

Betting Against Beta

Andrea Frazzini
AQR Capital Management LLC

Lasse H. Pedersen
NYU, CEPR, and NBER

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Motivation

➤ Background:

- Security Market Line for U.S. stocks too flat relative to CAPM (Black, Jensen, and Scholes (1972))
- Could be related to borrowing constraints (Black (1972, 1993))
- Surprisingly little research on factors based on the flatness of the SML

➤ Research questions:

1. Is the SML flat in other markets?
2. Betting-Against-Beta (BAB):
 - How to capture this effect with a factor?
 - BAB returns relative to size/ value/ momentum effects?
3. Additional predictions of a theory of funding constraints?
 - In the cross section?
4. Who Bets against Beta ?

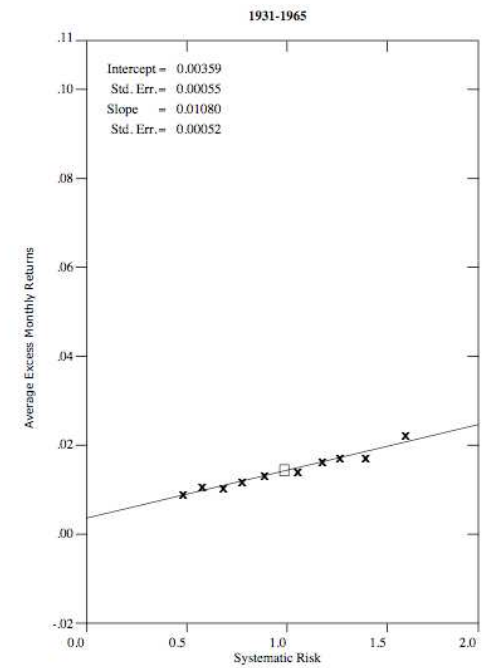


Figure 1 Average excess monthly returns versus systematic risk for the 35-year period 1931-65 for each of ten portfolios (denoted by x) and the market portfolio (denoted by □).

What We Do

Theory:

- Predictions of a dynamic model with constrained investors:
 - No leverage: some investors cannot (or will not) use leverage (e.g. pension funds, mutual funds, etc.)
 - Margin requirements: investors who are willing to use leverage are constrained by their margin requirements and may sometimes need to de-lever (e.g. hedge funds, proprietary traders, etc.)

Evidence:

- Beta-sorted portfolios in numerous major markets and asset classes
 - US stocks
 - Global stocks in 19 developed markets (other than US)
 - Treasuries
 - Credit markets
 - Futures: stock indices, bond futures, currencies, and commodities
- Market neutral Betting-Against-Beta (BAB) factors:
 - Long *levered* low-beta securities, short *de-levered* high-beta securities
- Test cross-sectional, time-series and portfolio predictions of the theory

Road Map of Talk

- Theory and predictions

- Evidence: testing the main predictions of the model
 1. Beta-sorted portfolios: alphas and Sharpe ratios
 - US stocks
 - Global stocks
 - Treasuries
 - Credit markets
 - Futures: equity indices, bonds, currencies, commodities

 2. Positive abnormal returns on BAB factors
 3. Time series prediction of the model: BAB time varying returns and funding-liquidity proxies
 4. Cross-sectional prediction of the model: beta compression
 5. Portfolio prediction: Who Betas Against Betas

out of sample evidence

 - Across options and ETFs: “Embedded Leverage,” Frazzini and Pedersen (2011)
 - Across asset classes: “Leverage Aversion and Risk Parity,” Asness, Frazzini, and Pedersen (2011)

- Conclusion

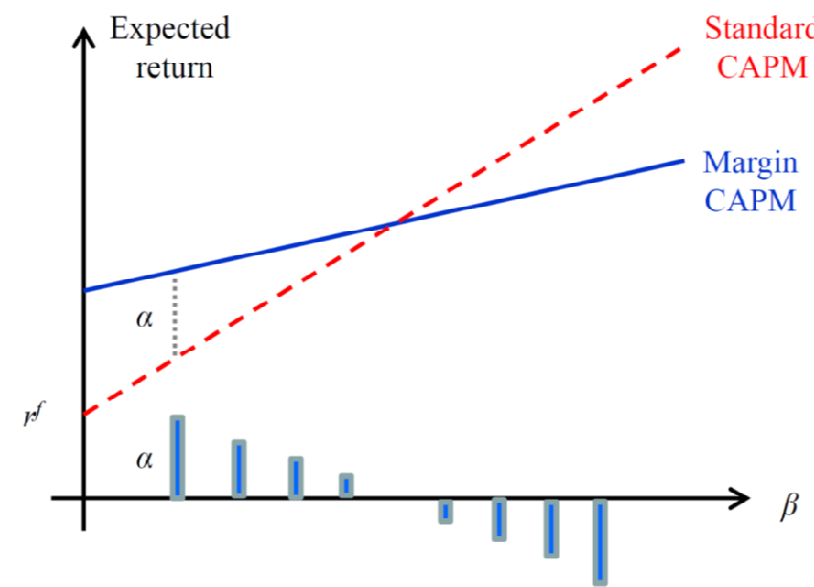
Model

- Competitive equilibrium in OLG economy where agents maximize their utility:

$$\max x'(E_t(P_{t+1}) - (1+r^f)P_t) - \frac{\gamma^i}{2} x' \Omega_t x$$

subject to a portfolio constraint which can capture

- No leverage, $m^i=1$ (as in Black (1972))
- No leverage and cash constraint, $m^i>1$
- Margin constraints, $m^i<1$



Prediction of the model

- Proposition 1
 - Flatter security market line where the slope depends on the tightness (i.e., Lagrange multiplier) of the funding constraints on average across agents

- Proposition 2i
 - BAB factors have positive average return, and that the return is increasing in the ex-ante tightness of constraints and in the spread in betas between high- and low-beta securities

- Proposition 2ii
 - During times of tightening funding liquidity constraints, the BAB factor realized negative returns as its expected future return rises

- Proposition 3
 - Betas of securities in the cross section are compressed towards 1 when funding liquidity risk is high

- Proposition 4
 - More constrained investors over-weight high-beta assets in their portfolios, while less constrained investors over-weight low beta assets and possibly apply leverage

Betting Against Beta Factors

- Betting-Against-Beta (BAB) factors:
 - Long low-beta assets, levered to a beta of 1
 - Short high-beta assets, de-levered to a beta of 1

$$r_{t+1}^{BAB} = \frac{1}{\beta_t^L} (r_{t+1}^L - r^f) - \frac{1}{\beta_t^H} (r_{t+1}^H - r^f)$$

- A BAB factor is a market-neutral excess return on a zero-cost portfolio (like HML and SMB)
- Example: BAB factor for US stocks
 - Long \$1.5 worth of low-beta stocks
 - Short \$0.7 worth of high-beta stocks, on average
- BAB factor useful for studying:
 - the magnitude of the beta effect and its relation of other known factors
 - the time-series of the beta effect
 - the beta effect in different assets classes and in subsets of securities (e.g., stocks by size)
 - and pricing other portfolios

Data Sources

➤ Equities (common stocks)

- CRSP 1927 – 2009.
- Xpressfeed Global 1984 – 2009
- 20 Countries (MSCI Developed Markets)

➤ Treasury bonds

- CRSP Fama Bond Portfolio Returns, monthly 1952 – 2009

➤ Credit

- Barclays Capital's Bond Hub database, 1973 – 2009
- US credit indices with maturity ranging from 1 to 10 years
- Corporate bond portfolios with credit risk ranging from AAA to Ca-D

➤ Futures markets

- Bloomberg, Datastream, Citigroup, various exchanges, 1965 – 2009
- Daily excess returns on rolled futures and forwards
- Equity indices: 13 developed markets
- Government Bonds : 9 developed markets, constant duration
- Foreign Exchange : 9 developed markets
- Commodities : 27 Commodities (Energy, Agricultural , Metal , Soft)

➤ Holdings data and LBO data

Estimating Betas and Constructing BAB portfolios

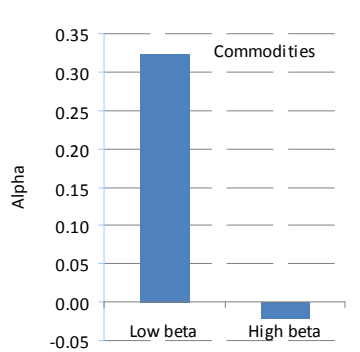
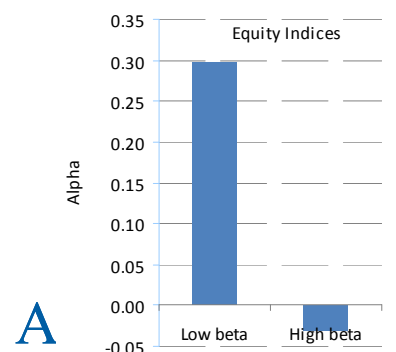
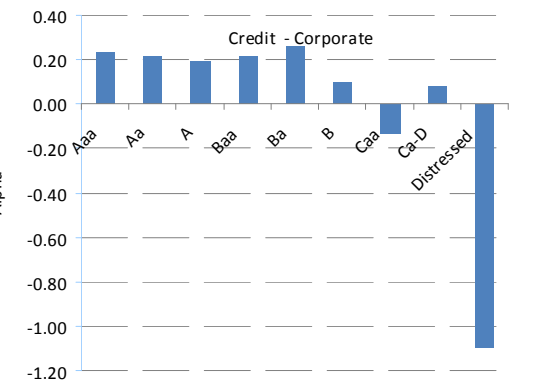
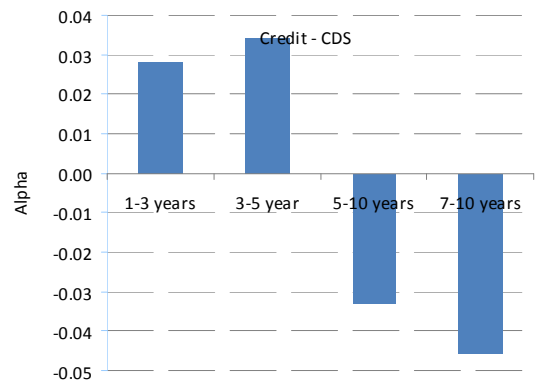
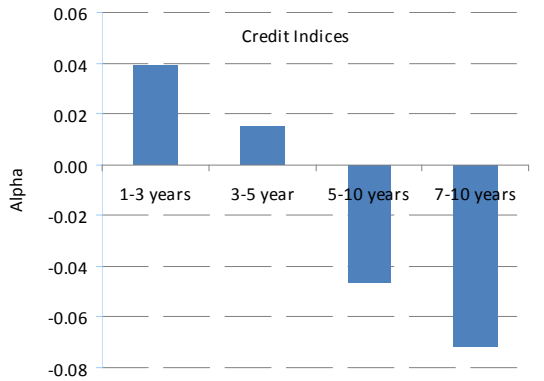
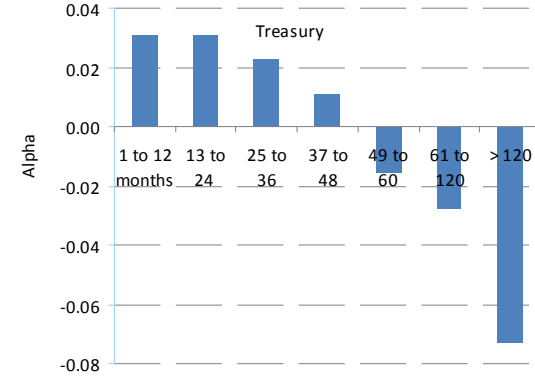
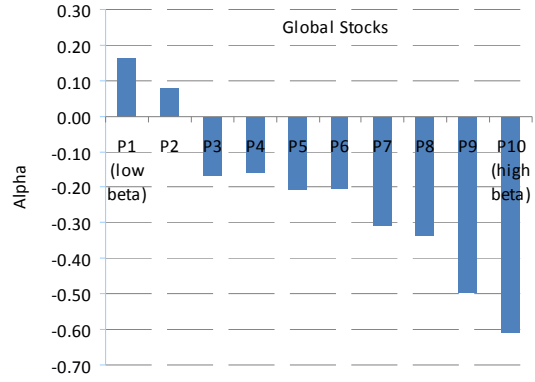
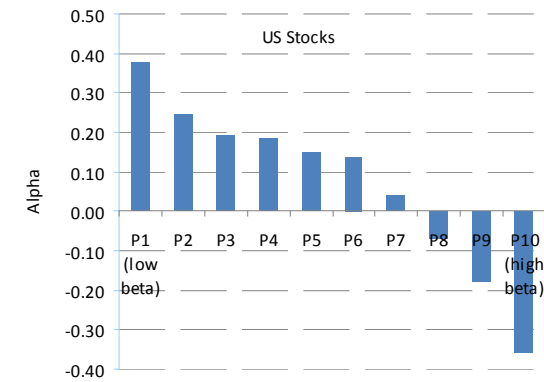
- Betas are computed from 1-year rolling regression of daily excess returns on market excess return
 - Markets excess return computed as value weighted index
 - Include 1 week lags on the RHS to account for small/illiquid securities and sum the slopes
 - Use a simplified Vasicek (1973) estimator: shrink betas towards one: $0.5*1 + 0.5*\hat{\beta}$

- We form monthly portfolios by sorting stocks in deciles.
 - Base currency USD. Returns, risk free rate, and alphas are in USD, no currency hedging

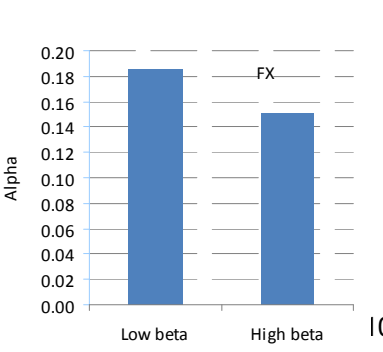
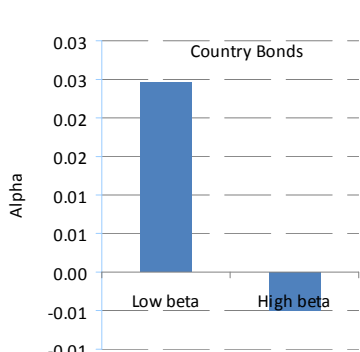
- To form zero-beta zero-costs BAB factors
 - Assign stocks to two portfolios: low beta and high beta
 - Rescale portfolios to have a beta of 1 at portfolio formation.
 - Long the (levered) low-beta portfolio and shorts the (de-levered) high-beta portfolio

Alphas by Beta-Sorted Portfolios

All Asset Classes, 1964 – 2009



a Fra:



BAB - US Treasury Bonds, 1952 – 2009

This table shows average monthly excess returns of Fama bond portfolios by maturity. Returns are in percent and 5% statistical significant is indicated in bold. BAB is a portfolio short (de-levered) long maturity and long (levered) low maturity

	P1 (low beta)	P2	P3	P4	P5	P6	P7* (high beta)	BAB Factor
Maturity (months)	1 to 12	13 to 24	25 to 36	37 to 48	49 to 60	61 to 120	> 120	
Excess return	0.05 (5.57)	0.09 (3.77)	0.11 (3.17)	0.12 (2.82)	0.12 (2.30)	0.14 (2.17)	0.21 (1.90)	0.16 (6.37)
Alpha	0.03 (5.87)	0.03 (3.42)	0.02 (2.21)	0.01 (1.10)	-0.02 (-1.59)	-0.03 (-2.66)	-0.07 (-2.04)	0.16 (6.27)
Beta (ex ante)	0.14	0.46	0.75	0.99	1.22	1.44	2.17	0.00
Beta (realized)	0.17	0.49	0.77	0.99	1.17	1.43	2.06	0.02
Volatility	0.83	2.11	3.23	4.04	4.76	5.80	9.12	2.32
Sharpe ratio	0.73	0.50	0.42	0.37	0.30	0.29	0.27	0.85

* Return missing from 196208 to 197112

BAB - Equities, 1926 - 2009

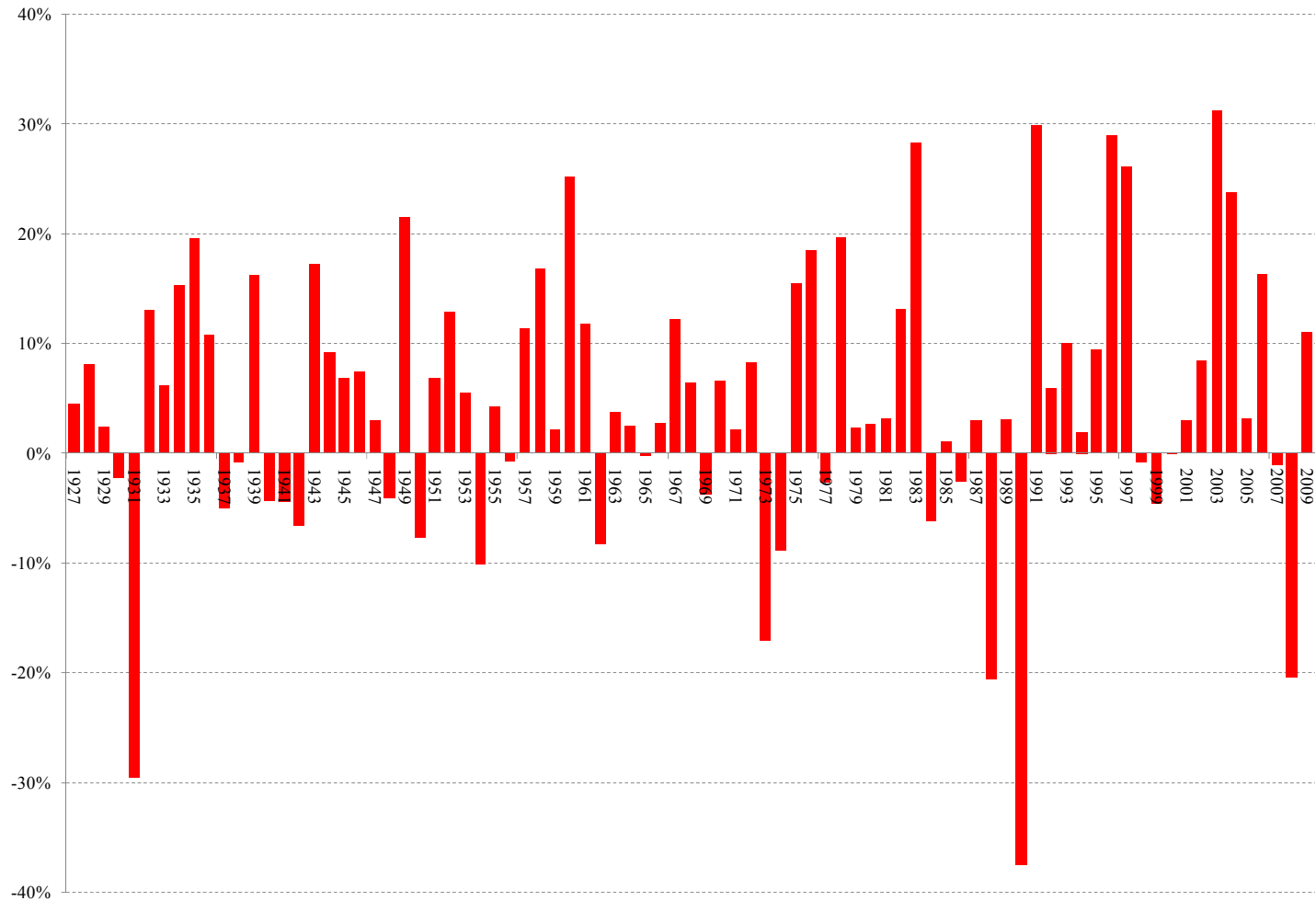
This table shows calendar-time portfolio returns. BAB is a portfolio short (de-levered) high beta stocks and long (levered) low beta stocks. Returns and alphas are in monthly percent, t-statistics are shown below the coefficient estimates, and 5% statistical significance is indicated in bold.

	US equities 1926 - 2009				Global Equities 1984 - 2009			
	P1 (Low beta)	...	P10 (high beta)	BAB Factor	P1 (Low beta)	...	P10 (high beta)	BAB Factor
Excess return	0.99 (5.90)	...	1.02 (2.77)	0.71 (6.76)	0.55 (2.13)	...	0.01 (0.01)	0.72 (3.79)
CAPM alpha	0.54 (5.22)	...	-0.05 (-0.29)	0.69 (6.55)	0.33 (1.46)	...	-0.55 (-1.30)	0.71 (3.72)
3-factor alpha	0.38 (5.24)	...	-0.36 (-3.10)	0.66 (6.28)	0.16 (0.78)	...	-0.61 (-1.47)	0.60 (3.18)
4-factor alpha	0.42 (5.66)	...	-0.07 (-0.59)	0.55 (5.12)	0.10 (0.46)	...	-0.37 (-0.88)	0.45 (2.47)
5-factor alpha*	0.23 (2.37)	...	0.01 (0.07)	0.46 (2.93)	-0.03 (-0.13)	...	-0.77 (-1.80)	0.42 (2.22)
Beta (ex ante)	0.57	...	1.64	0.00	0.50	...	1.44	0.00
Beta (realized)	0.75	...	1.82	0.03	0.48	...	1.18	0.02
Volatility	18.2	...	40.0	11.5	14.9	...	30.3	10.9
Sharpe Ratio	0.65	...	0.31	0.75	0.44	...	0.00	0.79

* Pastor and Stambaugh (2003) liquidity factor only available between 1968 and 2008.

US Equity BAB : 4-Factor Alphas 1926 - 2009

This figure shows calendar-time annual abnormal returns. This figure plots the annualized intercept in a regression of monthly excess return. The explanatory variables are the monthly returns from Fama and French (1993) mimicking portfolios and Carhart (1997) momentum factor. A separate factor regression is run for each calendar year. Alphas are annualized.



BAB – US Corporate Bonds

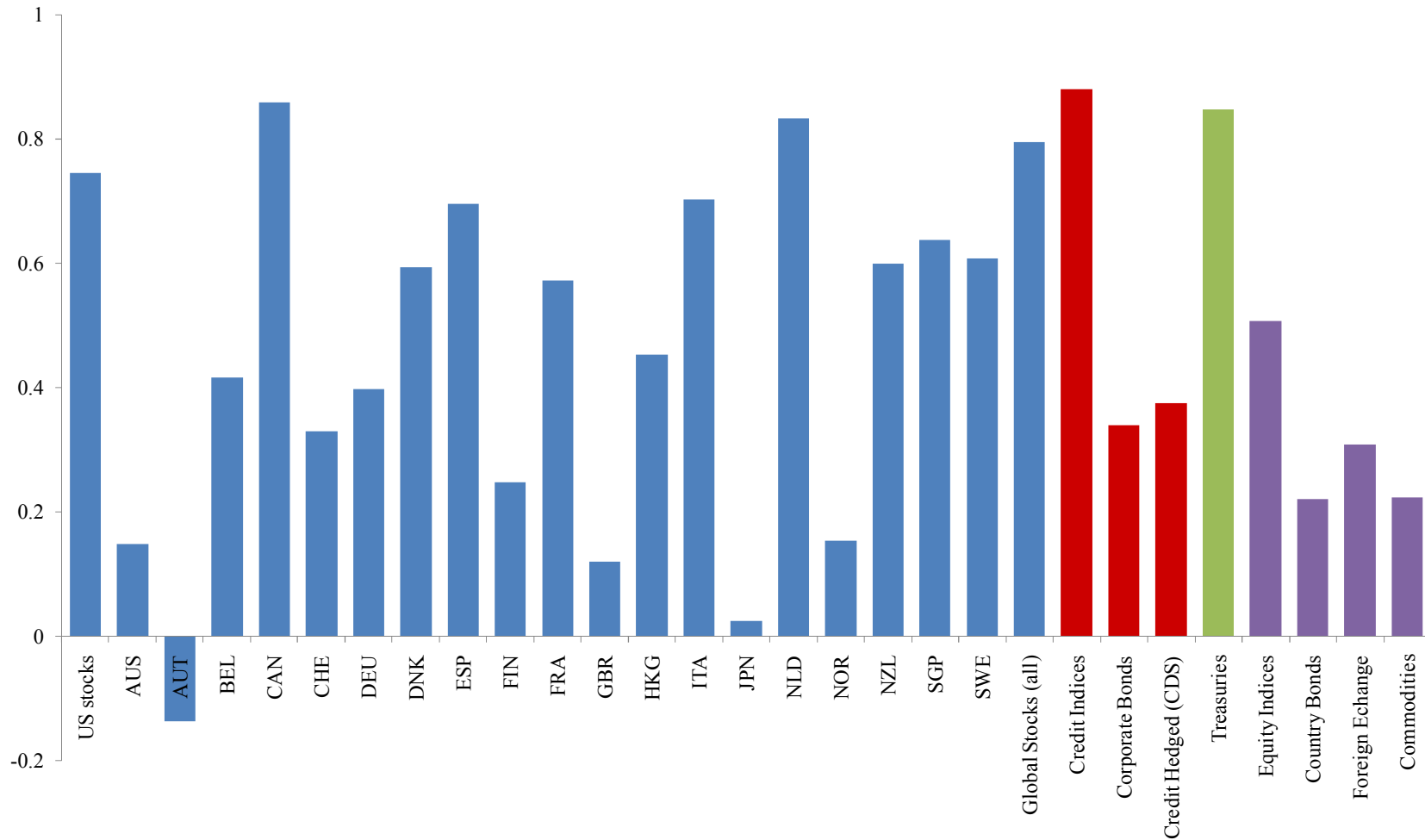
This table shows average monthly excess returns of US credit indices by maturity and US corporate bond. Returns are in percent and 5% statistical significant is indicated in bold. BAB is a portfolio short (de-levered) high beta bonds and long (levered) low beta bonds

US Credit indices 1976 - 2009		1-3 years	3-5 year	5-10 years	7-10 years	BAB Factor
Unhedged returns	Alpha	0.04 (2.77)	0.01 (0.96)	-0.05 (-4.01)	-0.07 (-4.45)	0.13 (4.91)
	Beta (ex ante)	0.60	0.85	1.39	1.52	0.00
	Beta (realized)	0.62	0.85	1.37	1.48	-0.01
Hedged returns (CDS)	Alpha	0.04 (3.62)	0.04 (3.23)	-0.03 (-2.38)	-0.04 (-2.16)	0.08 (3.33)
	Beta (ex ante)	0.70	0.78	1.14	1.38	0.00
	Beta (realized)	0.58	0.72	1.34	1.37	-0.34

US Corporate Bonds 1952 - 2009	Aaa	Aa	A	Baa	Ba	B	Caa	Ca-D	CSFB Distressed	BAB Factor
Alpha	0.23 (4.09)	0.21 (3.62)	0.19 (3.13)	0.21 (3.69)	0.26 (4.20)	0.10 (1.40)	-0.13 (-0.95)	0.08 (0.26)	-1.10 (-5.34)	0.56 (4.02)
Beta (ex ante)	0.67	0.70	0.72	0.77	0.89	1.01	1.25	1.74	1.66	0.00
Beta (realized)	0.13	0.24	0.33	0.40	0.69	0.95	1.39	2.77	2.49	-0.94

BAB Factor SRs - All Asset Classes 1964 – 2009

This table shows annualized Sharpe ratios of BAB factors across asset classes. BAB is a portfolio short (de-levered) high beta assets and long (levered) low beta assets



BAB - All Asset Classes 1964 – 2009

This table shows calendar-time BAB portfolio returns. Returns are in monthly percent and 5% statistical significant is indicated in bold. BAB is a portfolio short (de-levered) high beta assets and long (levered) low beta assets

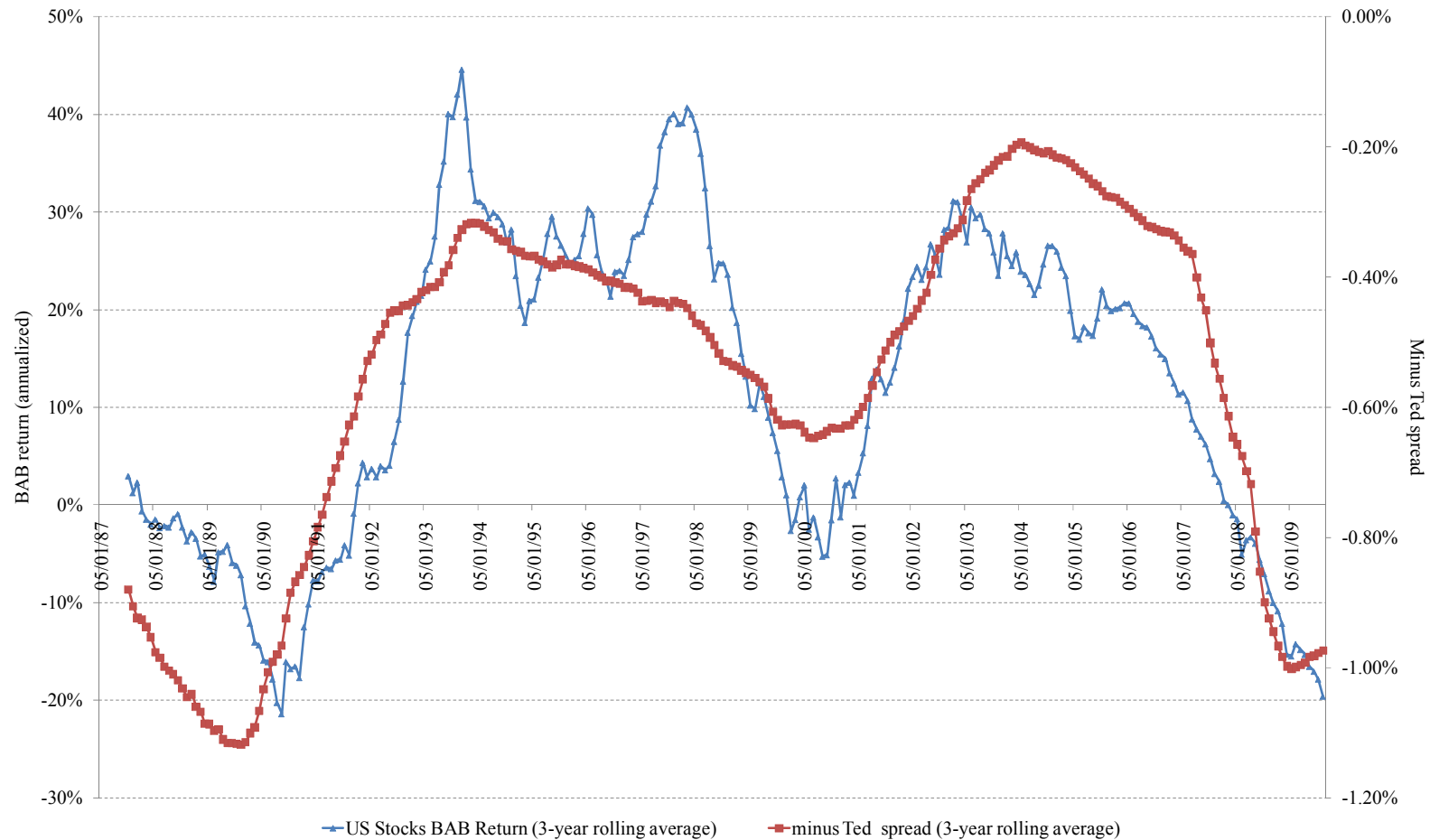
Panel A: Equity indices, country Bonds, Foreign Exchange and Commodities		Excess Return	T-stat Excess Return	Alpha	T(alpha)	\$Short	\$Long	Volatility	SR
Equity Indices	EI	0.78	2.90	0.69	2.56	0.93	1.47	18.46	0.51
Country Bonds	CB	0.08	0.99	0.06	0.73	0.95	1.69	4.47	0.22
Foreign Exchange	FX	0.2	1.45	0.14	1.08	0.61	1.61	7.72	0.31
Commodities	COM	0.42	1.44	0.38	1.26	0.78	1.56	22.65	0.22
All Futures*	EI + CB + FX + COM	0.47	3.99	0.52	4.50			9.02	0.62
Country Selection*	EI + CB + FX	0.64	3.78	0.71	4.42			11.61	0.66

Panel B: All Assets									
All Bonds and Credit*		0.73	6.00	0.72	5.88			11.06	0.79
All Equities*		0.77	8.10	0.78	8.16			10.31	0.89
All Assets*		0.71	8.60	0.73	8.84			8.95	0.95

* Equal risk, 10% ex ante volatility

US equity BAB and TED Spread

This figure shows annualized 3-year return of the US stocks BAB factor (left scale) and 3-year (negative) average rolling TED spread (right scale). BAB is a portfolio short (de-levered) high beta stocks and long (levered) low beta stocks



Regression Results: BAB Returns and Funding Liquidity

This table shows results from time series (pooled) regressions. The left-hand side is the month t return on the BAB factors. The explanatory variables include the TED spread (level and changes) and a series of controls. Asset fixed effects are include where indicated, t-statistics are shown below the coefficient estimates and 5% statistical significance is indicated in bold. Standard errors are clustered by date

LHS: BAB return	US - Stocks				Global Stocks - pooled				All Assets - pooled			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(9)	(9)	(10)	(11)	(12)
TED Spread	-0.033 -(8.29)	-0.019 -(3.10)			-0.020 -(4.37)	-0.016 -(3.63)			-0.013 -(4.65)	-0.011 -(3.93)		
Change in TED Spread			-0.040 -(3.52)	-0.029 -(2.50)			-0.017 -(2.31)	-0.014 -(2.10)			-0.012 -(2.73)	-0.010 -(2.48)
Lagged TED Spread			-0.031 -(7.88)	-0.017 -(2.63)			-0.021 -(4.12)	-0.017 -(3.40)			-0.013 -(4.38)	-0.011 -(3.62)
Beta Spread		0.022 (2.25)		0.023 (2.36)		0.012 (2.87)		0.012 (2.85)		0.009 (4.06)		0.009 (4.03)
Lagged BAB return		0.188 (2.07)		0.191 (2.10)		0.063 (1.18)		0.062 (1.18)		0.073 (1.50)		0.073 (1.50)
Inflation		-0.070 -(0.25)		-0.077 -(0.27)		-0.023 -(0.16)		-0.029 -(0.20)		0.007 (0.08)		0.006 (0.06)
Short Volatility Returns		0.325 (2.24)		0.318 (2.23)		-0.090 -(1.34)		-0.092 -(1.37)		-0.093 -(1.97)		-0.093 -(1.98)
Market return		0.000 (0.00)		-0.002 -(0.01)		0.022 (0.55)		0.021 (0.51)		0.011 (0.29)		0.011 (0.29)
Asset Fixed Effects	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Num of observations	294	294	294	294	4,606	4,606	4,606	4,606	7,168	7,168	7,168	7,168
Adjusted R2	0.097	0.199	0.096	0.201	0.013	0.022	0.013	0.022	0.008	0.019	0.008	0.019

Beta Compression and BAB Conditional Market Beta

Cross-sectional dispersion of betas in US and global stocks. *P1* to *P3* report coefficients on a regression of the dispersion measure on TED spread dummies (low, neutral and high) based on full sample breakpoints

Cross sectional Dispersion	Panel A: US Stocks			Panel B: International Stocks			Panel C: All Assets		
	Standard deviation	Mean Absolute Deviation	Interquintile Range	Standard deviation	Mean Absolute Deviation	Interquintile Range	Standard deviation	Mean Absolute Deviation	Interquintile Range
All	0.42	0.33	0.67	0.27	0.21	0.44	0.40	0.31	0.63
P1 (Low Ted Volatility)	0.44	0.35	0.71	0.30	0.23	0.47	0.43	0.34	0.70
P2	0.43	0.34	0.69	0.26	0.21	0.43	0.40	0.30	0.61
P2 (Low Ted Volatility)	0.37	0.29	0.61	0.25	0.19	0.41	0.37	0.28	0.56
P3 minus P1	-0.07	-0.05	-0.09	-0.05	-0.04	-0.06	-0.06	-0.06	-0.14
t-statistics	(-3.18)	(-3.09)	(-2.84)	(-3.99)	(-3.91)	(-3.29)	(-5.39)	(-5.75)	(-5.33)

Conditional market betas of BAB portfolios based on the TED spread. Full set on regressors included, only market loadings reported

Conditional Market Beta	Panel D: US				Panel E: International Stocks				Panel F: All Assets			
	P1 (Low)	P2	P3 (High)	P3 - P1	P1 (Low)	P2	P3 (High)	P3 - P1	P1 (Low)	P2	P3 (High)	P3 - P1
Ted Volatility												
CAPM	-0.16 (-0.99)	0.10 (0.75)	0.44 (2.96)	0.60 (2.72)	0.01 (0.22)	0.01 (0.12)	0.21 (2.42)	0.20 (1.91)	-0.03 (-0.80)	0.01 (0.27)	0.08 (2.07)	0.12 (2.05)
Control for 3 Factors	-0.03 (-0.19)	0.32 (2.84)	0.49 (3.32)	0.53 (2.36)	0.02 (0.37)	0.04 (0.90)	0.12 (1.86)	0.10 (1.25)				
Control for 4 Factors	0.07 (0.48)	0.37 (3.21)	0.51 (3.65)	0.44 (2.27)	0.04 (0.94)	0.08 (2.03)	0.16 (2.42)	0.12 (1.49)				

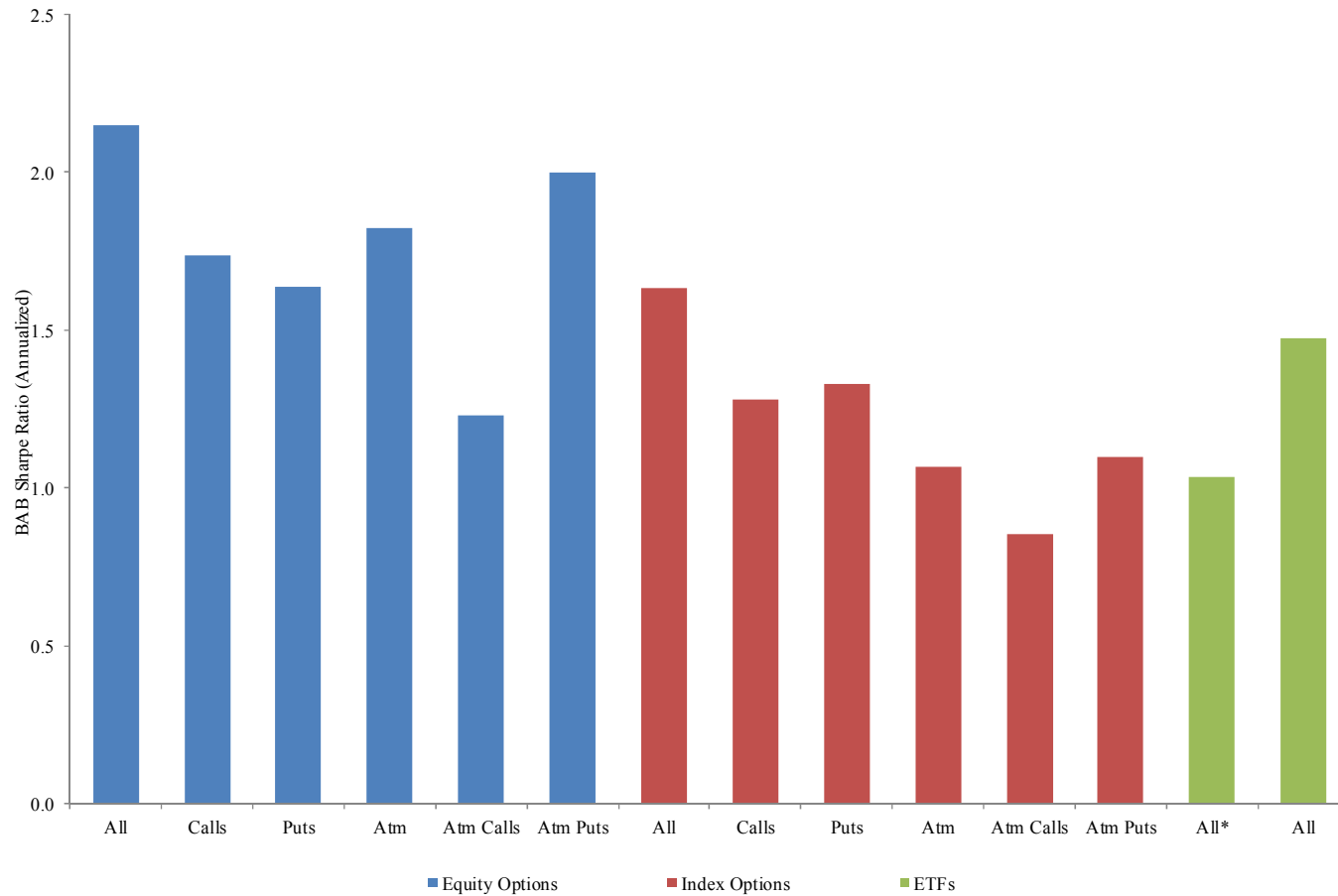
Evidence on Portfolio Holdings

➤ This table shows average ex-ante and realized portfolio betas for different groups of investors

Panel	Investor	Method	Sample Period	Ex Ante Beta of Positions		Realized Beta of Positions	
				Beta	t-statistics (H0: beta=1)	Beta	t-statistics (H0: beta=1)
A) Investors Likely to be Constrained							
A.1)	Mutual Funds	Value weighted	1980 - 2009	1.04	13.14	1.08	11.96
	Mutual Funds	Equal weighted	1980 - 2009	1.06	15.35	1.12	4.08
A.2)	Individual Investors	Value weighted	1991 - 1996	1.04	18.14	1.09	2.60
	Individual Investors	Equal weighted	1991 - 1996	1.05	16.03	1.08	1.17
B) Investors who use Leverage							
B.1)	Private Equity (All)	Value weighted	1963 - 2009	0.96	-2.67		
	Private Equity (All)	Equal weighted	1963 - 2009	0.92	-5.40		
	Private Equity (LBO, MBO)	Value weighted	1963 - 2009	0.83	-4.01		
	Private Equity (LBO, MBO)	Equal weighted	1963 - 2009	0.83	-4.02		
B.2)	Berkshire Hathaway	Value weighted	1980 - 2009	0.90	-10.73	0.78	-5.53
	Berkshire Hathaway	Equal weighted	1980 - 2009	0.90	-13.33	0.83	-5.29

Evidence on “Embedded Leverage” from Options and ETFs

This figure shows Sharpe ratios of Betting-Against-Beta portfolios (BAB). Source: “Embedded Leverage,” Frazzini and Pedersen (2011)



* Expense ratios added back

Results: BAB Portfolios

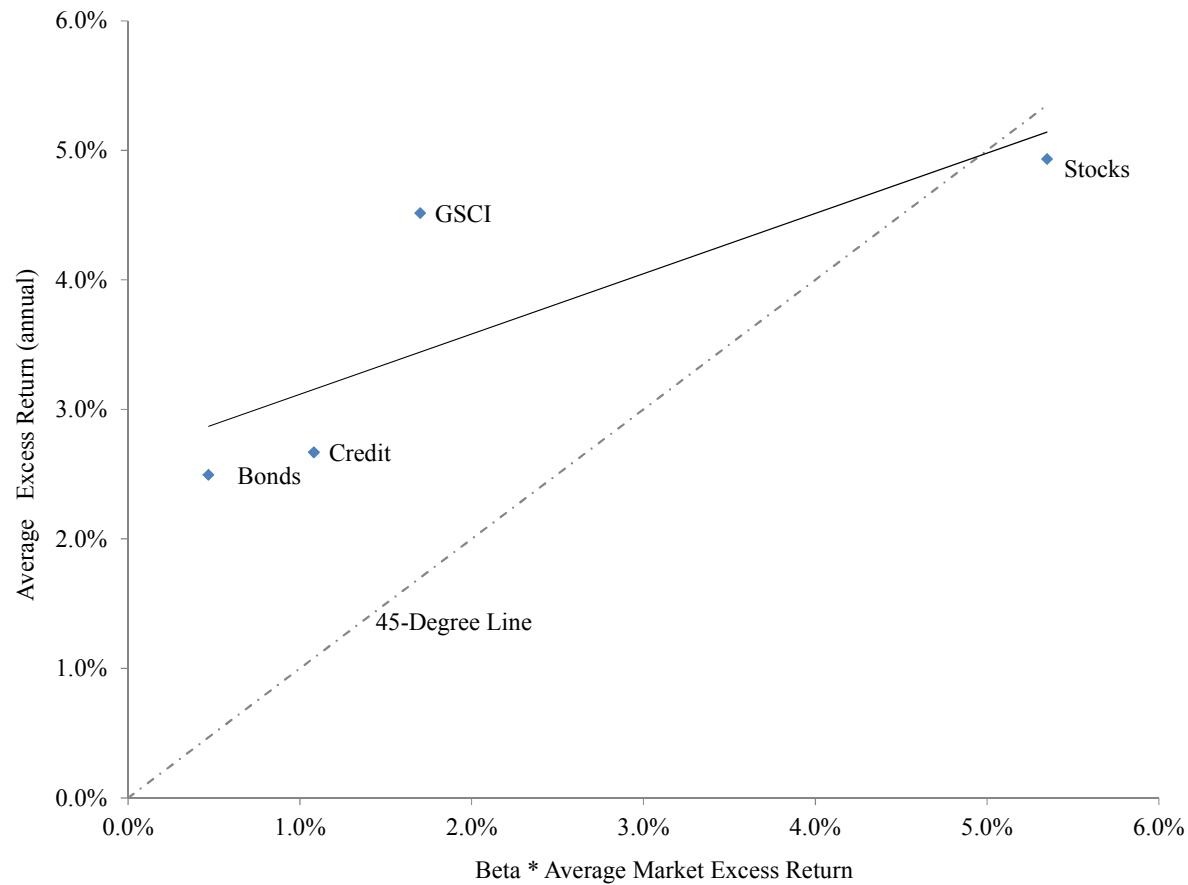
This table shows calendar-time portfolio returns of Betting-Against-Beta portfolios (BAB). Source: “Embedded Leverage,” Frazzini and Pedersen (2011)

	Equity options						Index options						ETFs	
	All			At-the-Money			All			At-the-Money			All*	All
	All	Calls	Puts	All	Calls	Puts	All	Calls	Puts	All	Calls	Puts		
Excess return %	0.36 (8.21)	0.29 (6.63)	0.43 (6.25)	0.32 (6.97)	0.24 (4.69)	0.40 (7.64)	0.33 (6.26)	0.22 (4.90)	0.44 (5.09)	0.23 (4.08)	0.17 (3.27)	0.28 (4.20)	0.06 (2.13)	0.08 (3.04)
5-factor alpha %	0.31 (7.10)	0.25 (6.12)	0.36 (5.13)	0.33 (7.40)	0.26 (5.44)	0.41 (7.49)	0.27 (5.01)	0.15 (3.34)	0.39 (4.23)	0.19 (3.37)	0.14 (2.50)	0.25 (3.59)	0.06 (2.15)	0.08 (3.01)
Frac (Alpha >0)	0.78	0.78	0.69	0.76	0.74	0.73	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86
MKT	0.00 (-0.34)	0.01 (1.26)	-0.02 (-1.14)	-0.04 (-4.76)	-0.05 (-5.51)	-0.03 (-3.06)	-0.02 (-1.82)	-0.01 (-1.03)	-0.03 (-1.62)	-0.04 (-3.18)	-0.03 (-3.00)	-0.04 (-2.88)	0.00 (0.43)	0.00 (0.45)
SMB	0.00 (0.29)	-0.01 (-0.58)	0.01 (0.68)	-0.02 (-1.68)	-0.03 (-2.17)	-0.01 (-0.89)	0.00 (-0.26)	0.01 (0.43)	-0.01 (-0.50)	-0.01 (-0.60)	-0.01 (-0.39)	-0.01 (-0.68)	0.00 (0.27)	0.00 (0.25)
HML	-0.03 (-2.24)	-0.06 (-4.98)	0.00 (0.13)	-0.02 (-1.72)	-0.04 (-2.95)	0.00 (-0.27)	-0.02 (-1.16)	-0.02 (-1.25)	-0.02 (-0.75)	-0.02 (-0.98)	-0.01 (-0.56)	-0.02 (-1.18)	-0.01 (-1.50)	-0.01 (-1.50)
UMD	-0.02 (-1.87)	-0.01 (-0.85)	-0.02 (-1.79)	-0.01 (-1.26)	-0.01 (-1.09)	-0.01 (-1.13)	-0.02 (-1.86)	0.00 (-0.55)	-0.03 (-1.90)	0.00 (-0.08)	0.00 (0.28)	0.00 (-0.35)	0.00 (-0.71)	0.00 (-0.69)
Straddle	-0.01 (-4.80)	-0.01 (-4.16)	-0.01 (-3.45)	0.00 (-1.32)	0.00 (-1.50)	0.00 (-0.88)	-0.01 (-5.02)	-0.01 (-5.44)	-0.01 (-3.24)	-0.01 (-3.01)	-0.01 (-2.94)	-0.01 (-2.66)	0.00 (0.83)	0.00 (0.85)
Ω long	4.84	4.76	4.92	5.04	5.63	4.44	6.71	6.40	7.02	7.05	7.51	6.60	1.00	1.00
Ω short	10.42	10.39	10.44	9.92	10.63	9.20	16.86	16.19	17.53	16.07	16.51	15.63	2.00	2.00
Dollar long	0.28	0.26	0.31	0.28	0.22	0.35	0.17	0.17	0.18	0.16	0.15	0.18	1.00	1.00
Dollar short	0.13	0.12	0.14	0.14	0.12	0.17	0.07	0.07	0.07	0.07	0.07	0.08	0.50	0.50
Volatility	2.00	1.98	3.16	2.09	2.30	2.40	2.43	2.03	4.01	2.57	2.42	3.11	0.65	0.65
Sharpe ratio	2.15	1.73	1.64	1.82	1.23	2.00	1.63	1.28	1.33	1.07	0.85	1.10	1.04	1.47

* Expense ratios added back

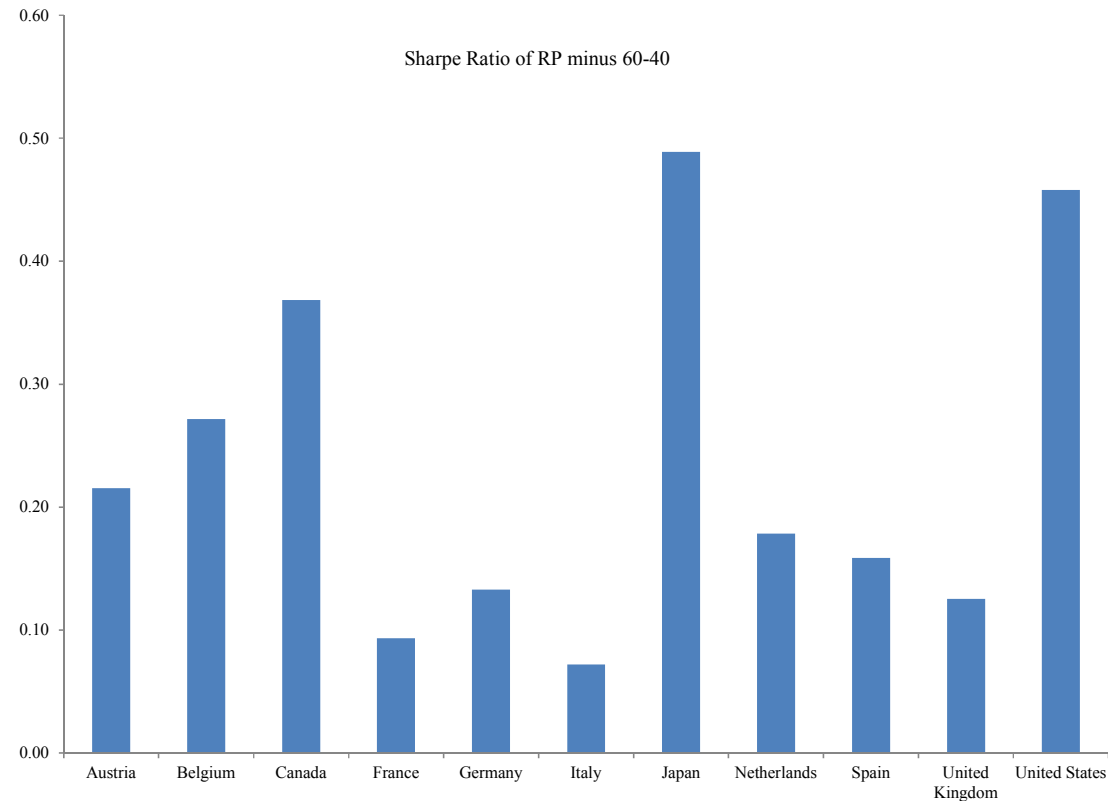
Evidence Across Asset Classes

- Source: “Leverage Aversion and Risk Parity,” Asness, Frazzini, and Pedersen (2011).



Evidence Across Asset Classes

- Source: “Leverage Aversion and Risk Parity,” Asness, Frazzini, and Pedersen (2011).
- Evidence from
 - Long sample (US stock/bonds 1926-2010),
 - Broad sample (US stocks/bonds/credit/commodities 1973-2010), and
 - Global Sample (1986-2010):



Conclusion

- High beta = low alpha and SR

- Market neutral *Beta-Against-Beta factor*:
 - Long levered low-beta securities, short high-beta securities
 - Surprisingly high and consistent performance in each of the major global markets and asset classes
 - U.S. stocks
 - Global stocks
 - Treasuries
 - Corporate bonds
 - Futures

- Betas compression and time-varying expected returns on BAB portfolios
 - Market betas compress towards 1 when credit constraints are likely to be binding
 - BAB factors loads on market and has drawdowns when credit is contracting

- More (Less) constrained investors hold riskier (less risky) assets

- Evidence points toward a theory with
 - Certain investors cannot (or are unwilling to) use leverage
 - Other investors subject to margin requirements and funding liquidity risk