Biased News and Irrational Investors: Evidence from Biased Beliefs about Uncertainty and Information Acquisition

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What is this paper about?

- To propose a novel understanding of the cause of investors' irrational decision-making behaviors, especially in firm-specific (private) information acquisition.

  $\Rightarrow$ To suggest that investors' irrationality mainly originates from information transmission bias, e.g. biased public information from news stories.

  $\Rightarrow$ To challenge the traditional assumptions in behavioral economics (e.g., overconfidence, heuristics effects, etc.) as the sole cause of economic agents' biased decisions.

  $\Rightarrow$ Not to presume that investors deliberately behave as irrational agents; to some extent, they are "forced" into behaving sub-optimally when they receive and apply biased public news information.

What is this paper about?

- Theory

  $\Rightarrow$ News "tone" (measured by textual sentiment) as a proxy for biased public information and firm-specific (private) information acquisition are negatively related.

  $\rightarrow$ 1. Investors read news written with linguistic or rhetorical tones about the market or firm-specific conditions.

  $\rightarrow$ 2. News tones bias investors' beliefs about the market or firm-specific uncertainty in the risky asset payoff from rational expectations.

  $\rightarrow$ 3. Investors are naive in their biased beliefs about the risky asset payoff uncertainties.[1]

  $\rightarrow$ 4. Investors' acquisition of firm-specific information deviates from the rational expectations equilibrium.

  $\rightarrow$ 5. Information risk in the asset varies with firm-specific news sentiment.[2]

[1] The naivety can be easily relaxed. See studies by (Anderson and McLaren, 2012; Gentzkow et al., 2015).

[2] The causation is from deviations of proportions of informed investors.

What is this paper about?

- Empirical Analysis

  $\Rightarrow$ There is a significant negative relationship between news sentiment and uncertainty proxies found in the data.

  $\Rightarrow$ News sentiment negatively predicts firm-specific information acquisition measured by the earnings-related information incorporated into the price before announcements.

  $\Rightarrow$ Firm-specific news sentiment positively predicts Generalized Probability of Informed Trade (GPIN) as a proxy for information risk.

  $\Rightarrow$ An increase in firm-specific news sentiment is predictive of a higher expected stock return.

  $\Rightarrow$ This positive return predictability is a novel argument for information risk premium caused by news sentiment.

Information Acquisition Literature

- Rational Expectations

  $\Rightarrow$ Uncertainty plays a crucial role in finance and economics studies of information acquisition (Grossman and Stiglitz, 1980; Veldkamp, 2006; Andrei et al., 2019; Benamar et al., 2019).

- Behavioral Perspective

  $\Rightarrow$ Overconfident investors overestimate the precision of private information and make irrational decisions on information acquisition (Odean, 1998; García et al., 2007; Ko and Huang, 2007).

- Enrichment from behavioral studies

  $\Rightarrow$ The incorporation of psychological factors can enrich neoclassical economics studies Tirole (2002). However, the preferred focus is on parsimony and normative analysis rather than the impulsive framework of psychology.

Information Transmission Bias Literature

- In a recent study by Hirshleifer (2020) proposes a novel intellectual paradigm-social economics and finance studies of agents' economic thinking and behaviors are shaped through social processes.
- Hirshleifer studies a model showing economic agents' irrational behaviors are caused by receiving information or signals containing bias which is added by the senders.
- **Following Hirsheilfer's (2020) study of biased information transmission, this study contributes a new understanding of how investors can make sub-optimal decisions by consuming news with biased tones added by information purveyors rather than though any inherent irrationality.**

Media Bias Literature

- Bias in the media, such as tones in the news, slants agents' economic and political decision-making (Mullainathan and Shleifer, 2005; Baron, 2006; Gentzkow et al., 2015).
- In financial markets, the news reported with journalists' preferences significantly impacts stock market behaviors and financial valuations (Dougal et al., 2012; Gurun and Butler, 2012; Hillert et al., 2018).
- **My study adds to the literature to bridge the gap on the effect of biased information from news on investors' acquisition of firm-specific information.**

  $\Rightarrow$ *Theoretical implications are from the biased acquisition of firm-specific information induced by the bias in the news-tones measured by textual sentiment.*

- *In this paper, the biasing affects the news tones to slant investors' beliefs about uncertainties.*

Measure of Tone in the News

- The tone in the news is measured by sentiment from the textual analysis provided by Thomson Reuther MarketPsych (TRMI).
- Daily news sentiment is calculated as :

$$Sentiment_{j,t} = \frac{Positive - Negative}{Total\ Buzz}, \text{where } \ j \in \{m, i\}$$

$\Rightarrow$ *Positive* is the sum of the count of all *Positive* terms and phrases.

$\Rightarrow$ *Negative* is the sum of the count of all *Negative* terms and phrases.

$\Rightarrow$ *Total Buzz* is the sum of total *Positive* and *Negative* counts of terms and phrases.

- For the quarterly or yearly study, the sentiment is aggregated by *Buzz*:

$$Sentiment_{j,T} = \frac{Buzz_{j,t} Sentiment_{j,t}}{\sum_t^T Buzz_{j,t}}$$

Biased Beliefs of Market Uncertainty

Negative relation between market uncertainty and sentiment in the market news

- I use VIX and Economic Policy Uncertainty (EPU) Index created by Baker et al. (2016) as the measure of market uncertainty.

Systematic Variable Correlations

	Stock Market Sentiment	VIX	EPU
Stock Market Buzz	-0.154	0.012	0.079
Stock Market Sentiment		**-0.319**	**-0.096**
VIX			0.406

- Note that the negative relation between textual sentiment and market uncertainty measures has been broadly discussed in the literature.[3]

[3] In Online Appendix, I also conduct a **test** to verify this empirical evidence.

Biased Beliefs of Firm-Specific Uncertainty

Negative relation between firm-specific uncertainty and sentiment in firm-specific news

- I use three proxies to measure firm-specific uncertainty.

  $\Rightarrow$ MSE from the AR(1) model of firm quarterly earnings:

$$EPS_{i,t+1} = \gamma_0 + \gamma_1 EPS_{i,t} + \epsilon_{i,t}$$

$$\hat{\sigma}^2_{e,t} \text{ for firm } i = \frac{\sum_{t=1}^{T} \epsilon^2_{i,t}}{T-2}$$

  $\Rightarrow$ The absolute value of unexpected earnings: $Abs(SUE)$

  $\Rightarrow$ The idiosyncratic volatility shock by Bali et al. (2018) :

$$IVOL_{i,t} = \phi_{0,t} + \phi_{1,t}\overline{IVOL}_{i,t-1} + \sum_{j=1}^{10} \Phi_{j,t} D_{i,j} + v_{i,t}$$

$$IDIO^{shock}_{i,t} \equiv v_{i,t}$$

Findings from Data

$$\hat{\sigma}^2_{e,t} = \beta_0 + \beta_1 Sentiment_{i,[t-30,t-1]} + X\delta + \epsilon_{i,t} \quad (a)$$

$$IDIO^{shock}_{i,t} = \beta_0 + \beta_1 Sentiment_{i,t-1} + X\delta + \epsilon_{i,t} \quad (b)$$

Table 1: Firm-Specific News Sentiment and Firm-Specific Uncertainty

	(1)	(2)	(3)	(4)
Dependent Variable	AR(1) σ^2_e	$Abs(SUE_{i,t})$	$Abs(SUE^{IBES}_{i,t})$	$IDIO^{shock}_{i,t}$
Sentiment$_{i,t-1}$	**−0.013*****	**−0.006*****	**−0.0004*****	**−0.0003*****
	(0.004)	(0.002)	(0.000)	(0.0001)
LagDep	0.926***	0.379***	0.317***	0.967***
	(0.006)	(0.018)	(0.012)	(0.0005)
Controls	Yes	Yes	Yes	Yes
FE Firm	Yes	Yes	Yes	
FE Year-Quarter	Yes	Yes	Yes	
Fama-Macbeth				Yes
Constant				0.0035***
				(0.0004)
Observations	61,393	89,973	89,973	2,847,177
R-squared	0.925	0.234	0.155	0.939
Number of id	2,589	3,042	3,042	3,592

Clustered standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

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$$\underset{j\in(m,e)}{\beta(S_j,\sigma_j^2)} = \sigma_{b,j}^2 \begin{cases} S_j \uparrow & \sigma_{b,j}^2 < \sigma_j^2 \\ S_j = 0 & \sigma_{b,j}^2 = \sigma_j^2 \\ S_j \downarrow & \sigma_{b,j}^2 > \sigma_j^2 \end{cases}$$

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where $\beta(*)$ is the bias function to paramterize biased belief of uncertainties.

- Therefore, I develop a model by extending on the study by Andrei et al. (2019) and analyze how the negative relation between news sentiment and uncertainty affects investors' economic behaviors in acquiring firm-specific information when making investment decisions.

Theory

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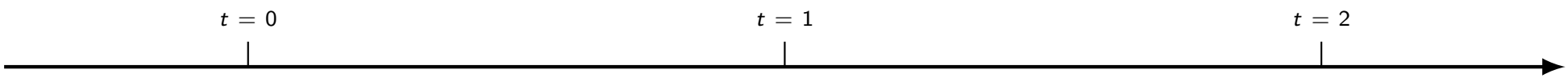
- Model with three dates
- Assets
  - $\Rightarrow$ A risk free asset paying a gross interest r_f on the last date
  - $\Rightarrow$ A risky asset with payoff D_2 realized on the last date
- The risky asset payoff D_2 has three components:
  - $\Rightarrow$ a mean payoff $\overline{D} > 0$
  - $\Rightarrow$ a market component $m_2 \sim N(0, \sigma_m^2)$
  - $\Rightarrow$ a firm-specific component $e_1 \sim N(0, \sigma_e^2)$
  - $\Rightarrow$ $D_2 = \overline{D} + m_2 + e_1$
- Two types of agents

  1. Informed investors: pay a cost (e.g. hiring financial advisers, analyzing financial reports etc.) to acquire the firm-specific information, e_1.

  2. Uninformed investors: stay uninformed about e_1 but can partially learn from the price discovery process.

Timeline



1 - Investors consume news either about the market or particular firms; their beliefs of uncertainty about the market (σ_m^2) and the firm (σ_e^2) are biased by the tone ($S_{m/e}$) in the news:

$$\underset{j\in(m,e)}{\beta(S_j, \sigma_j^2) = \sigma_{b,j}^2} \begin{cases} S_j \uparrow & \sigma_{b,j}^2 < \sigma_j^2 \\ S_j = 0 & \sigma_{b,j}^2 = \sigma_j^2 \\ S_j \downarrow & \sigma_{b,j}^2 > \sigma_j^2 \end{cases}$$

2 - Investors decide if they want to pay a cost c to acquire firm-specific information e_1 based on their unconscious biased beliefs about uncertainties ($\sigma_{b,j}^2$).

3 - There is a public signal about the market component $M_1 = m_2 + \eta_1$, where $\eta_1 \sim N(0, \sigma_\eta^2)$;

4 - Informed investors (λ_1) perfectly observe the firm-specific component e_1;

5 - All investors submit their demand for the risky asset (q^I and q^U), and the risky asset random supply, $x_1 \sim N(\overline{x}, \sigma_x^2)$.

6 - Investors trade competitively, and the market is cleared at:

$$\lambda_1 q^I + (1 - \lambda_1) q^U = x_1$$

7 - Asset payoff is realized D_2.

Biased Belief Equilibrium

- The model can be solved as the standard NREE model (Grossman and Stiglitz, 1980) by virtue of the naivety assumption for investors.

  $\Rightarrow$ The informative signal from equilibrium price revealing is:

$$\hat{p}_1 = \frac{P_1 - A\overline{D} - BM_1 + (K-H)\overline{x}}{G} = e_1 - \frac{K}{G}(x_1 - \overline{x})$$

  $\Rightarrow$ The indifference condition subject to biased beliefs is :

$$\frac{\mathbf{U}_b^I}{\mathbf{U}_b^U} = e^{\alpha c}\sqrt{\frac{Var_{b,1}^I[D_2]}{Var_{b,1}^U[D_2]}} = 1$$

  $\Rightarrow$ In investors' **biased belief equilibrium**, the proportion of investors who become informed λ_1 is solved by the benefit and cost function:[4]

$$\Pi(*) = \frac{\lambda_1^2\sigma_{b,e}^2\delta + \alpha^2 Var_{b,1}^I[D_2]^2\sigma_x^2\delta - \alpha^2 Var_{b,1}^I[D_2]\sigma_x^2\sigma_{b,e}^2}{\alpha^2 Var_{b,1}^I[D_2]\sigma_x^2\sigma_{b,e}^2\delta} = 0, \text{where} \quad \delta = e^{2\alpha c} - 1$$

[4]Noted that $Var_{b,1}^I[D_2]$ is a linear projection of $\sigma_{b,m}^2$ and σ_η^2 and directly biased as $\sigma_{b,m}^2$ is biased by tones in the market news.

Biased News Impact on Information Acquisition

Proposition 1

In equilibrium, from the benefit and cost function $\Pi(*)$ under a necessary condition $\Pi^{'}(\lambda_1) \geqslant 0$, since $\frac{\partial \lambda_1}{\partial \sigma_{b,j}} > 0$ and from the bias function $\beta(S_j, \sigma_j)$, $\sigma^2_{b,j}$ monotonically decreases with S_j, the model predicts $\frac{\partial \lambda_1}{\partial S_j} < 0$, where $j \in \{m, e\}$.

- **Other things being equal, the proportion of informed investors, λ_1, deviates from the rational expectations equilibrium because investors' belief of $\sigma^2_{b,m}$ or $\sigma^2_{b,e}$ are affected by the biased tones in the market or firm-specific news respectively.**

$\Rightarrow$ Market news tone (sentiment)

$S_m \xrightarrow{biases} \sigma^2_{b,m} \rightarrow$ price informativeness, $n_b = \frac{\lambda_1^2 \sigma^2_{b,e}}{\alpha^2 Var^I_{b,1}[D_2]^2 \sigma^2_x}$

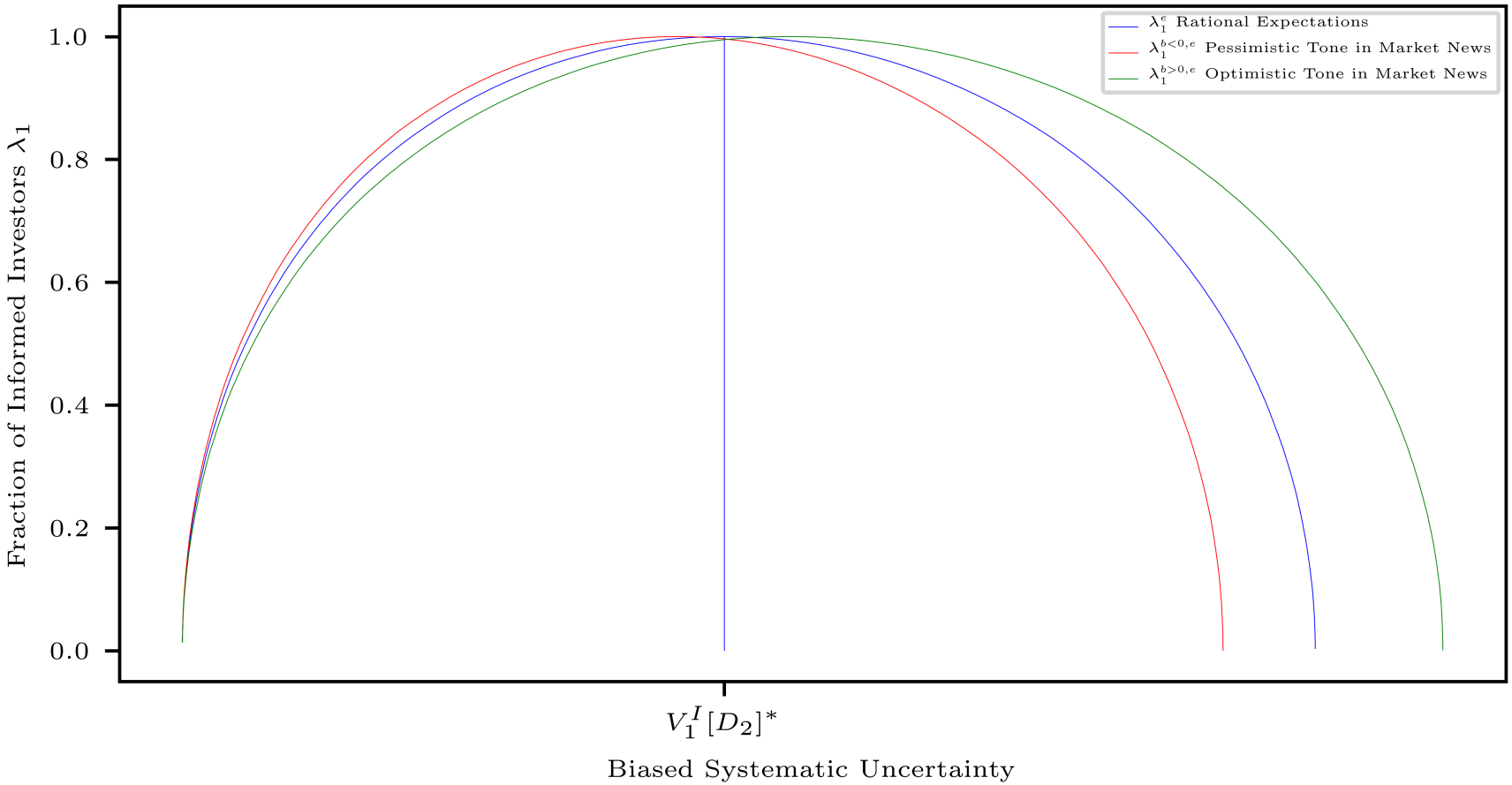
$\Rightarrow$ Firm-specific news tone (sentiment)

$S_e \xrightarrow{biases} \sigma^2_{b,e} \rightarrow Var^U_{b,1}[e_1|\hat{p}_1]$

Market News Sentiment Effect (S_m, $\sigma^2_{b,m}$ and λ_1)

Green Curve-Positive tone in the market news : $S_m \uparrow \rightarrow \sigma^2_{b,m}(Var^I_{b,1}[D_2]) \downarrow \rightarrow$ investors irrationally trade aggressively $\rightarrow n_b \uparrow \rightarrow \lambda_1 \downarrow$

Red Curve-Negative tone in the market news : $S_m \downarrow \rightarrow \sigma^2_{b,m}(Var^I_{b,1}[D_2]) \uparrow \rightarrow$ investors irrationally trade less aggressively $\rightarrow n_b \downarrow \rightarrow \lambda_1 \uparrow$



Firm-Specific News Sentiment Effect (S_e, $\sigma^2_{b,e}$ and λ_1)

Green Curve-Positive tone in the firm-specific news : $S_e \uparrow \rightarrow \sigma^2_{b,e}(Var^U_{b,1}[e_1|\hat{p}_1]) \downarrow \rightarrow$ investors under-perceive the benefit of becoming informed about $e_1 \rightarrow \lambda_1 \downarrow$

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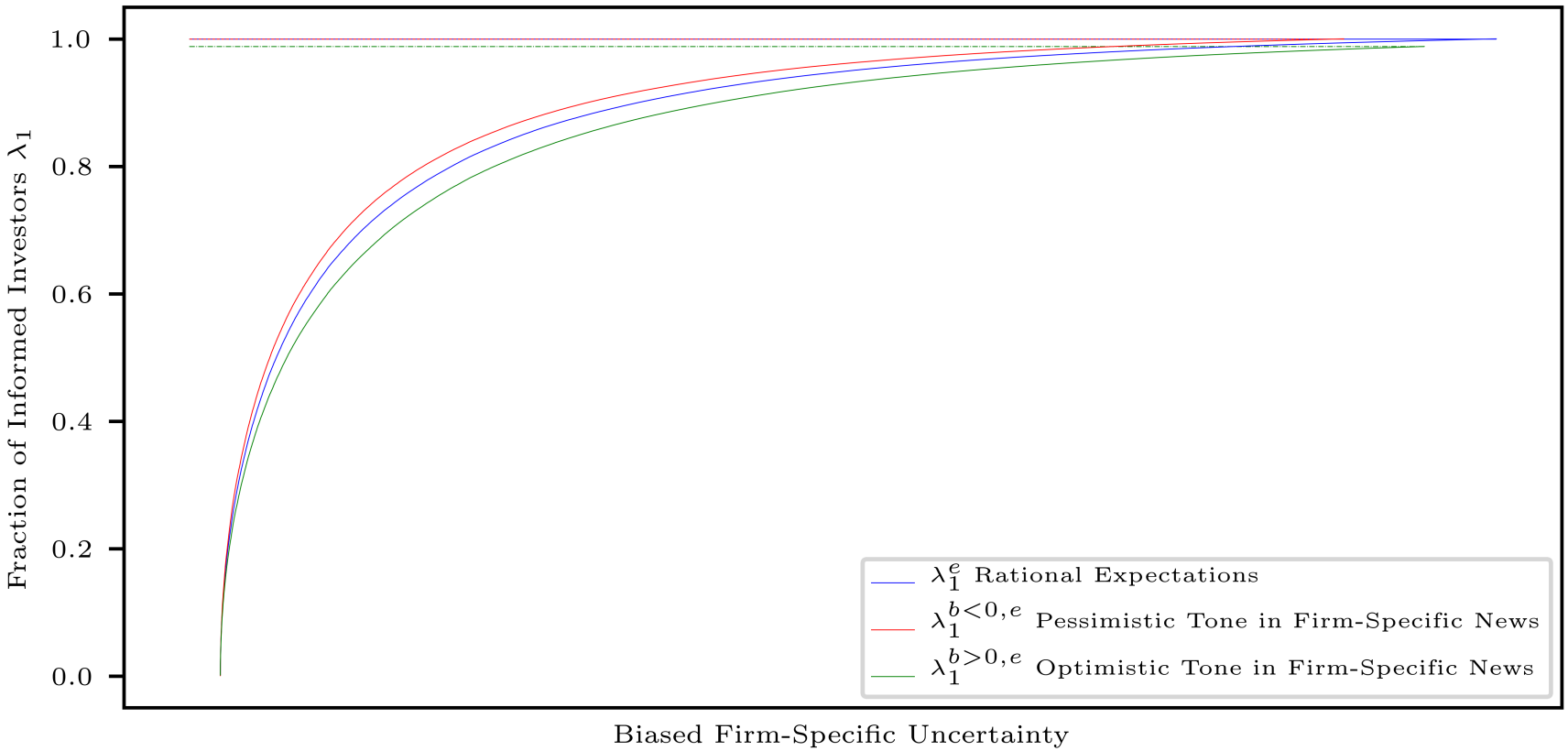

Implication

- **S_e deflects λ_1 from the rational expectations equilibrium, and this deflection of λ_1 implies variations of information risk in the risky asset.**

  $\Rightarrow$ **Price informativeness is in line with the proportion of informed investors, λ_1,** which is affected by sentiment in the firm-specific news.

  $\Rightarrow$ **Holding other things constant, information risk** contained in the risky asset departs from the rational expectations scenario.

  $\Rightarrow$ **The expected return as the information risk premium** required by traders to hold the risky asset varies with firm-specific news sentiment.

Implication Cont'd

Proposition 2

Expected risky asset return is $E[R_2] = \frac{\alpha\bar{x}}{\lambda_1\phi_I+(1-\lambda_1)\phi_U}$ [a] *and* $\frac{\partial E[R_2]}{\partial \lambda_1} < 0$. *From Proposition 1,* $\frac{\partial \lambda_1}{\partial S_e} < 0$, *therefore, sentiment in the firm-specific news has a positive predictability on the risky asset expected return* $\frac{\partial E[R_2]}{\partial S_e} > 0$.

[a] ϕ_I and ϕ_U are inverse-variance of risky asset payoff for informed and uninformed investors respectively.

Corollary 1: *If the tone (sentiment) in the firm-specific news tends to be more positive or negative ($S_e \uparrow$, $S_e \downarrow$), in a biased belief equilibrium, this tone predicts relatively higher or lower expected returns than the rational expectations equilibrium $E_b[R_2] > E_r[R_2]$ or $E_b[R_2] < E_r[R_2]$, where b and r denote the biased belief and rational expectations equilibrium respectively.*

Predictions from Theoretical Implications

- An increase in news tone (sentiment) as more positive/negative should be predictive of a less/more information acquisition about e_1.

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Firm-Specific Information Acquisition and News Sentiment

Information acquisition (λ_1) is not directly observed

- I measure λ_1 by estimating a price jump ratio which measures earnings-relevant information incorporated into the price before the earnings announcement released.

$$CAR_{i,t}^{j_1,j_2} = \sum_{t=j_1}^{j_2} \left(R_{it}^{e} - \alpha_i - \sum_{m=1}^{M} \beta_{i,m} f_{m,t} \right) = \sum_{t=j_1}^{j_2} \epsilon_{i,t}$$

$$Jump_{i,t}^{a,b} = \frac{CAR_{i,t}^{T-1,T+b}}{CAR_{i,t}^{T-a,T+b}}, \text{ where } a = 21, b = 2$$

- **Intuition:** the higher the price jump ratio, the less earnings-related information is incorporated into the price (less information acquisition, e_1) relative to the post-announcement information set and vice versa.
- To test how news sentiment biases investors' firm-specific information acquisition, I conduct a fixed effect regression as follows:

$$jump_{i,t} = \beta_0 + \beta_{j,1} Sentiment_{j,[t-21,t-1]} + X\delta + \epsilon_{i,t}, \quad \text{where } j \in \{m, i\}.$$

Empirical Results 1

Table 2: News Sentiment Impact on Information Acquisition

	Panel A Stock Market News Sentiment			*Panel B Firm-Specific News Sentiment*		
	(1)	(2)	(3)	(1)	(2)	(3)
Dependent Variable	$Jump_{i,t}$	$Jump_{i,t}$	$Jump_{i,t}$	$Jump_{i,t}$	$Jump_{i,t}$	$Jump_{i,t}$
$Sentiment_{i,t-21,t-1}$				**0.057*****	**0.050****	**0.051*****
				(0.015)	(0.020)	(0.020)
$Sentiment_{m,t-21,t-1}$	**0.089*****	**0.091*****	**0.116*****		0.120*	0.124**
	(0.010)	(0.011)	(0.011)		(0.063)	(0.063)
$Buzz_{m,t-21,t-1}$		0.027***	0.029***			
		(0.002)	(0.002)			
$Buzz_{i,t-21,t-1}$					-0.013***	-0.012**
					(0.005)	(0.005)
$VIX_{t-21,t-1}$		-0.002***			-0.001	
		(0.000)			(0.001)	
$EPU_{t-21,t-1}$			-0.0002			-0.0001
			(0.000)			(0.0001)
Controls	No	Yes	Yes	No	Yes	Yes
FE Month	Yes	Yes	Yes	Yes	Yes	Yes
FE Firm	Yes	Yes	Yes	Yes	Yes	Yes
Observations	93,198	91,873	91,873	3,550	3,521	3,521
R-squared		0.021	0.020		0.033	0.033
Number of Firms	10,329	10,241	10,241	1,891	1,880	1,880

Clustered standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Information Risk from Firm-Specific News Sentiment

- The more positive sentiment in firm-specific news, the less the investors want to acquire e_1.
- Consequently, uninformed investors cannot learn enough about e_1 through the price discovery process, and they face more asymmetric information problems (information risk).

  $\Rightarrow$ **An increase in positive tone in firm-specific news should be predictive of higher information risk in risky assets.**

- I use the Generalized Probability of Informed Trade (*GPIN*) by Duarte et al. (2020) as the measure of information risk in risky assets.[5]

  $\Rightarrow$ I conduct the fixed effect regression to test if firm-specific news sentiment predicts a higher *GPIN*.

$$GPIN_{i,t} = \beta_0 + \beta_1 Sentiment_{i,t-1} + X\delta + \epsilon_{i,t}$$

[5] *GPIN* is only available for NYSE stocks; therefore, the regression results are very conservative.

Empirical Results 2

Table 3: Firm-Specific News Sentiment Impact on Probability of Informed Trading

	(1)	(2)	(3)
Dependent Variable	$GPIN_{i,t}$	$GPIN_{i,t}$	$GPIN_{i,t}$
$Sentiment_{i,t-1}$	**0.017*****	**0.014*****	**0.014*****
	(0.005)	(0.005)	(0.005)
$Sentiment_{m,t-1}$			0.118
			(0.087)
$Buzz_{m,t-1}$			-0.022
			(0.014)
$Buzz_{i,t-1}$		-0.002	-0.002
		(0.001)	(0.001)
Controls	No	Yes	Yes
FE Year	Yes	Yes	Yes
FE Firm	Yes	Yes	Yes
Observations	15,571	13,551	13,551
R-squared	0.150	0.148	0.148
Number of Firms	1,434	1,355	1,355

Clustered standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Firm-Specific News Sentiment Impact on Stock Returns

- Information risk in assets varies with the variations in the proportion of informed investors caused by firm-specific news sentiment.
- As indicated in Proposition 2 and Corollary 1, firm-specific news sentiment should be positively predictive of expected stock returns.
- This prediction on assets' returns comes from investors' biased information acquisition, which is different from existing textual studies that argue news sentiment causes mispricing of the fundamental value of assets.
- Therefore, this theoretical implication of asset return predictability from firm-specific news sentiment should be persistent and without reversal.

  $\Rightarrow$ I conduct daily Fama-Macbeth cross-sectional regression to test this prediction:

$$DepVar_{i,t+1} = \beta_0 + \beta_1 Sentiment_{i,t} + \delta X + \epsilon_{i,t} \text{ for each trading day } t.$$

Empirical Results 3

Table 4: Cross-Sectional Return Predictability from Firm-Specific News Sentiment

	(1)	(2)	(3)
Dependent Variable	$R^e_{i,t+1}$	$R^e_{i,t+2,t+5}$	$R^e_{i,t+2,t+10}$
$Sentiment_{i,t}$	**3.089**	**3.764**	**4.341**
	(8.188)	(5.084)	(3.799)
$EmotionVsFact_{i,t} * Sentiment_{i,t}$	-2.673	-1.743	-1.966
	(-5.109)	(-1.743)	(-1.326)
$EmotionVsFact_{i,t} * AbRet_{i,t}$	-3.908	1.459	-1.311
	(-3.302)	(0.799)	(-0.484)
$Buzz_{i,t} * AbRet_{i,t}$	3.505	3.895	5.850
	(7.019)	(5.318)	(5.296)
$Buzz_{i,t}$	-0.180	-0.279	0.869
	(-0.643)	(-0.459)	(0.866)
$EmotionVsFact_{i,t}$	-0.348	-2.006	-0.715
	(-0.543)	(-1.604)	(-0.376)
Controls	Yes	Yes	Yes
Constant	3.395	15.841	33.927
	(1.939)	(2.462)	(2.561)
Daily Average Observations	540	540	539
Adjusted R-squared	0.141	0.133	0.129
Observations	2,842,780	2,840,509	2,838,805

Information Risk Premium from Firm-Specific News Sentiment - a novel argument

- Variations of information risk caused by firm-specific news sentiment provide a novel explanation for its cross-sectional return predictability.

  $\Rightarrow$ Traders require high expected returns as the premium for holding risky assets, subject to high information risk.

  $\Rightarrow$ More importantly, the magnitude of information risk in risky assets is affected by biased information acquisition from investors (even rational ones) who are subject to the positive or negative tone of news about firms.

- Following empirical asset pricing studies, I conduct a portfolio analysis to verify this novel argument about the information risk premium caused by firm-specific news sentiment.

  $\Rightarrow$ To identify if classical pricing factors can explain the proposed risk premium from firm-specific news sentiment.

Empirical Results 4

Table 5: Firm-Specific News Sentiment Factor Risk Premium-FF Factor Model Testing

Panel A Correlations Between Different Factors									
	MKT_t	SMB_t	HML_t	RMW_t	CMA_t	UMD_t	ST_t	LT_t	$PSLIQ_t$
$Sentiment_t$	-0.106	0.029	-0.102	0.071	0.084	0.202	-0.142	0.025	0.010
Panel B Risk-Adjusted News Sentiment Zero-Cost Portfolio Return									
	$Sentiment_t$	*CAPM*	*FF3*	*FF5*	*FF5 + UMD*	*FF5 + Full*			
$\boldsymbol{\alpha}$	**0.066**	**0.067**	**0.068**	**0.064**	**0.061**	**0.065**			
$\boldsymbol{t_\alpha}$	**(6.397)**	**(6.588)**	**(6.756)**	**(6.390)**	**(6.143)**	**(6.640)**			
MKT_t		-0.065	-0.069	-0.031	-0.016	0.000			
t_{MKT}		(-4.795)	(-5.349)	(-2.582)	(-1.382)	(0.039)			
SMB_t			0.051	0.056	0.041	0.035			
t_{SMB}			(1.991)	(2.304)	(1.732)	(1.430)			
HML_t			-0.123	-0.202	-0.126	-0.135			
t_{HML}			(-4.263)	(-7.421)	(-4.851)	(-5.091)			
RMW_t				0.058	0.038	0.029			
t_{RMW}				(1.670)	(1.125)	(0.784)			
CMA_t				0.235	0.185	0.147			
t_{CMA}				(5.430)	(4.438)	(3.196)			
$PSLIQ_t$			0.021	0.018	0.020	0.024			
t_{PSLIQ}			(1.151)	(1.026)	(1.166)	(1.425)			
UMD_t					0.115	0.109			
t_{UMD}					(6.780)	(6.806)			
ST_t						-0.088			
t_{ST}						(-4.669)			
LT_t						0.019			
t_{LT}						(0.568)			
R^2	0.007	0.011	0.024	0.038	0.055	0.064			
Days	5241	5241	5241	5241	5241	5241			

Robustness

- SEC EDGAR queries file downloads as a direct measure of information acquisition.

  $\Rightarrow$ The findings consistently indicate investors research less public company financial information through the **SEC files**.

- Fama-Macbeth regression analysis re-conducted by excluding earnings announcement days, or sorting data into sub-samples based on financial characteristics.

  $\Rightarrow$ *firm size, illiquidity, analyst coverage, analyst forecast and institutional ownership.*

- News sentiment factor test is robust to an alternative factor pricing model and additional control for genuine news information effect (*EmotionVsFact*).

  $\Rightarrow$ ***q*-factor model** by Hou et al. (2015)

  $\Rightarrow$ **factual and emotion** news information factor

Conclusions

- News written with positive or negative tones offers a novel understanding of irrational behaviors regarding information acquisition on risky assets.
- Information acquisition plays a central role in cornerstone theories of asymmetric information risk contained in risky assets (O'Hara, 2003).
- This paper argues that information acquisition can be biased by investors' consumption of news written with particular tones, and this bias implies information risk varies with firm-specific news sentiment.
- Using a novel news dataset, I show that news sentiment is negatively related to firm-specific information acquisition. Additionally, stock return predictability from firm-specific news sentiment implies that information risk premium is caused by biased information transmission.
- The study may help economic agents analyze public information and price assets when news about the market or firms is subject to positive or negative bias.

Market News Sentiment Biases Market Uncertainty

Table 6: Market News Sentiment and Market Uncertainty

	(1)	(2)	(3)
Dependent Variable	$SP500RV$	EPU	VIX
$Sentiment_{m,[t-1,t-21]}$	$\mathbf{-0.166}^{***}$	$\mathbf{-121.736}^{***}$	$\mathbf{-15.111}^{***}$
	(0.002)	(1.346)	(0.243)
$SP500RV_{t-1,t-21}$	0.254^{***}		
	(0.005)		
$EPU_{t-1,t-21}$	0.0003^{***}	0.522^{***}	0.040^{***}
	(0.000)	(0.003)	(0.001)
$Buzz_{t-1,t-21}$	0.381^{***}	-58.285^{***}	38.643^{***}
	(0.005)	(2.115)	(0.479)
$VIX_{t-1,t-21}$		0.174^{***}	0.326^{***}
		(0.021)	(0.005)
Controls	Yes	Yes	Yes
FE Firms	Yes	Yes	Yes
FE Month	Yes	Yes	Yes
FE Year	Yes	Yes	Yes
Observations	91,873	91,873	91,873
R-squared	0.620	0.728	0.720
Number of Firms	10,241	10,241	10,241
Cluster standard errors in parentheses			
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$			

go back

SEC EDGAR Measure of Information Acquisition

Table 7: News Sentiment Impact on Information Acquisition Measured by Counts of SEC Files Clicks

	Panel A Stock Market News Sentiment			*Panel B Firm-Specific News Sentiment*		
	(1)	(2)	(3)	(1)	(2)	(3)
Dependent Variable	$LogSEC_{i,t}$	$LogSEC_{i,t}$	$LogSEC_{i,t}$	$LogSEC_{i,t}$	$LogSEC_{i,t}$	$LogSEC_{i,t}$
$Sentiment_{i,t-21,t-1}$				**-0.052*****	**-0.042****	**-0.042****
				(0.017)	(0.017)	(0.017)
$Sentiment_{m,t-21,t-1}$	**-0.231*****	**-0.247*****	**-0.227****		-0.42**	-0.394**
	(0.085)	(0.091)	(0.09)		(0.187)	(0.189)
$Buzz_{m,t-21,t-1}$		-0.016	-0.034			
		(0.025)	(0.028)			
$Buzz_{i,t-21,t-1}$					0.023***	0.022***
					(0.004)	(0.004)
$VIX_{t-21,t-1}$		0.004*			0.001	
		(0.002)			(0.004)	
$EPU_{t-21,t-1}$			0.0004			-0.0004
			(0.000)			(0.0006)
LagDep	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes
Day of Week	Yes	Yes	Yes	Yes	Yes	Yes
FE Year-Month	Yes	Yes	Yes	Yes	Yes	Yes
FE Firm	Yes	Yes	Yes	Yes	Yes	Yes
Observations	40,412	39,971	39,971	9,183	9,121	9,121
R-squared		0.845	0.845		0.861	0.861
Number of Firms	3,660	3,641	3,641	2,586	2,568	2,568

Clustered standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

q-factor Model Testing

Table 8: Firm-Specific News Sentiment Factor Risk Premium-q-factor Model Testing

Panel A Correlations Between Different Factors					
	$R_{MKT,t}$	$R_{ME,t}$	$R_{IA,t}$	$R_{ROE,t}$	$R_{EG,t}$
$Sentiment_t$	-0.108	0.019	0.069	0.095	0.092
Panel B Risk-Adjusted Firm-Specific News Sentiment Zero-Cost Portfolio Returns by q-factor Model					
	$Sentiment_t$	q-factor	q-factor + PLS	q-factor+UMD	q-factor+Full
α	**0.066**	**0.062**	**0.062**	**0.060**	**0.065**
t_α	(6.397)	(6.009)	(6.005)	(5.921)	(6.453)
$R_{MKT,t}$		-0.045	-0.046	-0.030	-0.014
$t_{R_{MKT}}$		(-3.115)	(-3.198)	(-2.274)	(-0.942)
$R_{ME,t}$		0.059	0.059	0.027	0.036
$t_{R_{ME}}$		(2.131)	(2.104)	(1.076)	(1.318)
$R_{IA,t}$		0.053	0.050	0.083	0.077
$t_{R_{IA}}$		(1.437)	(1.385)	(2.412)	(1.974)
$R_{ROE,t}$		0.059	0.058	-0.073	-0.067
$t_{R_{ROE}}$		(1.544)	(1.538)	(-1.895)	(-1.712)
$R_{EG,t}$		0.090	0.093	0.081	0.045
$t_{R_{EG}}$		(2.173)	(2.264)	(2.055)	(1.109)
$PSLIQ_t$			0.014	0.019	0.019
t_{PSLIQ}			(0.849)	(1.132)	(1.187)
UMD_t				0.155	0.154
t_{UMD}				(8.518)	(8.514)
ST_t					-0.087
t_{ST}					(-4.509)
LT_t					-0.043
t_{LT}					(-1.412)
$\overline{R^2}$	0.007	0.018	0.019	0.048	0.057
Days	5241	5241	5241	5241	5241

Innovative News *EmotionVsFact* Factor

Table 9: Latent Information of Firm-Specific News Sentiment Factor Risk Premium Testing

Panel A Correlations Between Different Factors									
	MKT_t	SMB_t	HML_t	RMW_t	CMA_t	UMD_t	ST_t	LT_t	$PSLIQ_t$
$EFSENT_t$	0.0164	-0.0023	-0.0004	-0.0228	-0.0124	0.0297	0.0386	0.0029	0.0013

Panel B Risk-Adjusted Latent Information of Firm-Specific News Sentiment Zero-Cost Portfolio Returns						
	$EFSENT_t$	*CAPM*	*FF*3	*FF*5	*FF*5 + *UMD*	*FF*5 + *Full*
α	**0.027**	**0.026**	**0.026**	**0.027**	**0.026**	**0.025**
t_α	(2.859)	(2.831)	(2.840)	(2.941)	(2.867)	(2.721)
MKT_t		0.009	0.010	0.003	0.008	0.002
t_{MKT}		(0.831)	(0.816)	(0.275)	(0.648)	(0.182)
SMB_t			-0.004	-0.011	-0.015	-0.014
t_{SMB}			(-0.199)	(-0.548)	(-0.789)	(-0.726)
HML_t			0.000	0.005	0.028	0.030
t_{HML}			(-0.001)	(0.259)	(1.218)	(1.306)
RMW_t				-0.030	-0.036	-0.032
t_{RMW}				(-0.969)	(-1.162)	(-0.980)
CMA_t				-0.010	-0.025	-0.014
t_{CMA}				(-0.223)	(-0.548)	(-0.288)
$PSLIQ_t$			0.000	0.001	0.002	0.000
t_{PSLIQ}			(-0.001)	(0.084)	(0.130)	(0.035)
UMD_t					0.034	0.036
t_{UMD}					(2.193)	(2.391)
ST_t						0.029
t_{ST}						(1.749)
LT_t						-0.003
t_{LT}						(-0.100)
$\overline{R}^2$	0.001	0.000	0.000	0.000	0.001	0.002
Days	5241	5241	5241	5241	5241	5241

Firm-Specific News Sentiment Factor Testing Controlled by *EmotionVsFact* Effect

Table 10: Risk-Adjusted Firm-Specific News Sentiment Portfolio Returns Controlling $EFSENT_{i,t}$.

	$Sentiment_t$	$CAPM$	$FF3$	$FF5$	$FF5 + UMD$	$FF5 + Full$
α	**0.067**	**0.069**	**0.069**	**0.065**	**0.063**	**0.067**
t_α	(6.567)	(6.758)	(6.929)	(6.554)	(6.331)	(6.808)
$EFSENT_t$	-0.063	-0.062	-0.061	-0.060	-0.066	-0.062
t_{EFSENT}	(-1.649)	(-1.611)	(-1.616)	(-1.601)	(-1.752)	(-1.663)
MKT_t		-0.065	-0.069	-0.031	-0.016	0.001
t_{MKT}		(-4.734)	(-5.272)	(-2.555)	(-1.324)	(0.048)
SMB_t			0.051	0.055	0.040	0.035
t_{SMB}			(1.953)	(2.252)	(1.665)	(1.375)
HML_t			-0.123	-0.202	-0.124	-0.133
t_{HML}			(-4.260)	(-7.380)	(-4.750)	(-4.989)
RMW_t			0.021	0.056	0.036	0.027
t_{RMW}			(1.156)	(1.619)	(1.056)	(0.732)
CMA_t				0.234	0.183	0.146
t_{CMA}				(5.351)	(4.327)	(3.143)
$PSLIQ_t$			0.021	0.018	0.020	0.024
t_{PSLIQ}			(1.151)	(1.035)	(1.181)	(1.436)
UMD_t					0.117	0.112
t_{UMD}					(6.826)	(6.848)
ST_t						-0.086
t_{ST}						(-4.595)
LT_t						0.018
t_{LT}						(0.562)
R^2	0.011	0.014	0.027	0.038	0.055	0.064
$Days$	5241	5241	5241	5241	5241	5241

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