

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 ($H = 0$):

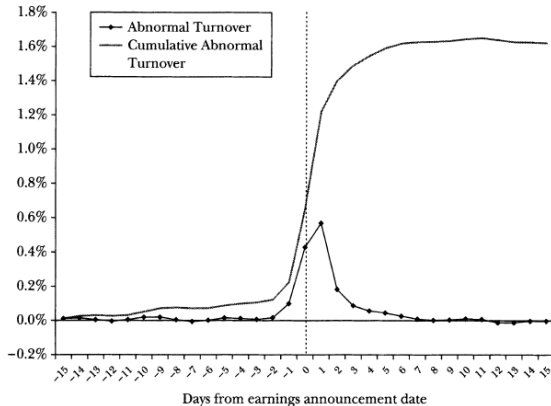
$$P = V - \gamma S \quad \text{and} \quad \text{Volume} = 0$$

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

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

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)

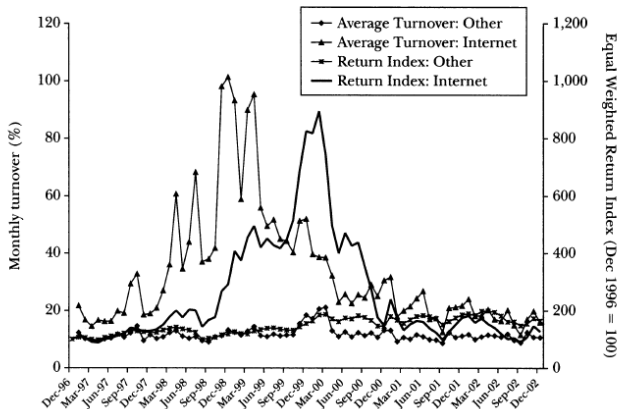
Heterogeneous beliefs & Short-sales constraints

- ▶ 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 ($X_i \geq 0$):

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

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					All Stocks
	Small		Large			
	S1	S2	S3	S4	S5	
D1 (low)	1.52	1.45	1.50	1.51	1.48	1.48
D2	1.12	1.40	1.41	1.18	1.35	1.36
D3	0.99	1.20	1.32	1.11	1.36	1.23
D4	0.76	1.07	1.18	1.33	1.33	1.12
D5 (high)	0.14	0.56	0.83	1.03	1.20	0.69
D1–D5	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)				(High)	
		RI1	RI2	RI3	RI4	RI5	RI5 - RI1 (<i>t</i> -statistic)
<i>Panel A: firm characteristics by residual institutional ownership quintile</i>							
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	
<i>Panel C: intersection with sort on analyst forecast dispersion (ADISP)</i>							
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)
	(<i>t</i> -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)
	(<i>t</i> -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)
	(<i>t</i> -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) → welfare efficient

- ▶ Paternalism → 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)

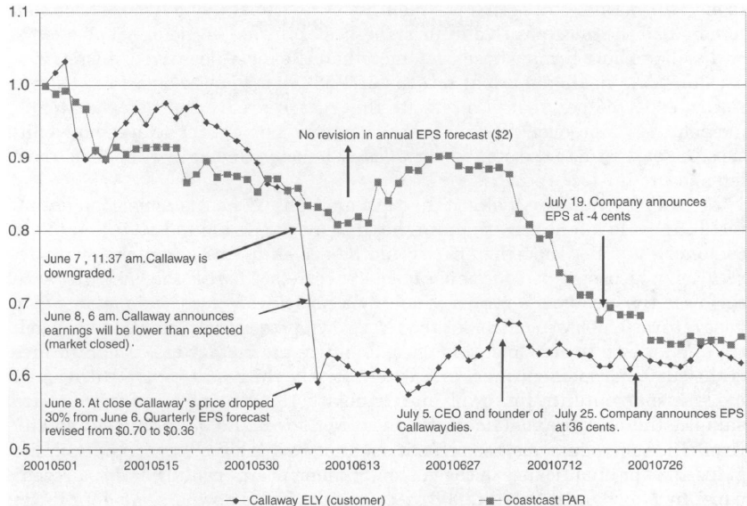
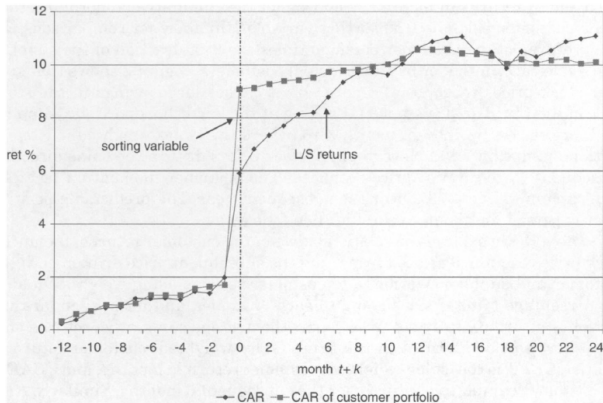


Figure 1. Coastcast Corporation and Callaway Golf Corporation. This figure plots the stock prices of Coastcast Corporation (ticker = PAR) and Callaway Golf Corporation (ticker = ELY) between May and August 2001. Prices are normalized (05/01/2001 = 1).

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

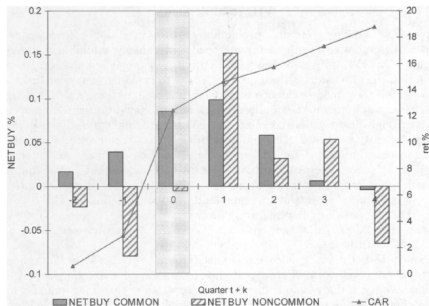


Figure 3. Customer momentum, event-time CAR, and mutual fund's net purchases. This figure shows the average cumulative return and mutual funds net purchases in quarter $t+k$ on a long-short portfolio formed on the firm's customer return in quarter t . At the beginning of every quarter, stocks are ranked 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	<i>SD</i>	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		
Sentiment	Number of Messages	
	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	<i>SD</i>
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	<i>SD</i>	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

Disagreement measure	Abnormal Log Volume (t)					
	(1)	(2)	(3)	(4)	(5)	(6)
Disagreement (t)	0.099*** (0.008)	+1 s.d. --> volume +10%				
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*** (0.015)	0.723*** (0.015)	0.727*** (0.015)	0.725*** (0.015)	0.705*** (0.017)	0.717*** (0.016)
Media (t)	0.069*** (0.013)	0.071*** (0.012)	0.080*** (0.013)	0.077*** (0.013)	0.045*** (0.010)	0.057*** (0.011)
Volatility ($t - 5$ to $t - 1$)	0.259 (0.229)	0.364 (0.237)	0.398* (0.233)	0.391* (0.233)	0.164 (0.238)	0.331 (0.243)
AbRet ($t - 5$ to $t - 1$)	0.178*** (0.051)	0.174*** (0.052)	0.173*** (0.051)	0.172*** (0.051)	0.172*** (0.052)	0.167*** (0.053)
AbRet ($t - 30$ to $t - 6$)	0.113*** (0.026)	0.119*** (0.024)	0.117*** (0.024)	0.118*** (0.024)	0.108*** (0.027)	0.117*** (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*** (0.014)	0.025*** (0.005)
Sentiment Unsophisticated (BMO)	0.007 (0.008)	0.454*** (0.012)
AbLogVol ($t - 1$)	0.017*** (0.003)	0.014*** (0.004)
Media	0.016*** (0.004)	0.023*** (0.005)
Volatility ($t - 5$ to $t - 1$)	-0.019 (0.034)	0.077 (0.063)
AbRet ($t - 5$ to $t - 1$)	0.032*** (0.011)	0.038** (0.015)
AbRet ($t - 30$ to $t - 6$)	0.007 (0.005)	0.017** (0.007)
Observations	42,053	42,053
R^2	0.394	0.573

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