Topics in Asset Pricing

Lecture 3: Beliefs

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Outline

1. Heterogeneous beliefs
   - Trading volume
   - Short-sales constraints & over-valuation
   - Speculative behavior
   - Welfare
2. Sources of disagreement
   - Limited attention
   - Model disagreement
3. Belief formation
   - Experience
   - Extrapolative expectations
   - Sticky expectations

Heterogeneous beliefs

- Puzzle: large trading volume
- No-trade theorem: asymmetric information does not generate trading in a common value environment (Akerlof 1970, Milgrom-Stokey 1982)
- Difference in beliefs that leads investors to "agree to disagree" generates trading. Can come from:
    a. Different priors (different models)
    b. Different information + Overconfidence about precision of own info
- This lecture:
    1. Implications of disagreement for markets
    2. Sources of disagreement
    3. Belief formation

Overconfidence & Trading (Barber and Odean, 2001)

TABLE II

POSITION VALUE, TURNOVER, AND RETURN PERFORMANCE OF COMMON STOCK INVESTMENTS OF FEMALE AND MALE HOUSEHOLDS: FEBRUARY 1991 TO JANUARY 1997

	All households			Married households			Single households		
	Women	Men	Difference (women–men)	Women	Men	Difference (women–men)	Women	Men	Difference (women–men)
Number of households	8,005	29,659	NA	4,894	19,741	NA	2,306	6,326	NA
Panel A: Position Value and Turnover									
Mean [median] beginning position value ($)	18,371 [7,387]	21,975 [8,218]	−3,604*** [−831]***	17,754 [7,410]	22,293 [8,175]	−4,539*** [−765]***	19,654 [7,491]	20,161 [8,097]	−507*** [−606]***
Mean [median] monthly turnover (%)	4.40 [1.74]	6.41 [2.94]	−2.01*** [−1.20]***	4.41 [1.79]	6.11 [2.81]	−1.70*** [1.02]***	4.22 [1.55]	7.05 [3.32]	−2.83*** [−1.77]***
Panel B: Performance									
Own-benchmark monthly abnormal gross return (%)	−0.041*** (−2.84)	−0.069*** (−3.66)	0.028*** (2.43)	−0.050*** (−2.89)	−0.068*** (−3.67)	0.018 (1.28)	−0.029* (−1.64)	−0.074*** (−3.60)	0.045*** (2.53)
Own-benchmark monthly abnormal net return (%)	−0.143*** (−9.70)	−0.221*** (−10.83)	0.078*** (6.35)	−0.154*** (−9.10)	−0.214*** (−10.48)	0.060*** (3.95)	−0.121*** (−6.68)	−0.242*** (−11.15)	0.120*** (6.68)

***, **, * indicate significant at the 1, 5, and 10 percent level, respectively. Tests for differences in medians are based on a Wilcoxon sign-rank test statistic.

Households are classified as female or male based on the gender of the person who opened the account. Beginning position value is the market value of common stocks held in the first month that the household appears during our sample period. Mean monthly turnover is the average of sales and purchase turnover. [Median values are in brackets.] Own-benchmark abnormal returns are the average household percentage monthly abnormal return calculated as the realized monthly return for a household less the return that would have been earned if the household had held the beginning-of-year portfolio for the entire year (i.e., the twelve months beginning February 1). *T*-statistics for abnormal returns are in parentheses and are calculated using time-series standard errors across months.

Heterogeneous beliefs

- Idea: Disagreement generates trading
- Risky asset in supply S
- Mass 1 of investors with CARA γ
- $t = 2$: Payoff $V + \varepsilon$ with $\varepsilon \sim \mathcal{N}(0, 1)$
- $t = 1$: Investors agree to disagree: beliefs about V uniformly distributed over $[V - H, V + H]$
- Equilibrium with homogeneous beliefs ($H = 0$):

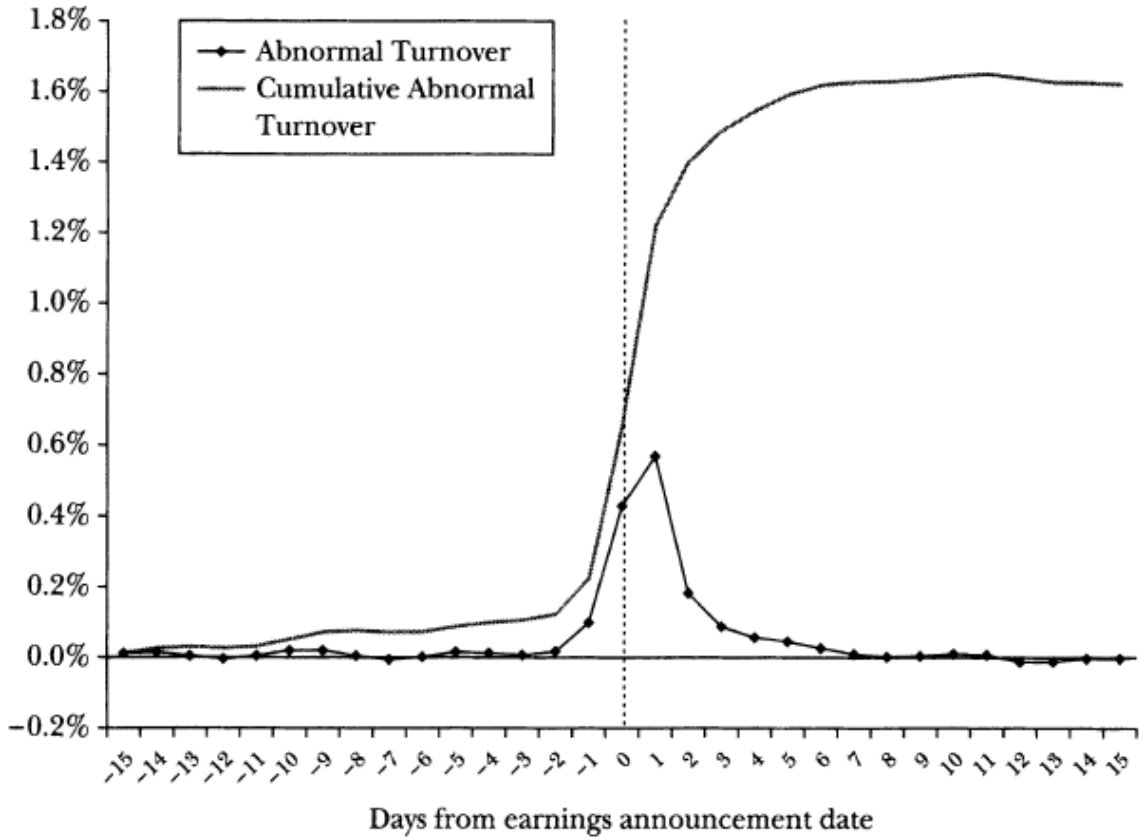
$$P = V - \gamma S \qquad \text{and} \qquad \mathit{Volume} = 0$$

- Equilibrium with heterogeneous beliefs ($H > 0$):

$$P = V - \gamma S \qquad \text{and} \qquad \mathit{Volume} = \frac{H}{4\gamma}$$

Heterogeneous beliefs & Trading volume

Abnormal Turnover Around Earnings Announcements, 1986–2005



Source: The underlying data is from the Center for Research in Security Prices (CRSP) database. Earnings announcement dates are taken from Compustat.

Notes: Analysis is based on the universe of the 1,000 largest stocks on CRSP in each quarter from 1986Q1 to 2005Q4. Abnormal daily turnover for any given stock is actual daily turnover in the stock minus average turnover in the stock for the 250 days preceding the event window (days −266 to −16 relative to the earnings announcement date). Cumulative abnormal turnover is then the cumulative sum of abnormal daily turnover over the event window.

source: Hong and Stein (2007)

Heterogeneous beliefs & Short-sales constraints

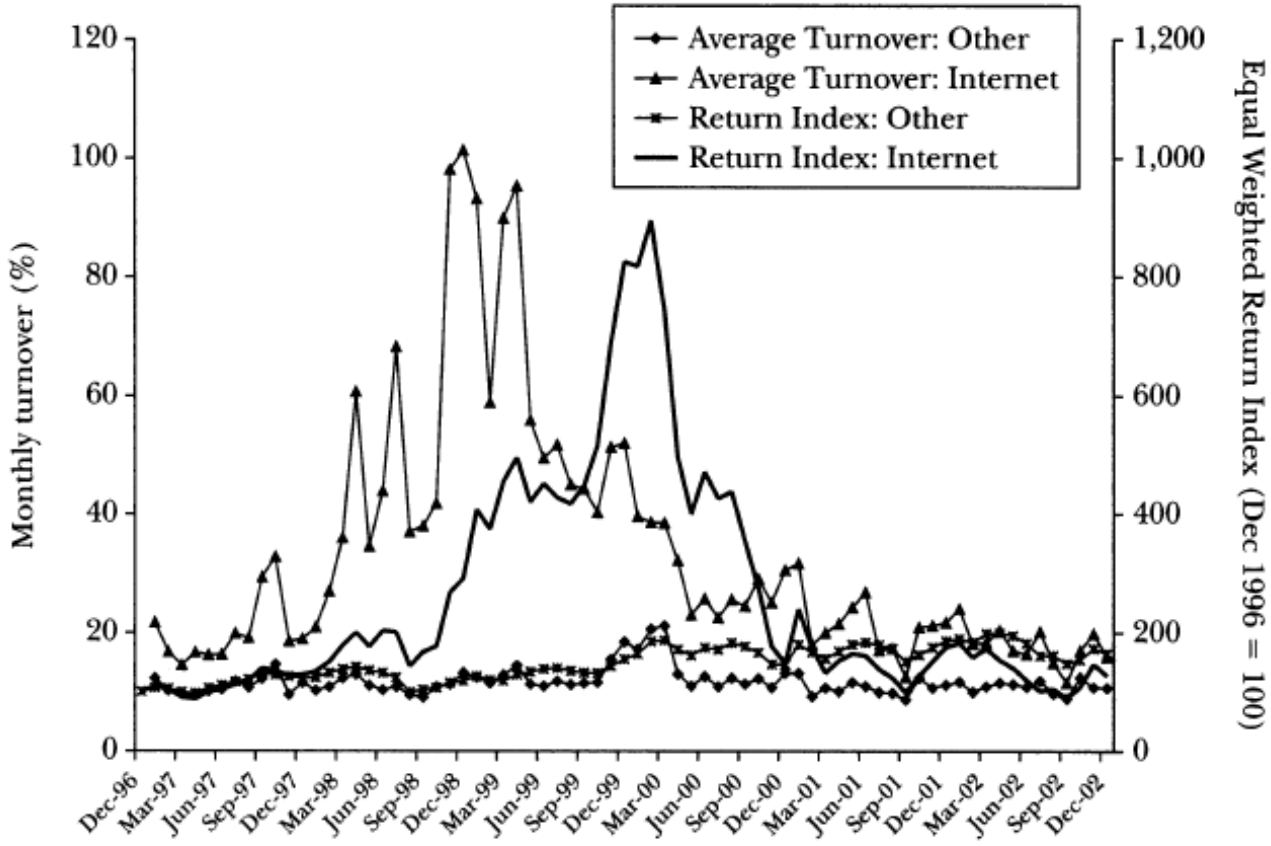
- Idea: Disagreement + Short-selling constraints generate over-valuation because optimistic beliefs are reflected in prices whereas pessimistic beliefs are not (Miller, 1977)

- Equilibrium with heterogeneous beliefs ($H > 0$) & short-sales constraints ($X_i \geq 0$):

$$P = \begin{cases} V - \gamma S & \text{if } H \leq \gamma S \\ V + H - 2\sqrt{\gamma S H} & \text{if } H > \gamma S \end{cases}$$

Heterogeneous beliefs & Overvaluation

Prices and Turnover for Internet and Non-Internet Stocks, 1997–2002



Sources: The underlying data is from the Center for Research in Security Prices (CRSP) database. We use the same sample of Internet stocks as Ofek and Richardson (2003). Their sample is obtained from lists of "pure" Internet companies published by Morgan Stanley, available on Eli Ofek's home page at ⟨http://pages.stern.nyu.edu/~eofek/⟩.

Notes: For each month, we divide the set of all common stocks listed on CRSP into "Internet" and "all other" portfolios, and calculate average monthly turnover and price indices for these two categories. Our turnover and price-level indices are equal-weighted, but the results are qualitatively similar using market-capitalization weights.

Evidence

- Empirical challenge: proxy for H?
  - Analyst forecasts (Diether, Malloy and Scherbina, 2002)
  - Investor holdings (Chen, Hong and Stein, 2002)
  - Content of traditional/social media (Cookson and Niessner, 2020)

Diether, Malloy and Sherbina (2002)

Table II

Mean Portfolio Returns by Size and Dispersion in Analysts' Forecasts

Each month stocks are sorted in five groups based on the level of market capitalization as of the third Thursday of the previous month. Stocks in each size group are then sorted into five additional groups based on dispersion in analyst earnings forecasts for the previous month. Dispersion is defined as the ratio of the standard deviation of analysts' current-fiscal-year annual earnings per share forecasts to the absolute value of the mean forecast, as reported in the I/B/E/S Summary History file. Stocks with a mean forecast of zero are assigned to the highest dispersion groups, and stocks with a price less than five dollars are excluded from the sample. Stocks are held for one month, and portfolio returns are equal-weighted. The time period considered is February 1983 through December 2000. The table reports average monthly portfolio returns; *t*-statistics in parentheses are adjusted for autocorrelation.

Mean Returns

Dispersion Quintiles	Size Quintiles: Small				Large	All Stocks
	*S*1	*S*2	*S*3	*S*4	*S*5	
*D*1 (low)	1.52	1.45	1.50	1.51	1.48	1.48
*D*2	1.12	1.40	1.41	1.18	1.35	1.36
*D*3	0.99	1.20	1.32	1.11	1.36	1.23
*D*4	0.76	1.07	1.18	1.33	1.33	1.12
*D*5 (high)	0.14	0.56	0.83	1.03	1.20	0.69
*D*1–*D*5	1.37[a]	0.89[a]	0.67[b]	0.48	0.29	0.79[a]
t-statistic	(5.98)	(3.12)	(2.41)	(1.55)	(0.94)	(2.88)

Evidence (cont'd)

- Additional prediction of theory: effect of disagreement on over-valuation is stronger when short-sales constraints are tighter

- Proxy for short-sales constraints?
  - High lending fees (Jones and Lamont 2002) but...
  - Low short interest (Asquith Pathak Ritter 2005) but...
  - Low institutional ownership (Nagel 2005)

Nagel (2005)

Table 2

		Residual institutional ownership						
		(Low) RI1	RI2	RI3	RI4	(High) RI5	RI5 - RI1	(*t*-statistic)
Panel A: firm characteristics by residual institutional ownership quintile								
Mean size (millions of dollars)		920	2243	2889	1843	706		
Median size (millions of dollars)		224	351	366	272	189		
Mean institutional ownership		0.13	0.29	0.39	0.46	0.53		
Median institutional ownership		0.10	0.29	0.41	0.47	0.54		
Panel C: intersection with sort on analyst forecast dispersion (ADISP)								
P1	(Low)	1.40	1.55	1.51	1.37	1.47	0.07	(0.36)
P2		1.15	1.29	1.31	1.29	1.35	0.21	(1.00)
P3		1.07	1.14	1.18	1.04	1.32	0.25	(1.54)
P4		0.87	0.93	1.08	1.05	1.19	0.31	(2.04)
P5	(High)	0.43	0.73	0.86	0.90	0.97	0.54	(2.47)
P1–P5	Raw	0.97	0.83	0.66	0.48	0.49	0.48	(1.63)
(*t*-statistic)		(1.87)	(1.97)	(1.77)	(1.42)	(1.55)		
P1–P5	CAPM α	1.43	1.19	0.93	0.74	0.74	0.69	(1.92)
(*t*-statistic)		(2.38)	(2.34)	(2.00)	(1.76)	(1.89)		
P1–P5	FF3F α	0.74	0.56	0.33	0.23	0.24	0.50	(1.57)
(*t*-statistic)		(1.73)	(1.54)	(1.02)	(0.73)	(0.80)		

Heterogeneous beliefs & Speculative behavior

- Idea: Anticipation of future optimism leads to speculation

  seminal paper: Harrison and Kreps (1978)

  full-fledged dynamic model: Scheinkman and Xiong (2003)

  today: simple model

- 2 groups of risk-neutral investors A and B
- $t = 3$: Payoff $V_1 + V_2 + \varepsilon$
- $t = 1, 2$: Investors learn about V_t and disagree: V_t^A and V_t^B i.i.d. with mean zero
- Short-sales constraints
- Equilibrium:

$$P_1 > \max\{V_1^A, V_1^B\}$$

  $\Rightarrow$ "speculative behavior"

Heterogeneous beliefs & Welfare

- Example

  Pillow made of cotton or polyester

  Joe believes cotton with 90%, Bob believes polyester with 90%

  They bet \$100, cut pillow open, winner replaces pillow at \$50 cost

  Each one wants to bet despite pure transfer + pillow destroyed

- Libertarian/beliefs as preferences (Savage 1954) $\rightarrow$ welfare efficient
- Paternalism $\rightarrow$ welfare inefficient
- "Belief-neutral" welfare criterion (Brunnermeier-Simsek-Xiong 2014)

  An allocation is belief-neutral efficient if there is no other allocation that achieves higher welfare under any convex combination of agents' beliefs (where welfare criterion can be utilitarian, Pareto, etc.)

Sources of disagreement

Difference in beliefs (=disagreement) can come from:

a. Different priors

e.g., different "models of the world"

b. Different information + overconfidence about precision of own info

e.g., limited attention + non-Bayesian updating, leading to gradual information diffusion

Slow information diffusion: Cohen and Frazzini (2008)

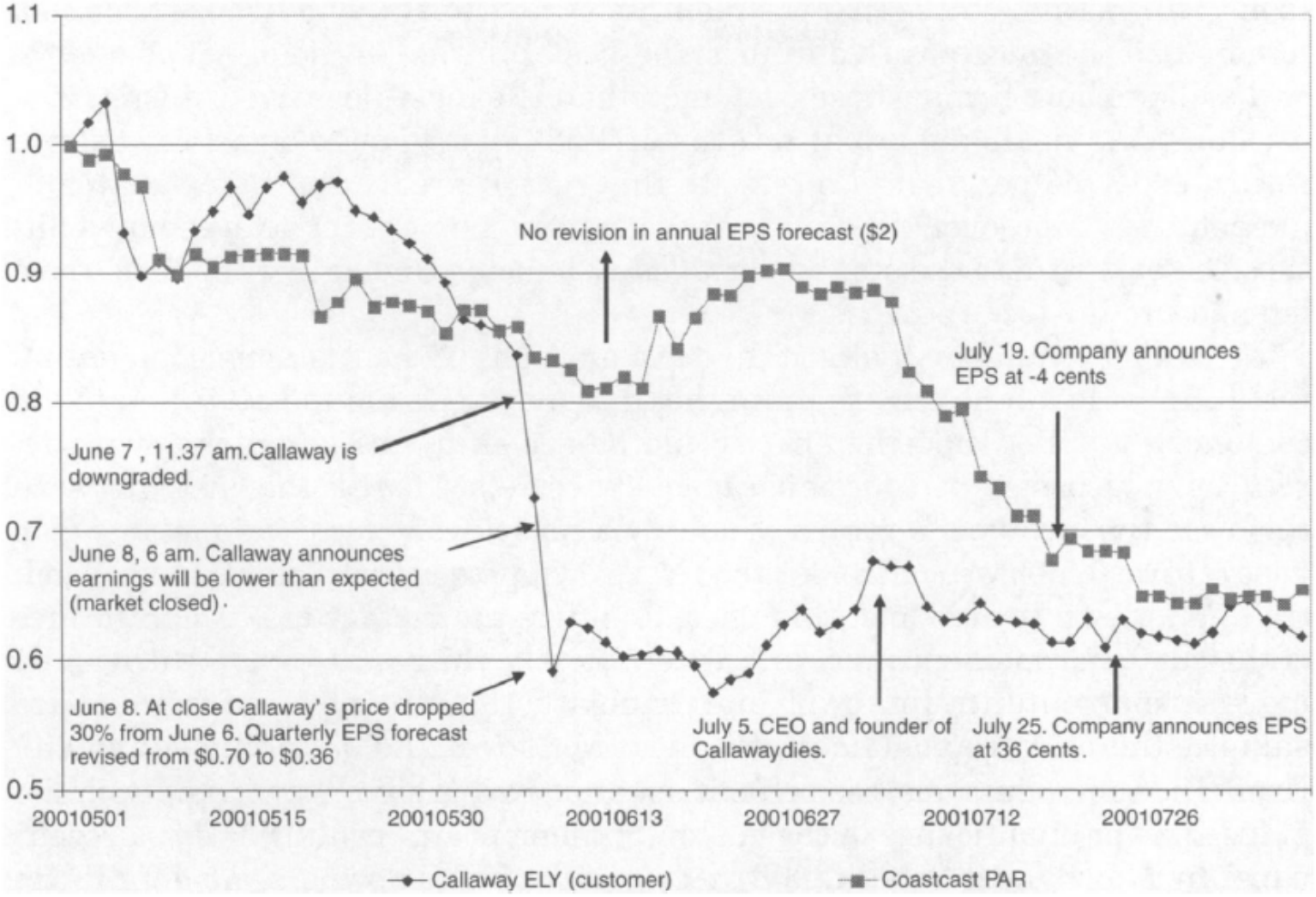
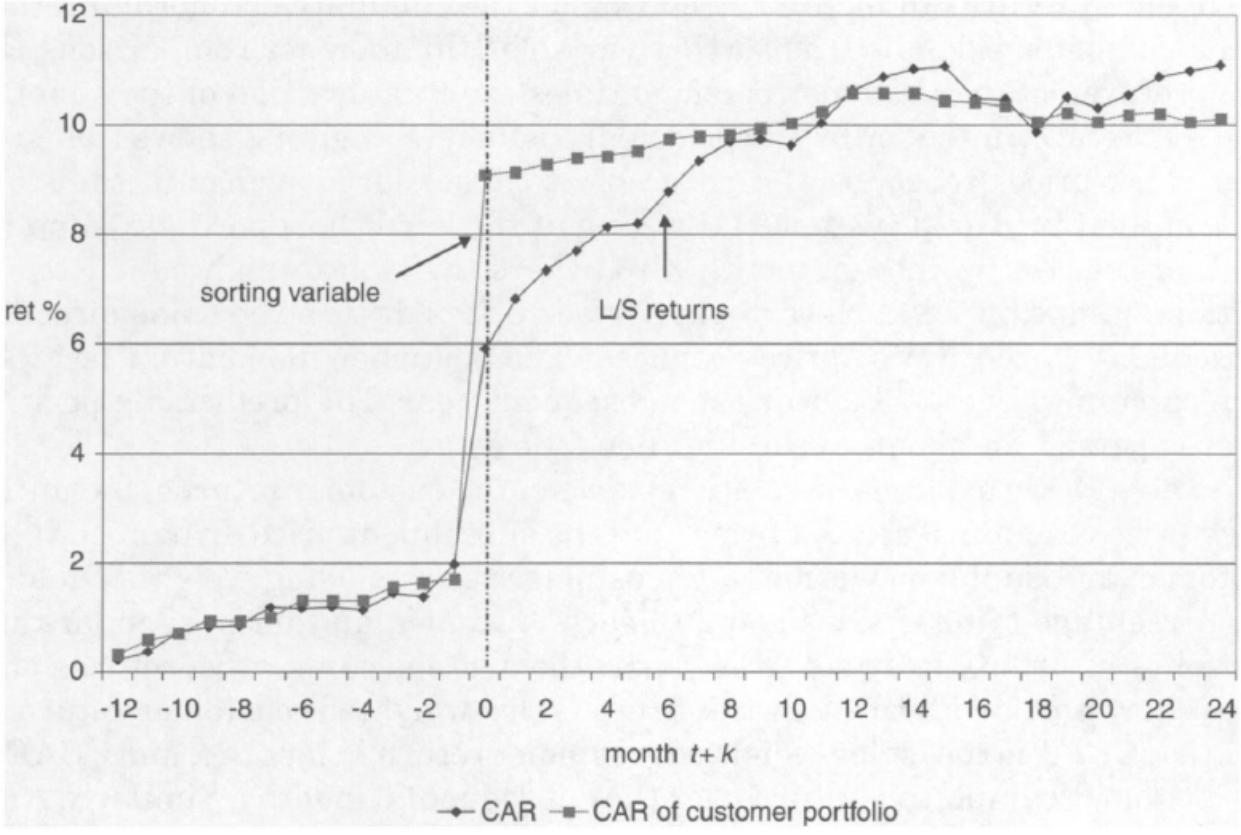


Figure 1. Coastcast Corporation and Callaway Golf Corporation. This figure plots the stock prices of Coastcast Corporation (ticker = PAR) and Callaway Golf Corporation (ticker = ELY) between May and August 2001. Prices are normalized (05/01/2001 = 1).

Panel A: Value Weights	Q1(Low)	Q2	Q3	Q4	Q5(High)	L/S
Excess returns	−0.596	−0.157	0.125	0.313	0.982*	1.578*
	[−1.42]	[−0.41]	[0.32]	[0.79]	[2.14]	[3.79]
Three-factor alpha	−1.062*	−0.796*	−0.541*	−0.227	0.493*	1.555*
	[−3.78]	[−3.61]	[−2.15]	[−0.87]	[1.98]	[3.60]
Four-factor alpha	−0.821*	−0.741*	−0.488	−0.193	0.556*	1.376*
	[−2.93]	[−3.28]	[−1.89]	[−0.72]	[1.99]	[3.13]
Five-factor alpha	−0.797*	−0.737*	−0.493	−0.019	0.440	1.237*
	[−2.87]	[−3.04]	[−1.94]	[−0.07]	[1.60]	[2.99]



At Least 20 Mutual Funds Holding the Stock		
	All Stocks	
	EW	VW
Low COMOWN	1.653*	2.301*
Lower percentage of common ownership	[5.46]	[5.24]
High COMOWN	0.750*	1.098*
Higher percentage of common ownership	[1.97]	[2.17]
High-low	−0.903*	−1.203*
	[−2.08]	[−1.99]

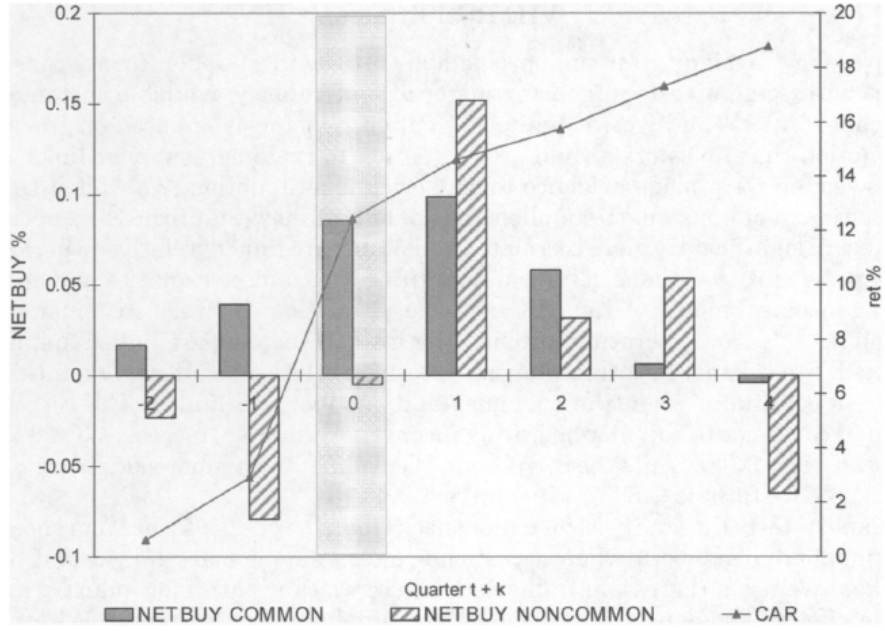


Figure 3. Customer momentum, event-time CAR, and mutual fund's net purchases. This figure shows the average cumulative return and mutual funds net purchases in quarter $t+k$ on a long-short portfolio formed on the firm's customer return in quarter t. At the beginning of every quarter, stocks are ranked in ascending order based on the return of a portfolio of its major customers at the end of the previous quarter. Stocks are assigned to one of five quintile portfolios. The figure shows average cumulative returns (in %) over time of a zero-cost portfolio that holds the top 20% high customer return stocks and sells short the bottom 20% low customer returns stocks, and the average net purchases by common and noncommon funds. For a given stock *NETBUY COMMON* is defined as $\Delta CS_t/SHROUT_{t-1}$, where ΔCS_t is the change in total number of shares owned by mutual fund managers that also hold the customer in their portfolio in a given quarter. *SHROUT* is shares outstanding. *NETBUY NONCOMMON* is defined as $\Delta NCS_t/SHROUT_{t-1}$, where ΔNCS_t is the change in total number of shares owned by mutual fund managers that do not hold the customer in their portfolio.

Model disagreement: Cookson and Niessner (2020)

Panel A: Characteristics of Messages and Users

	Mean	*SD*	Min	p25	p50	p75	Max
Number of messages per stock	14,420	32,493	616	1,589	5,296	14,686	275,969
Number of messages per user	119	391	1	5	19	80	11,759
Number of messages per stock per day	43	134	1	3	10	31	4,690
Sentiment stock/day	0.439	0.518	−1	0.167	0.5	1	1
Number of followers user has	212	2,126	0	2	6	21	96,433
Number of people user follows	45	197	0	5	15	45	9,990
Total Days Active	457	411	1	131	343	679	1,908

Panel B: Frequencies of User Profile Characteristics

Investment Philosophy	Number of Users	Percent Users	Number of Messages	Percent Messages
Fundamental	1,505	12.51%	203,383	14.10%
Technical	4,610	38.32%	538,425	37.02%
Momentum	2,395	19.91%	368,939	26.12%
Global Macro	269	2.24%	12,974	0.90%
Growth	2,158	17.94%	217,504	15.08%
Value	1,092	9.08%	100,826	6.99 %
Total	12,029	100%	1,442,051	100%

Experience	Number of Users	Percent Users	Number of Messages	Percent Messages
Novice	3,392	28.20%	228,041	15.81%
Intermediate	6,272	52.14%	803,198	55.70%
Professional	2,365	19.66%	410,812	28.49%
Total	12,029	100%	1,442,051	100%

Panel A: Most Salient Words Used by Approach	
Approach	Most Common Unique Words
Fundamental	eps, sales, growth, sentiment, read, revenue, earnings, million, quarter, consensus, billion, share, cash, results, analysts
Technical	chart, support, nice, break, looking, looks, gap, move, day, stop, calls, daily, close, resistance, bounce
Momentum	play, calls, time, via, week, day, news, squeeze, hod (high of day), hit, shares, cover, highs, run, money
Value	view, attempts, bulls, rising, aboard, stair, intraday, correction overextended, breakdown, fresh, mayb, steak, moved, rollout
Growth	news, er (earnings report), hope, green, shares, plug, money, article, time, bears, waitings, ve, wait, board, share, future

Panel A: Sentiment Classification

	Number of Messages	
Sentiment	Original Sample	MaxEnt Classification
Bearish	86,615	452,258
Bullish	385,753	989,793
Unclassified	969,683	

Panel B: Sentiment Summary Statistics

	Average Sentiment	
	Mean	*SD*
All investors	0.342	0.492
Fundamental	0.146	0.494
Technical	0.264	0.535
Momentum	0.237	0.504
Growth	0.252	0.489
Value	0.118	0.457

Panel C: Disagreement within and across Approaches

	Mean	*SD*	Min	p25	p50	p75	Max
All investors	0.467	0.446	0	0	0.628	0.932	1
Cross-group disagreement	0.382	0.262	0	0.151	0.435	0.545	1.117
Within-group disagreement	0.245	0.299	0	0	0	0.480	0.994
Fundamental	0.172	0.354	0	0	0	0.531	1
Technical	0.341	0.434	0	0	0	0.866	1
Momentum	0.249	0.401	0	0	0	0.699	1
Growth	0.171	0.346	0	0	0	0.000	1
Value	0.124	0.313	0	0	0	0.000	1

Panel A: Disagreement and Trading Volume

	Abnormal Log Volume (t)					
Disagreement measure	(1)	(2)	(3)	(4)	(5)	(6)
Disagreement (t)	0.099***	+1 s.d. --> volume +10%				
	(0.008)					
Disagreement (BMO, t)		0.053***				
		(0.006)	+1 s.d. --> volume +30%			
Cross-Group Disagreement (t)			0.030***			
			(0.008)			
Cross-Group Disagreement (BMO, t)				0.033***		
				(0.005)	+1 s.d. --> volume +18%	
Within-Group Disagreement (t)					0.175***	
					(0.011)	
Within-Group Disagreement (BMO, t)						0.085***
						(0.009)
AbLogVol ($t-1$)	0.719***	0.723***	0.727***	0.725***	0.705***	0.717***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.017)	(0.016)
Media (t)	0.069***	0.071***	0.080***	0.077***	0.045***	0.057***
	(0.013)	(0.012)	(0.013)	(0.013)	(0.010)	(0.011)
Volatility ($t-5$ to $t-1$)	0.259	0.364	0.398*	0.391*	0.164	0.331
	(0.229)	(0.237)	(0.233)	(0.233)	(0.238)	(0.243)
AbRet ($t-5$ to $t-1$)	0.178***	0.174***	0.173***	0.172***	0.172***	0.167***
	(0.051)	(0.052)	(0.051)	(0.051)	(0.052)	(0.053)
AbRet ($t-30$ to $t-6$)	0.113***	0.119***	0.117***	0.118***	0.108***	0.117***
	(0.026)	(0.024)	(0.024)	(0.024)	(0.027)	(0.025)
Observations	42,041	42,041	42,041	42,041	42,041	42,041
R^2	0.637	0.633	0.632	0.632	0.649	0.636

Panel B: Lead-Lag of Sophisticated versus Unsophisticated Sentiment

Disagreement measure	Sentiment Sophisticated (AMO) (1)	Sentiment Unsophisticated (AMO) (2)
Sentiment Sophisticated (BMO)	0.065***	0.025***
	(0.014)	(0.005)
Sentiment Unsophisticated (BMO)	0.007	0.454***
	(0.008)	(0.012)
AbLogVol ($t-1$)	0.017***	0.014***
	(0.003)	(0.004)
Media	0.016***	0.023***
	(0.004)	(0.005)
Volatility ($t-5$ to $t-1$)	−0.019	0.077
	(0.034)	(0.063)
AbRet ($t-5$ to $t-1$)	0.032***	0.038**
	(0.011)	(0.015)
AbRet ($t-30$ to $t-6$)	0.007	0.017**
	(0.005)	(0.007)
Observations	42,053	42,053
R^2	0.394	0.573

Learning from experience: Malmendier and Nagel (2011)

	10th pct	Median	90th pct	Mean	Std. dev.	#Obs.
	Panel A: All households					
Liquid assets	0	6,382	144,639	80,248	652,585	51,204
Income	11,883	43,419	105,339	60,511	178,088	51,204
Experienced real stock return ($\lambda = 1.50$)	0.062	0.092	0.119	0.091	0.022	51,204
Experienced real bond return ($\lambda = 1.50$)	–0.002	0.006	0.051	0.018	0.022	51,204
Stock market participation	0	0	1	0.342	0.474	51,204
Bond market participation	0	0	1	0.376	0.484	49,866
Elicited risk tolerance (1983–2007)	1	2	3	1.826	0.841	28,732
	Panel B: Stock market participants					
Liquid assets	4,974	51,567	409,723	210,070	1,108,027	22,541
Income	28,339	67,799	164,596	99,759	297,869	22,541
Bond market participation	0	1	1	0.681	0.466	22,293
Fraction of liquid assets in stocks	0.071	0.451	0.900	0.466	0.295	21,669
Elicited risk tolerance (1983–2007)	1	2	3	2.103	0.801	17,049
	Panel C: Bond market participants					
Liquid assets	2,332	31,842	322,119	169,981	1,027,384	22,553
Income	26,113	61,926	143,552	89,119	275,068	22,553
Stock market participation	0	1	1	0.628	0.483	22,553
Fraction of liquid assets in stocks	0	0.157	0.740	0.266	0.294	21,556
Elicited risk tolerance (1983–2007)	1	2	3	2.010	0.804	15,954

$$Experience_{it} = \sum_{k=1}^{Age_{it}-1} w_k R_{t-k} \qquad w_k = \frac{(Age_{it} - k)^\lambda}{\sum_{\ell=1}^{Age_{it}-1} (Age_{it} - \ell)^\lambda}$$

TABLE II
ELICITED RISK TOLERANCE

	(i)	(ii)
Experienced stock return coefficient β	4.533	6.692
	(1.106)	(1.180)
Weighting parameter λ	1.834	1.433
	(0.452)	(0.280)
Income controls	Yes	Yes
Liquid assets controls	–	Yes
Household characteristics	Yes	Yes
Age dummies	Yes	Yes
Year dummies	Yes	Yes
Average of fitted prob. at 90th pct. minus fitted prob. at 10th pct. of experienced stock return		
Risk tolerance = 1 (low)	−0.088	−0.103
[unconditional freq. = 0.413]	(0.020)	(0.016)
Risk tolerance = 2	0.025	0.029
[unconditional freq. = 0.391]	(0.001)	(0.003)
Risk tolerance = 3	0.040	0.047
[unconditional freq. = 0.153]	(0.011)	(0.010)
Risk tolerance = 4 (high)	0.023	0.027
[unconditional freq. = 0.043]	(0.009)	(0.009)
#Obs.	28,571	28,571
Pseudo R^2	0.09	0.10

TABLE III
STOCK AND BOND MARKET PARTICIPATION

	Experienced stock returns and stock market participation		Experienced bond returns and bond market participation	
	(i)	(ii)	(iii)	(iv)
Experienced return coefficient β	6.963	10.627	10.809	8.433
	(1.149)	(1.403)	(1.446)	(1.680)
Weighting parameter λ	1.924	1.325	1.176	1.282
	(0.267)	(0.209)	(0.218)	(0.367)
Income controls	Yes	Yes	Yes	Yes
Liquid assets controls	–	Yes	–	Yes
Household characteristics	Yes	Yes	Yes	Yes
Age dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Average of fitted prob. at 90th pctile. minus	0.092	0.102	0.161	0.114
fitted prob. at 10th pct. of experienced return	(0.019)	(0.017)	(0.022)	(0.023)
#Obs.	51,013	51,013	49,678	49,678
Pseudo R^2	0.40	0.49	0.27	0.33

TABLE V
USING STOCK AND BOND RETURNS JOINTLY

Dependent variable	Elicited risk tolerance	Stock market participation	Bond market participation	Fraction of liquid assets in stocks	Fraction of liquid assets in bonds
Sample	Full	Full	Full	Stock market participants	Bond market participants
	(i)	(ii)	(iii)	(iv)	(v)
Experienced stock return coeff. β_{stock}	4.670	10.564	–1.149	1.765	–1.381
	(2.042)	(1.405)	(1.244)	(0.410)	(0.361)
Weighting parameter for stocks λ_{stock}	1.433	1.325	1.325	1.166	1.166
	[fixed]	[fixed]	[fixed]	[fixed]	[fixed]
Average of fitted values at 90th pct. minus fitted values at 10th pct. of experienced stock return…	0.072	0.101	–0.015	0.103	–0.085
	(0.029)	(0.016)	(0.016)	(0.024)	(0.022)
…where fitted value refers to	probability of not being in lowest risk tolerance category	probability of stock market participation	probability of bond market participation	fraction of liquid assets in stocks	fraction of liquid assets in bonds
Experienced bond return coeff. β_{bond}	5.413	0.944	8.562	–0.748	0.970
	(4.420)	(1.904)	(1.579)	(0.572)	(0.487)
Weighting parameter for bonds λ_{bond}	1.282	1.282	1.282	1.282	1.282
	[fixed]	[fixed]	[fixed]	[fixed]	[fixed]
Average of fitted values at 90th pctile. minus fitted values at 10th pctile. of experienced bond return…	0.101	0.009	0.115	–0.036	0.046
	(0.079)	(0.018)	(0.021)	(0.028)	(0.023)
…where fitted value refers to	probability of not being in lowest risk tolerance category	probability of stock market participation	probability of bond market participation	fraction of liquid assets in stocks	fraction of liquid assets in bonds

Learning from experience

- Malmendier and Nagel (2016): inflation expectations
- Chernenko, Hanson and Sunderam (2016): asset managers
- Bailey, Cao, Kuchler and Stroebel (2018): housing prices using geographical variation

Extrapolative expectations: Greenwood and Shleifer (2014)

Table 2
Correlations between different measures of investor expectations

	Gallup (N = 135)	Graham-Harvey (N = 42)	American Association (N = 294)	Investor Intelligence (N = 588)	Shiller (N = 132)	Michigan (N = 22)	Index (N = 294)
Graham-Harvey	0.77						
	[0.000]						
American Association	0.64	0.56					
	[0.000]	[0.000]					
Investor Intelligence	0.60	0.64	0.55				
	[0.000]	[0.000]	[0.000]				
Shiller	0.39	0.66	0.51	0.43			
	[0.000]	[0.000]	[0.000]	[0.000]			
Michigan	0.61	−0.12	0.60	0.19	−0.55		
	[0.003]	[0.922]	[0.003]	[0.395]	[0.020]		
Expectations Index	0.87	0.58	0.87	0.81	0.52	0.55	
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.008]	
Fund flow	0.69	0.71	0.42	0.20	0.51	0.40	0.45
	[0.000]	[0.000]	[0.000]	[0.002]	[0.001]	[0.068]	[0.000]

This table shows partial correlation coefficients; that is, it uses the full sample of overlapping data for each series. The Expectations Index combines data in the Gallup, American Association, and Investor Intelligence series. Numbers in brackets denote *p*-values on the hypothesis that the correlation between the two series is zero.

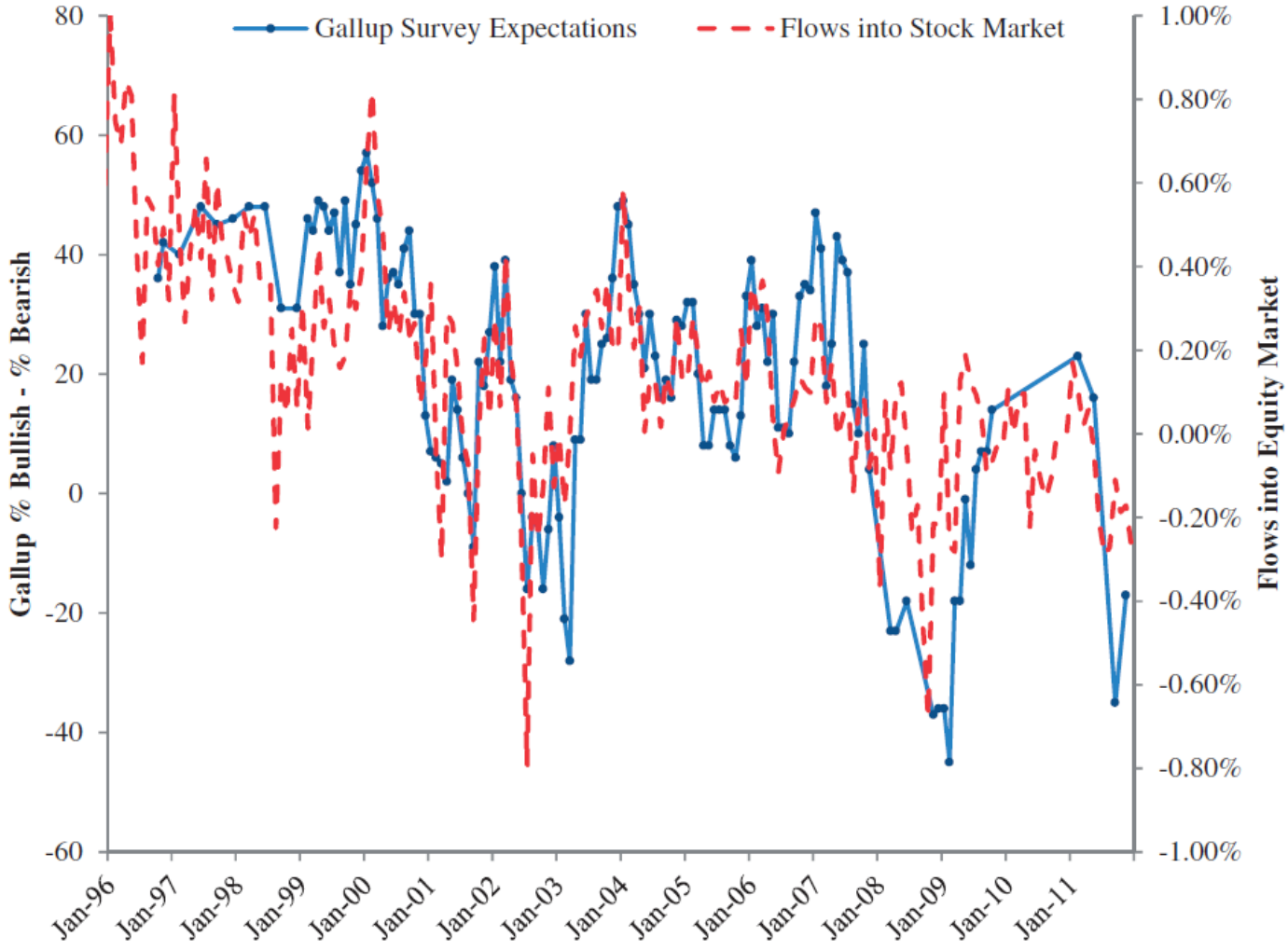


Figure 4
Comparing the Gallup survey with flows into equity mutual funds
The solid line denotes the percentage of investors who are bullish in the Gallup survey (left axis). The dashed line (right axis) is flows into mutual funds as a percentage of equity market capitalization, as reported by the Investment Company Institute.

Table 3
Determinants of investor expectations

	(1) Gallup	(2) GH	(3) AA	(4) II	(5) Shiller	(6) Michigan	(7) Index	(8) Gallup	(9) GH	(10) AA	(11) II	(12) Shiller	(13) Michigan	(14) Index
Panel A: Past returns and price levels														
R_{t-12}	91.227	3.133	32.479	50.771	1.626	3.897	3.092	89.155	3.354	36.173	53.454	3.368	6.868	3.347
	[8.811]	[2.515]	[4.046]	[6.012]	[0.182]	[1.680]	[5.516]	[13.052]	[2.460]	[5.839]	[7.031]	[0.691]	[5.050]	[7.600]
Log(P/D)								25.995	3.404	15.721	11.465	17.801	5.389	1.087
								[4.107]	[3.264]	[4.234]	[3.131]	[4.808]	[6.359]	[5.785]
Constant	14.881	5.789	5.018	6.915	81.965	9.614	−0.337	−92.859	−7.979	−56.461	−34.654	9.893	−13.535	−4.587
	[5.307]	[12.030]	[2.320]	[3.084]	[43.492]	[12.910]	[2.312]	[−3.523]	[−1.902]	[−3.847]	[−2.491]	[0.668]	[−3.858]	[−6.079]
N	135	42	294	588	132	22	294	135	42	294	588	132	22	294
R^2	0.611	0.133	0.135	0.188	0.002	0.191	0.300	0.689	0.348	0.259	0.243	0.317	0.827	0.443

$$Expectations_t = a + b \sum_{j=0}^{k} \frac{\lambda^j}{\sum_{i=0}^{k} \lambda^i} R_{t-j} + \epsilon_t$$

Table 4
Determinants of investor expectations

	(1) Gallup	(2) GH	(3) AA	(4) II	(5) Shiller	(6) Michigan	(7) Index
λ	0.770	0.457	0.392	0.493	0.334	0.918	0.542
	[19.946]	[2.617]	[3.968]	[4.950]	[0.384]	[42.126]	[2.274]
a	11.725	5.781	5.206	6.530	81.912	8.693	−0.359
	[4.464]	[2.425]	[2.256]	[2.780]	[43.906]	[25.511]	[5.119]
b	502.643	14.690	133.816	227.675	12.270	65.140	14.142
	[8.563]	[23.839]	[2.349]	[5.819]	[0.234]	[5.542]	[5.107]
N	135	42	294	588	132	22	294
R^2	0.675	0.252	0.219	0.281	0.015	0.768	0.415

Table 6
Continued

Panel B: Forecasting thirty-six-month returns

Gallup*	−7.485 [−4.864]									−6.205 [−3.306]		−4.815 [−2.028]		−7.362 [−4.701]	
Graham-Harvey		−0.050 [−1.084]													
AA**			−4.154 [−1.097]												
II**				−5.319 [−3.206]											
Shiller*					−1.784 [−0.508]										
Index*						−5.713 [−2.678]					−3.189 [−2.048]		−2.174 [−0.859]		−3.686 [−1.577]
Log(D/P)							0.186 [1.554]			0.544 [1.566]	0.457 [2.141]				
-Surplus cons.								3.618 [3.890]				2.984 [1.973]	4.153 [2.540]		
cay									12.359 [4.717]					6.148 [1.641]	11.618 [3.432]
Constant	0.818 [5.675]	0.353 [1.239]	0.667 [1.955]	0.721 [3.676]	0.259 [0.692]	0.825 [3.825]	0.847 [2.051]	0.749 [4.352]	0.166 [3.607]	2.958 [2.140]	2.346 [2.773]	1.057 [3.856]	1.068 [3.618]	0.850 [7.130]	0.527 [2.635]
N	124	31	261	555	99	261	555	555	555	124	261	124	261	124	261
R^2	0.235	0.080	0.018	0.110	0.012	0.094	0.052	0.266	0.388	0.341	0.253	0.342	0.320	0.326	0.450

We estimate time-series regressions of the form:

$$R^x_{t+k} = a + bX_t + u_{t+k},$$

where R^x denotes the k-month excess return on the stock market, and X is a predictor variable. The independent variables include measures of expectations and measures of expected returns, including *cay*, the log dividend price ratio, and surplus consumption. Selected investor expectations variables are starred to indicate that we use the rescaled versions. The rescaled versions can be interpreted in units of nominal stock returns. Panel A shows results for twelve-month returns; Panel B shows thirty-six-month returns. Newey-West-based t-statistics are in brackets. Note that Michigan is excluded from Panel B because it does not have enough observations needed to compute the standard errors. In Columns (1)–(7) of Panel A, for each measure of survey expectations, we show the p-value on the test that $b=1$.

Example of deviation from RE

- Denote

  x_{t+1}: variable being forecast

  $F_t x_{t+1}$: forecast at t

  $E_t x_{t+1}$: RE forecast at t

- Assume

$$F_t x_{t+1} = (1-\lambda) E_t x_{t+1} + \lambda F_{t-1} x_{t+1}$$

  $\lambda = 0$: rational expectations

  $\lambda > 0$: under-reaction (sticky expectations)

  $\lambda < 0$: over-reaction (extrapolative expectations)

- Coibion and Gorodnichenko (2015)

$$\Leftrightarrow \quad E_t x_{t+1} - F_t x_{t+1} = \frac{\lambda}{1-\lambda} \left[F_t x_{t+1} - F_{t-1} x_{t+1} \right]$$

  Forecast revision predicts forecast error $\rightarrow$ can be estimated by OLS

Muth (1961)

Deviations from Rationality. Certain imperfections and biases in the expectations may also be analyzed with the methods of this paper. Allowing for cross-sectional differences in expectations is a simple matter, because their aggregate effect is negligible as long as the deviation from the rational forecast for an individual firm is not strongly correlated with those of the others. Modifications are necessary only if the correlation of the errors is large and depends systematically on other explanatory variables. We shall examine the effect of over-discounting current information and of differences in the information possessed by various firms in the industry. Whether such biases in expectations are empirically important remains to be seen. I wish only to emphasize that the methods are flexible enough to handle them.

Let us consider first what happens when expectations consistently over- or under-discount the effect of current events. Equation (3.8), which gives the optimal price expectation, will then be replaced by

$$p_t^e = f_1 W_1 \varepsilon_{t-1} + \sum_{i=2}^{\infty} W_i \varepsilon_{t-i} . \tag{3.18}$$

In other words the weight attached to the most recent exogenous disturbance is multiplied by the factor f_1, which would be greater than unity if current information is over-discounted and less than unity if it is under-discounted.

Extrapolative expectations

Bordalo, Gennaioli, La Porta and Shleifer (2019)

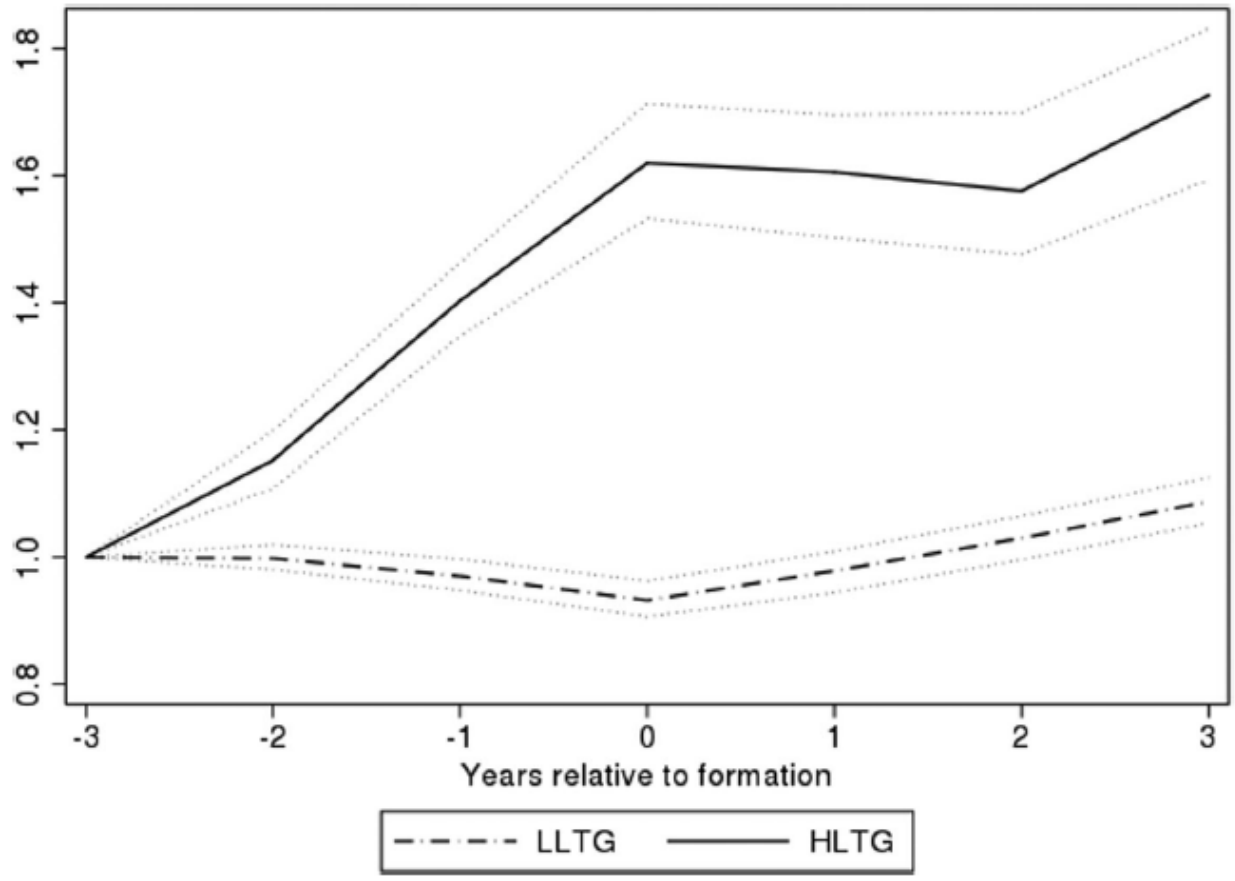


Figure 2. Evolution of EPS. In December of years (t) 1981, 1984, ... 2011, and 2014, we form decile portfolios based on ranked analysts' expected growth in long-term EPS (LTG). We report the (bootstrapped) mean value of EPS for the highest (HLTG) and lowest (LLTG) LTG deciles for each year between $t-3$ and $t+3$. We exclude firms with negative earnings in $t-3$ and normalize to 1 the value of EPS in $t-3$. To do so, we restrict the computation to firms that have positive earnings at $t-3$. The dotted lines indicate 5^{th} and 95^{th} confidence levels determined via nonparametric bootstrapping using 1,000 samples (the results are robust to changing the size of sample draws).

Table II

Coibion-Gorodnichenko Regressions for EPS

Each entry in the table corresponds to the estimated coefficient of regressing the forecast errors $(EPS_{t+n}/EPS_t)^{1/n} - LTG_t$ for $n = 3$, 4, and 5 on the variables listed in the first column of the table and year fixed effects (not shown).[a] indicates significance at the 1% level.

	Dependent Variable		
	$(EPS_{t+3}/EPS_t)^{1/3} - LTG_t$	$(EPS_{t+4}/EPS_t)^{1/4} - LTG_t$	$(EPS_{t+5}/EPS_t)^{1/5} - LTG_t$
$LTG_t - LTG_{t-1}$	−0.0351	−0.1253[a]	−0.1974[a]
	(0.0734)	(0.0642)	(0.0516)
$LTG_t - LTG_{t-2}$	−0.2335[a]	−0.2687[a]	−0.2930[a]
	(0.0625)	(0.0602)	(0.0452)
$LTG_t - LTG_{t-3}$	−0.2897[a]	−0.2757[a]	−0.3127[a]
	(0.0580)	(0.0565)	(0.0437)

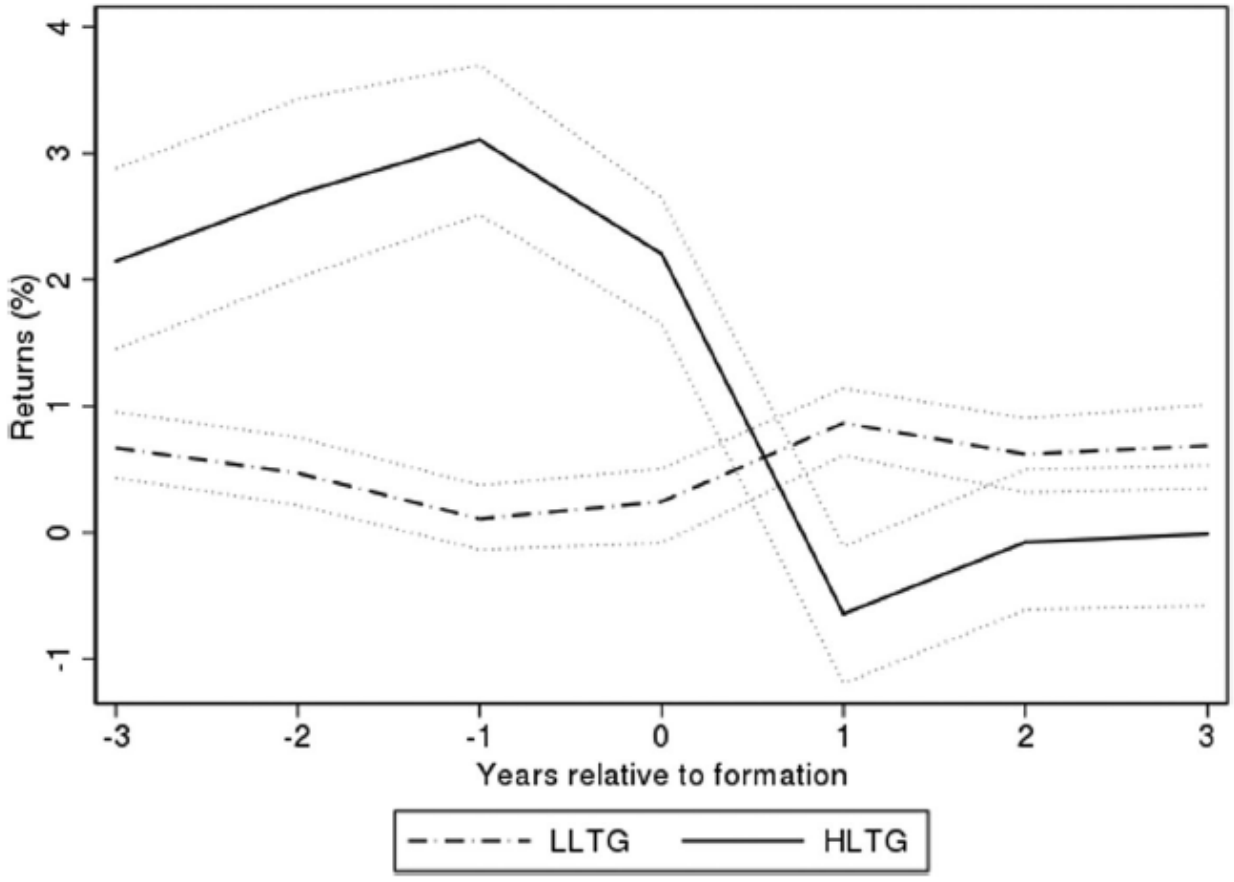


Figure 5. Twelve-day returns on earnings announcements for LTG portfolios. In December of each year t between 1981 and 2013, we form decile portfolios based on ranked analysts' expected growth in long-term EPS. Next, for each stock, we compute the three-day market-adjusted return centered on earnings announcements in years $t-3, \ldots, t+3$. Next, we compute the annual return that accrues over earnings announcements by compounding all three-day stock returns in each year. We report the equally weighted (bootstrapped) average annual return during earnings announcements for the highest (HLTG) and lowest (LLTG) LTG deciles. Excess returns are defined relative to the equally weighted CRSP market portfolio. The dotted lines indicate 5^{th} and 95^{th} confidence levels determined via bootstrapping.

Sticky expectations

Bouchaud, Krueger Landier and Thesmar (2019)

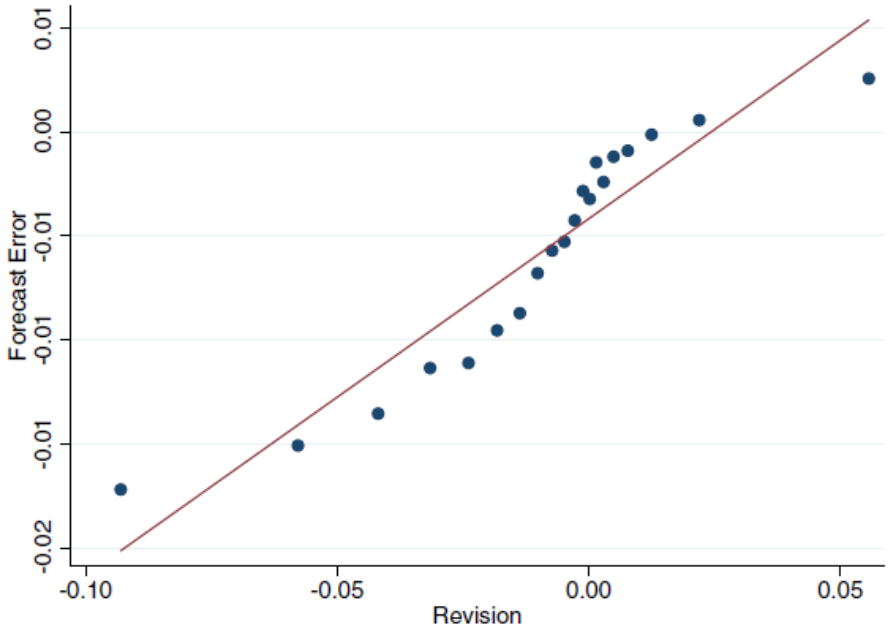


Figure 1. Forecast errors and forecast revisions. This figure shows the forecast errors as a function of forecast revisions. We sort observations into 20 bins of forecast revision $(F_{t-1}\pi_{f,t} - F_{t-2}\pi_{f,t})/P_{f,t-2}$ and calculate the average forecast error (defined as $(\pi_{f,t} - F_{t-1}\pi_{f,t})/P_{f,t-2}$) and the average forecast revision for each of the 20 ordered bins. (Color figure can be viewed at wileyonlinelibrary.com)

Dependent Variable: $(\pi_{f,t} - F_{t-1}\pi_{f,t})/P_{f,t-2}$	
$(F_{t-1}\pi_{f,t} - F_{t-2}\pi_{f,t})/P_{f,t-2}$	0.165***
	(10.28)
$F_{t-1}\pi_{f,t}/P_{f,t-2}$	
$F_{t-2}\pi_{f,t}/P_{f,t-2}$	
$(\pi_{f,t-1} - \pi_{f,t-2})/P_{f,t-2}$	
Observations	54,090
R^2	0.030

Panel A: Analyst-Level

	Count	Mean	*SD*	Min	p5	p10	p25	p50	p75	p90	p95	Max
λ_a	6,938	0.16	0.56	−2.26	−0.78	−0.42	−0.05	0.18	0.40	0.66	0.91	2.61

Panel A: Dependent Variable λ_a (Analyst Level)

Experience	−0.005***					−0.002
	(−3.20)					(−0.61)
Firm experience		−0.019***				−0.012*
		(−4.26)				(−1.65)
Industry experience			−0.010***			−0.001
			(−4.64)			(−0.13)
Covered industries				0.011***		0.020***
				(3.44)		(5.05)
Covered firms					−0.003***	−0.005***
					(−2.73)	(−4.25)
Constant	0.185***	0.197***	0.200***	0.116***	0.191***	0.196***
	(14.43)	(14.24)	(15.02)	(8.85)	(11.67)	(9.34)
Observations	6,938	7,054	6,890	7,036	7,063	6,716
R^2	0.001	0.002	0.003	0.002	0.001	0.007

terciles of stock-level lambda (= median lambda of analysts following the stock)

	Q1 (1)	Q2 (2)	Q3 (3)	Q4 (4)	Q5 (5)	Q5 − Q1 (6)
Panel A: Cash Flows (cf)						
T1	−0.18	0.03	0.21**	0.26**	0.33**	0.51**
	(−1.00)	(0.34)	(2.29)	(2.30)	(2.37)	(2.42)
T2	0.12	0.16*	0.31***	0.41***	0.59***	0.47**
	(0.76)	(1.74)	(3.50)	(4.50)	(4.39)	(2.40)
T3	−0.58***	−0.18*	0.12	0.20*	0.44***	1.02***
	(−3.56)	(−1.81)	(1.39)	(1.80)	(3.74)	(4.94)
T3 − T1	−0.40**	−0.21**	−0.09	−0.06	0.11	0.51***
	(−2.36)	(−2.45)	(−0.99)	(−0.78)	(1.11)	(3.18)
Panel C: Momentum (mom)						
T1	−0.51***	−0.08	0.10	0.32***	0.60**	1.11***
	(−3.08)	(−0.68)	(1.06)	(3.44)	(2.38)	(3.28)
T2	−0.20	−0.01	0.24**	0.39***	0.79***	0.99***
	(−1.00)	(−0.08)	(2.49)	(4.51)	(3.61)	(2.76)
T3	−0.87***	−0.25**	0.05	0.34***	0.65***	1.51***
	(−4.94)	(−1.97)	(0.41)	(3.41)	(3.56)	(4.79)
T3 − T1	−0.36***	−0.17*	−0.05	0.01	0.05	0.41***
	(−3.16)	(−1.87)	(−0.57)	(0.12)	(0.30)	(2.64)

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