

Investor Sentiment, Beta, and the Cost of Equity Capital

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Abstract

We hypothesize that periods of optimism attract equity investment by unsophisticated and overconfident traders who under-assess risk, while, owing to shorting costs, face leverage constraints (or are simply averse to borrowing/shorting) such traders stay along the sidelines during pessimistic periods.

In turn, we argue that pessimistic (optimistic) periods may accentuate (suppress) the pricing of covariance risk.

Controlling for well-known return determinants, we find that beta is strongly and positively priced in pessimistic periods (but not in optimistic ones), with a reasonable estimate of the market risk premium.

The evidence supports the notion that rational pricing varies dynamically with the populace of rational agents in the market

Key Motivation

- This study is motivated by the simple idea that high beta stocks are a natural speculation vehicle for investors who are optimistic about the stock market and face leverage constraints (or are simply averse to borrowing/shorting).

Structure of Presentation

- Background
- Hypothesis
- Data & Methods
- Results
- Conclusion & Contribution

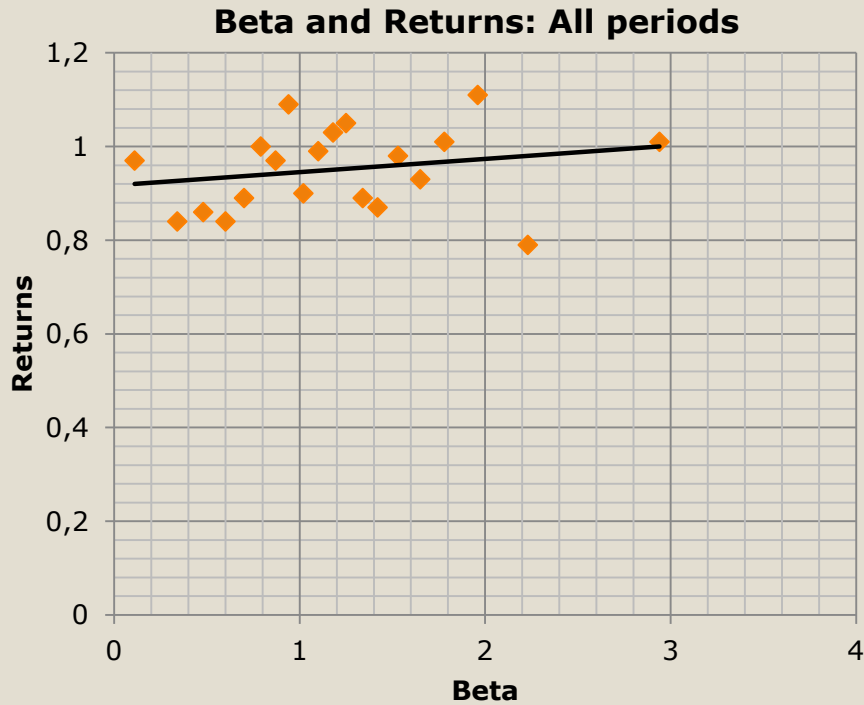
CAPM Breakdown

- The CAPM of Sharpe (1964), Lintner (1965) and Mossin (1966) posits that if traders are rational and sophisticated (...no arbitrage limits), expected returns increase linearly with asset betas, and is an integral element of capital budgeting decisions.
- In a seminal study, Fama and French (1992) show that beta is **unrelated** to returns, casting doubt on the applicability of the CAPM.
- Various explanations have been put forward to explain this puzzle ranging from **mispecifications of risk** (Jagannathan and Wang, 1996), to **inefficiency of market proxies** (Roll and Ross, 1994) to **frictions** (Black, 1972; Baker, Bradley and Wurgler, 2011).

Market Anomalies

- Evidence against neoclassical financial theories:
 - Price predictability (momentum, reversals, PEAD)
 - Equity premium puzzle & excess volatility
 - Generally... a weak 'fit' of asset pricing models
- Behavioural finance explains these 'anomalies' by incorporating evidence from psychology
 - Non-Bayesian beliefs due to:
 - Decision heuristics (representativeness, conservatism)
 - **Sentiment ('mood' or affect)**
 - Non-EU preferences (Prospect Theory, ambiguity aversion)
- In this paper we examine whether **sentiment** affects the validity of the CAPM

A sneak preview...



Sentiment and Biases

- **Current sentiment** affects judgment about the likelihood of **future** events. Evidence shows that:
 - People in a 'good mood' perceive positive events as more likely and negative events as less likely
 - People in a 'bad mood' perceive negative events as more likely and positive events as less likely
 - **Sentiment induces a bias in human beliefs**
- How will this bias affect asset prices?
 - **Optimistic** investors will **overprice** assets as they will overweight positive outcomes (vice versa for pessimism)
 - Returns going forward will be out of line with fundamentals & will be predictable as prices correct
 - **Sentiment** (coupled with **limits to arbitrage, borrowing and shorting**) triggers market inefficiency

Sentiment & Anomalies

- Applications of sentiment uncovered intriguing time-variation in the behaviour of several anomalies:
 - **Size effect** only holds in pessimistic periods [Baker and Wurgler, 2006]
 - **Momentum effect** only holds in optimistic periods [Antoniou Doukas and Subrahmanyam 2013]
 - **Several anomalies** not explained by FF-3 are more profitable in optimistic periods [Stambaugh et al, 2012]
 - Market returns positively related to conditional volatility **only in pessimistic periods** [Yu and Yuan, 2012]
- **'Anomalies'** seem to be stronger in optimistic periods

Our Hypothesis

- We build on this evidence and examine whether sentiment affects the validity of the CAPM
 - Fama and French (1992) show that CAPM beta **is not related to returns**, a major violation of neoclassical theories
- We hypothesize that this result arises because:
 - Optimism entails **long** positions, which are unrestricted
 - More noise trading in optimistic periods, which pushes prices away from fundamentals→ **beta not related to returns**
 - Pessimism entails **short** positions, which are restricted (expensive & complicated)
 - Less noise trading in pessimistic periods, so prices are more in line with fundamentals→ **beta related to returns**

- In general we propose that the level of **sentiment** determines the amount of **noise trading**, as discussed in Black (1986)
 - In pessimistic periods noise traders are kept out so ***prices=f(fundamentals)***
 - In optimistic periods noise traders participate so ***prices=f(fundamentals + noise)***
 - This mechanism can explain the evidence discussed previously which suggests that **markets are more efficient in pessimistic periods**
- Theoretically this prediction is derived in Daniel et al (2001)
 - When behavioural biases are weaker the pricing of covariance risk will be stronger

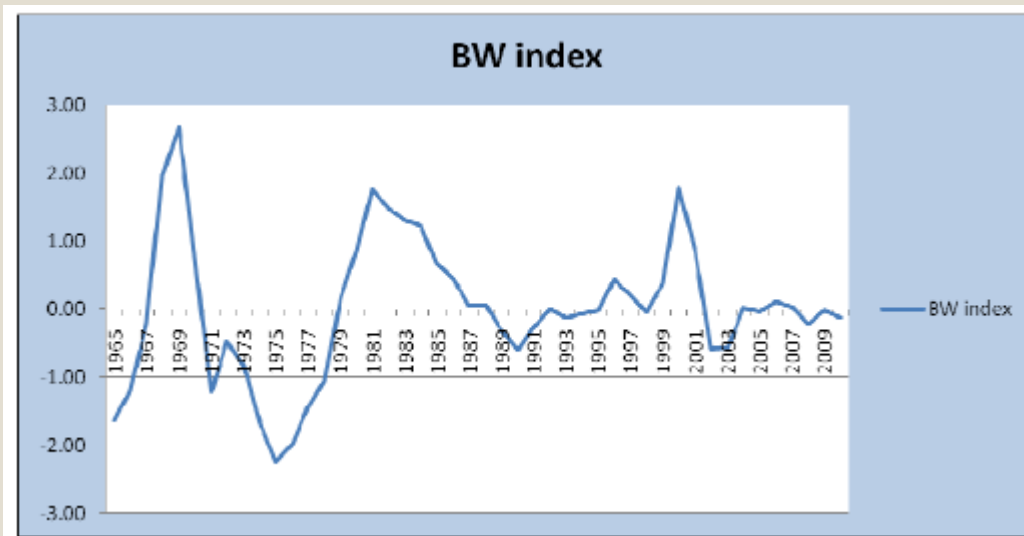
Data & Methodology

- Returns are from CRSP, book values from Compustat
- Analyst forecast data from IBES
- Mutual fund data from Thomson Reuters and CRSP
- We use all common stocks on CRSP
- Measure sentiment using the Baker and Wurgler (2006) index
- The index is available from 1965 to 2010, so our sample covers the period 1966-2010

- Use the Fama and French (1992) methodology
 - Assign portfolio betas to individual stocks
 - Portfolio sorts: Beta and returns conditional on sentiment
 - Fama-McBeth regressions: Average coefficients conditional on sentiment
 - Robustness checks

The BW sentiment index

- BW combine 6 market variables that capture investors propensity to invest in equities
 - Trading volume (NYSE turnover)
 - Premium on dividend paying stocks
 - Closed-end fund discount
 - Number and first day returns of IPO's
 - Equity share in new issues
 - Orthogonalize these measures to macroeconomic variables



Baker and Wurgler (2006, 2007) discuss how the index lines up well with patterns of boom and bust in the market

Positive (negative) values in year $t-1$ indicate Opt. (Pess.) sentiment in year t

Post-Formation betas

	Low β	2	3	4	5	6	7	8	9	High β
Small ME	0.98	1.01	1.18	1.23	1.39	1.44	1.56	1.64	1.82	2.01
2	0.90	1.03	1.10	1.23	1.31	1.41	1.51	1.59	1.72	1.98
3	0.86	0.96	1.05	1.12	1.18	1.27	1.40	1.53	1.56	1.95
4	0.82	0.93	0.98	1.12	1.19	1.29	1.37	1.48	1.72	1.94
5	0.77	0.87	1.00	1.09	1.12	1.20	1.36	1.44	1.49	1.83
6	0.64	0.74	0.95	1.02	1.11	1.18	1.22	1.32	1.47	1.78
7	0.66	0.74	0.95	1.04	1.12	1.21	1.27	1.29	1.37	1.73
8	0.58	0.75	0.95	0.99	1.09	1.09	1.18	1.21	1.38	1.64
9	0.60	0.71	0.84	0.88	0.98	1.02	1.06	1.14	1.25	1.59
Large ME	0.55	0.63	0.73	0.85	0.88	0.93	0.99	1.10	1.22	1.48

- Post formation betas reproduce the ranking from pre-formation betas
- Sizable variation in beta in the various size portfolios
- Betas are higher for smaller stocks

Results: Characteristics of beta-portfolios

	Low β	2	3	4	5	6	7	8	9	High β
log(BM)	-0.37	-0.35	-0.35	-0.35	-0.37	-0.38	-0.38	-0.41	-0.44	-0.63
Log(ME)	4.84	5.10	5.10	5.06	5.01	4.98	4.79	4.61	4.40	4.03
ROA	0.06	0.09	0.09	0.09	0.09	0.08	0.08	0.07	0.06	0.01
Total Volatility	2.30%	2.14%	2.26%	2.34%	2.48%	2.61%	2.81%	3.03%	3.33%	4.06%
Analyst disagreement	0.13	0.16	0.14	0.15	0.17	0.21	0.27	0.25	0.30	0.37

- High beta stocks are smaller, with lower B/M ratio and ROA, higher volatility and higher analyst disagreement
 - These characteristics highlight that high beta stocks are of course riskier

Descriptive stats and correlations

Panel A: Descriptive statistics							
	mean	st. dev	median	Q1	Q3		
rolling beta	1.31	0.46	1.24	0.98	1.57		
Full sample beta	1.3	0.34	1.24	1.03	1.51		
log(ME)	4.8	2.08	4.64	3.28	6.18		
log(BM)	-0.44	0.9	-0.37	-0.94	0.13		
Panel B: Correlation coefficients							
	rolling beta	FF beta	log(ME)	log(BM)	ret1	ret6	ret12
rolling beta	1	0.81	-0.24	-0.05	0.008	0.036	0.04
		[<.0001]	[<.0001]	[<.0001]	[<.0001]	[<.0001]	[<.0001]
FF beta		1	-0.29	-0.07	0.01	0.03	0.05
			[<.0001]	[<.0001]	[<.0001]	[<.0001]	[<.0001]
log(ME)			1	-0.37	-0.04	-0.04	0.03
				[<.0001]	[<.0001]	[<.0001]	[<.0001]
log(BM)				1	0.03	0.08	-0.04
					[<.0001]	[<.0001]	[<.0001]
ret1					1	-0.02	0.003
						[<.0001]	[<.0001]
ret6						1	-0.01
							[<.0001]
ret12							1

Beta and Returns-Portfolios

	Low β	2	3	4	5	6	7	8	9	High β	H-L
All (n=540)	0.90	0.86	0.94	1.04	0.93	1.01	0.89	0.98	1.04	0.89	-0.01
Pess. (n=276)	0.79	0.77	0.87	1.12	1.25	1.12	1.35	1.39	1.67	1.88	1.09**
Opt. (n=264)	1.01	0.95	1.00	0.96	0.59	0.90	0.41	0.55	0.38	-0.15	-1.16**
										Pess.-Opt.	2.25

- **Unconditionally** the relationship between beta and returns is **flat**, as shown by FF 1992
- In pessimistic periods **high beta stocks outperform low beta stocks**, as predicted by the CAPM
- In Optimistic periods the reverse is true (?)

An aside: Momentum and B/M effects

	Losers	2	3	4	5	6	7	8	9	Winners	H-L
All (n=540)	0.47	0.78	0.94	1.11	1.16	1.21	1.29	1.36	1.45	1.60	1.13**
Pess. (n=276)	1.83	1.73	1.67	1.69	1.63	1.60	1.67	1.75	1.90	2.26	0.43
Opt.(n=264)	-0.95	-0.20	0.19	0.52	0.67	0.81	0.89	0.95	0.98	0.91	1.87**
	Growth	2	3	4	5	6	7	8	9	Value	H-L
All (n=540)	0.66	0.95	1.00	1.17	1.22	1.31	1.37	1.50	1.63	1.78	1.12**
Pess. (n=276)	1.47	1.65	1.42	1.58	1.67	1.73	1.80	1.92	2.14	2.58	1.11*
Opt.(n=264)	-0.19	0.22	0.55	0.73	0.75	0.87	0.93	1.06	1.09	0.95	1.14*

- Momentum premium **only** in optimistic periods.
- Value premium **in both** sentiment periods

Beta and Returns-FM Regressions

Panel A: All (n=540)						Panel B: Pessimistic (n=276)						Panel C: Optimistic (n=264)					
β	lnME	lnB/M	ret1	ret6	ret12	β	lnME	lnB/M	ret1	ret6	ret12	β	lnME	lnB/M	ret1	ret6	ret12
0.31						1.46						-0.88					
[1.23]						[4.26]						[-2.46]					
0.04	-0.11					0.97	-0.21					-0.93	-0.02				
[0.18]	[-3.11]					[3.07]	[-4.02]					[-2.61]	[-0.33]				
0.18	-0.07	0.28				0.97	-0.17	0.20				-0.65	0.04	0.37			
[0.79]	[-1.78]	[5.04]				[3.17]	[-3.36]	[2.70]				[-2.05]	[0.77]	[4.36]			
0.16	-0.07	0.30	-0.05			0.97	-0.17	0.22	-0.06			-0.68	0.04	0.38	-0.04		
[0.76]	[-1.84]	[5.50]	[-13.45]			[3.23]	[-3.41]	[3.04]	[-10.71]			[-2.23]	[0.80]	[4.70]	[-8.29]		
0.10	-0.07	0.29	-0.05	0.005		0.84	-0.17	0.21	-0.06	0.001		-0.69	0.03	0.37	-0.04	0.009	
[0.49]	[-2.02]	[5.46]	[-13.80]	[2.35]		[3.07]	[-3.50]	[2.93]	[-10.98]	[0.23]		[-2.45]	[0.66]	[4.80]	[-8.51]	[3.61]	
0.11	-0.08	0.30	-0.05	0.005	0.006	0.85	-0.17	0.25	-0.06	0.000	0.005	-0.65	0.02	0.37	-0.04	0.009	0.007
[0.59]	[-2.23]	[5.89]	[-14.31]	[2.24]	[4.90]	[3.22]	[-3.63]	[3.38]	[-11.47]	[0.17]	[2.50]	[-2.43]	[0.48]	[4.98]	[-8.76]	[3.46]	[4.76]

Beta and returns in optimistic periods

- Why do high beta stocks underperform in optimistic periods?
- High beta stocks entail **more subjective valuations**
 - Could do very well or very badly in the future
 - Such stocks are prone to sways in sentiment
 - During optimistic periods investors overweight the likelihood of the positive outcomes, which leads to an overpricing [Baker and Wurgler, 2006]
- Are higher in beta stocks favoured by noise traders in optimistic periods?

- Test this notion using the Frazzinni and Lamont (2008) method which involves flows into mutual funds
 - Fund flows reflect the preferences of noise traders
 - Stocks that are owned by funds that experience **abnormal inflows** can be thought to be favoured by noise traders
 - We identify hypothetical fund TNA in a world where flows are proportional to past TNA's and calculate $z = \text{TNA} - \text{HTNA}$
 - Stocks owned by funds with high z are favoured by noise traders

Beta portfolio	1	10	H-L	t-stat
Optimistic	-0.06	0.27	0.33	4.05
Pessimistic	0.52	0.64	-0.12	-1.48

- In Optimistic periods high beta stocks are favoured by noise traders, so become overpriced
- No effect in pessimistic periods

Robustness checks

- High and low betas stocks differ in many respects. Are our results capturing dimensions of risk other than covariance?
- Two-way sorts of beta portfolios to control for:
 - **Agency risk:** Institutional ownership
 - **Information quality risk:** Analyst coverage
 - **Noise trader risk :** Option listing status
- We sort our beta portfolios into high/low values of the above variables and repeat the analysis separately for each group

	Low β	2	3	4	5	6	7	8	9	High β	H-L	t-stat
Low institutional ownership												
Optimistic (n=210)	0.88	0.98	1.10	1.03	0.90	0.94	0.39	0.41	-0.11	-0.80	-1.68**	-2.37
Pessimistic (n=144)	0.85	0.98	1.29	1.17	1.57	1.69	2.02	2.55	2.24	2.36	1.51**	1.92
High institutional ownership												
Optimistic (n=210)	1.03	0.96	1.00	1.04	0.52	0.77	0.37	0.49	0.30	-0.21	-1.24*	-1.86
Pessimistic (n=144)	1.06	0.96	1.31	1.68	1.64	1.55	1.97	1.83	2.31	2.60	1.54**	2.29

	Low β	2	3	4	5	6	7	8	9	High β	H-L	t-stat
Panel A: Low coverage												
Optimistic (n=222)	1.00	0.97	1.03	0.90	0.44	1.01	0.48	0.55	0.29	-0.45	-1.45**	-2.34
Pessimistic (n=144)	1.06	0.81	1.34	1.68	1.50	1.53	1.92	1.57	2.40	2.55	1.49**	2.12
Panel B: High coverage												
Optimistic (n=222)	1.01	1.09	1.16	1.15	0.95	0.90	0.67	0.67	0.88	0.15	-0.86	-1.21
Pessimistic (n=144)	1.05	1.22	1.49	1.62	1.72	1.63	1.97	2.18	2.31	2.71	1.66**	2.35

	Low β	2	3	4	5	6	7	8	9	High β	H-L	t-stat
Panel A: No Options												
Optimistic (n=96)	0.59	0.25	-0.07	0.61	0.69	0.51	0.40	0.51	-0.19	-1.03	-1.62	-1.45
Pessimistic (n=78)	1.20	1.11	1.51	2.12	2.04	2.06	2.34	2.44	3.10	3.68	2.48**	2.43
Panel B: With Options												
Optimistic (n=96)	0.49	0.16	0.33	0.42	-0.18	0.19	-0.41	-0.01	-0.57	-1.13	-1.62	-1.41
Pessimistic (n=78)	1.04	0.89	1.43	1.79	1.79	1.86	2.29	2.31	2.72	3.42	2.38**	2.38

1. High beta stocks outperform low beta stocks in **pessimistic** sentiment periods in **all portfolios**
2. The pattern in **optimistic** patterns is **less stable**
3. Stronger among stocks that entail more subjective valuations and have stronger limits to arbitrage

Results: Robustness checks – U. of Michigan index

- U of Michigan contacts every month 500 randomly selected households and asks questions regarding their outlook for the economy. Index data available 1978-2010
- Their answers are amalgamated to a numerical index
- We orthogonalize this index w.r.t macro variables and use the residuals as an alternative sentiment index

Panel A: All (n=396)						Panel B: Pessimistic (n=170)						Panel C: Optimistic (n=226)					
β	lnME	lnB/M	ret1	ret6	ret12	β	lnME	lnB/M	ret1	ret6	ret12	β	lnME	lnB/M	ret1	ret6	ret12
0.16	-0.04	0.27	-0.04	0.005	0.006	0.71	-0.04	0.14	-0.04	0.002	0.005	-0.25	-0.03	0.37	-0.04	0.007	0.005
[0.70]	[-1.06]	[4.66]	[-10.62]	[2.45]	[4.17]	[2.18]	[-0.83]	[1.73]	[-7.34]	[0.62]	[2.66]	[-2.82]	[-0.70]	[4.53]	[-7.66]	[3.39]	[3.21]

- Results hold with this alternative specification of sentiment

Conclusions

- Beta is positively linked to returns in Pessimistic periods, as predicted by the CAPM
- This relationship breaks down in optimistic periods, so unconditionally the relationship between beta and returns is flat
- Our results hold in a both portfolio and FM regression frameworks
- Not driven by other dimensions of risk or the choice of the sentiment index

Contributions

- **Asset pricing:** Time variation in sentiment leads to conditional deviations from rational asset pricing
 - **Markets are not always efficient or inefficient.** Rather efficiency is determined by the level of unsophisticated trading in the market as gauged by sentiment
- **Corporate finance:** CAPM should be used for capital budgeting only in pessimistic periods
- **Policy implication:** Educating investors can make markets more efficient