011)	(0.009)	(0.009)
STD_DEV_{t-1}		1.164***		1.358***		1.503***
		(0.107)		(0.068)		(0.123)

Different Samples

	1975-1979 (1)	*1980-1984* (2)	*1985-1989* (3)	*1990-1994* (4)	*1995-1999* (5)	*2000-2004* (6)	*2005-2009* (7)	*2010-2014* (8)	*2015-2019* (9)
$FDISP_{t-1}$	0.017	0.006	0.010*	0.008	0.008	0.008***	0.012*	0.004	0.007*
	(0.115)	(0.005)	(0.005)	(0.006)	(0.006)	(0.003)	(0.007)	(0.006)	(0.004)
STD_DEV_{t-1}	0.579**	0.778***	0.754***	1.618***	1.998***	1.720***	1.554***	1.337***	1.134***
	(0.233)	(0.180)	(0.133)	(0.144)	(0.118)	(0.109)	(0.121)	(0.105)	(0.106)

- STD_DEV is significant across all 5-year periods.
- Coef. on FDISP is significantly down
- Clear rise in STD_DEV coef. from 1990s ← EDGAR effect!



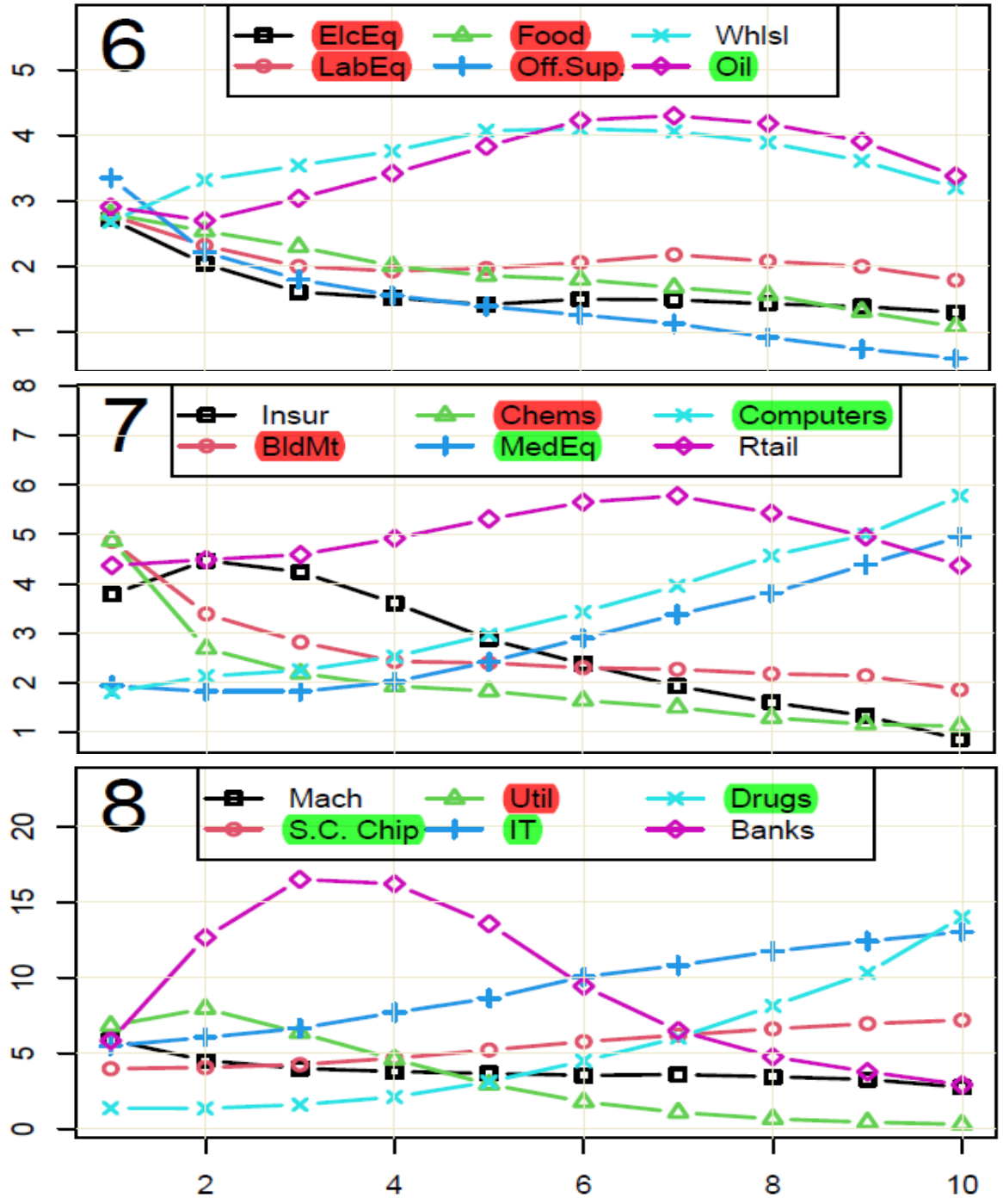
Information Environment and Disagreement

- Sensitivity of volume to disagreement captures firm's information dissemination inefficiency
  - Disrupted, convoluted, opaque or delayed
- Other determinants
  - Firm age, report length, number of segments, institutional ownership
- Construct a firm by firm measure of inefficiency
  - Predicts next period volatility and spread

Portfolio Criterion	w/o STD_DEV	with STD_DEV	
	$FDISP_{t-1}$	$FDISP_{t-1}$	STD_DEV_{t-1}
Number of Analysts			
$NUMEST \in \{2,3\}$	0.046***	0.030***	1.652***
$NUMEST \in \{4 \ldots 10\}$	0.043***	0.023***	1.569***
$NUMEST \geq 11$	0.061***	0.043***	1.198***
10-K Document Size			
DOC_SIZE-1	0.016	0.005	1.202***
DOC_SIZE-2	0.028***	0.013	1.412***
DOC_SIZE-3	0.039***	0.018	1.719***
10-K Complex Words			
$COMPLEX\_WORDS-1$	0.034*	0.015	1.357***
$COMPLEX\_WORDS-2$	0.021**	0.007	1.366***
$COMPLEX\_WORDS-3$	0.013	-0.003	1.688***
Months (s) Since 10-K Filing			
$s \in \{1,2,3\}$	0.036***	0.022***	1.441***
$s \in \{4,5,6\}$	0.032***	0.012	1.459***
$s \in \{7,8,9\}$	0.019	0.001	1.504***
$s \geq 10$	0.032**	0.014	1.599***

Disagreement and Industry Characteristics

- Should disagreement be higher for?
  - Utilities
    - stable cash flows, established businesses and no growth options
  - Pharmaceuticals
    - R&D, drug trials, regulations, patents and lots of real options
- High disagreement: Oil, Drugs, Wholesale, S.C. chips, IT, Retail
  - Fundamental uncertainty
    - Real options, uncertain future cash flows, growth opportunities, patents, global risks.
  - Low Disagreement: materials, utilities, chemicals, machines, insurance



Thank You!