Buffett's Alpha

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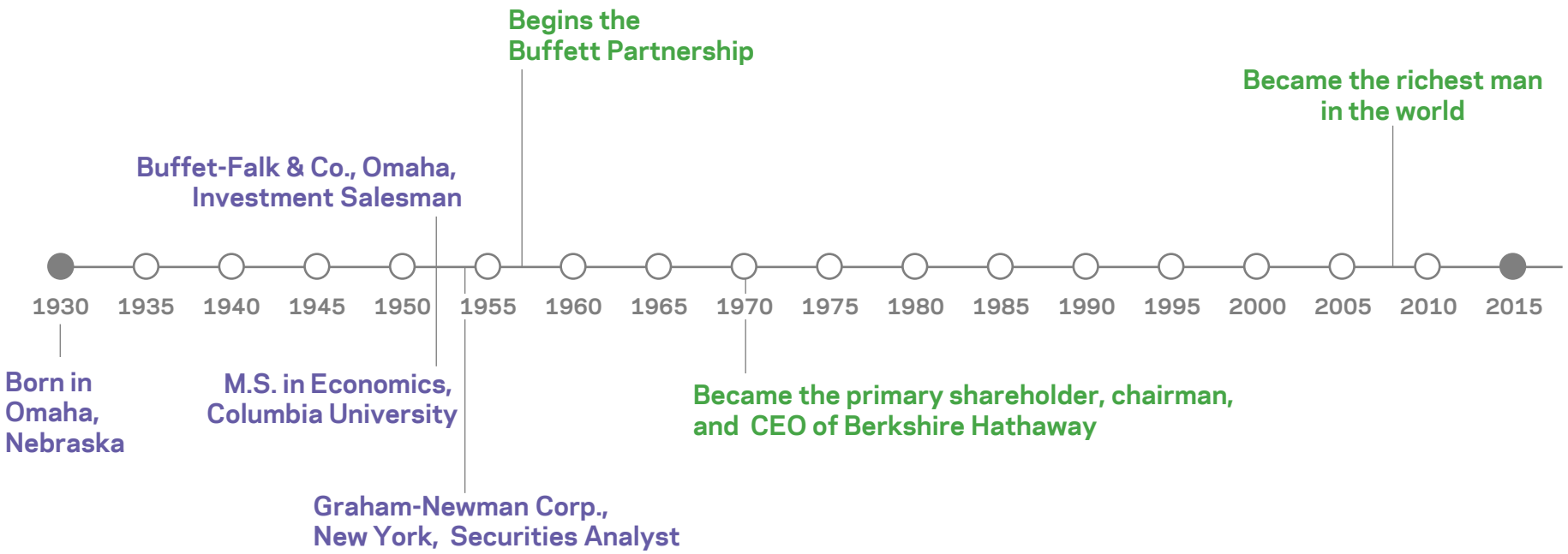
AQR Capital *AQR Capital* *Copenhagen Business School, NYU, and AQR*

This is the views of the authors, not necessarily those of AQR Capital

Who is Warren Buffett?

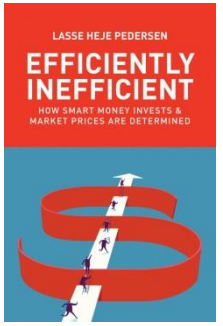


Understanding Buffett's Alpha: Outline

1. Research background: Leverage aversion
- The low risk anomaly: betting against beta
- Quality minus junk

2. Can this theory also explain Buffett?
- Track record: How good is Buffett?
- Buffett's Leverage
- Decomposing Buffett: CEO vs. stock picker
- Exposures: What type of stocks?
- Systematic Buffett strategy

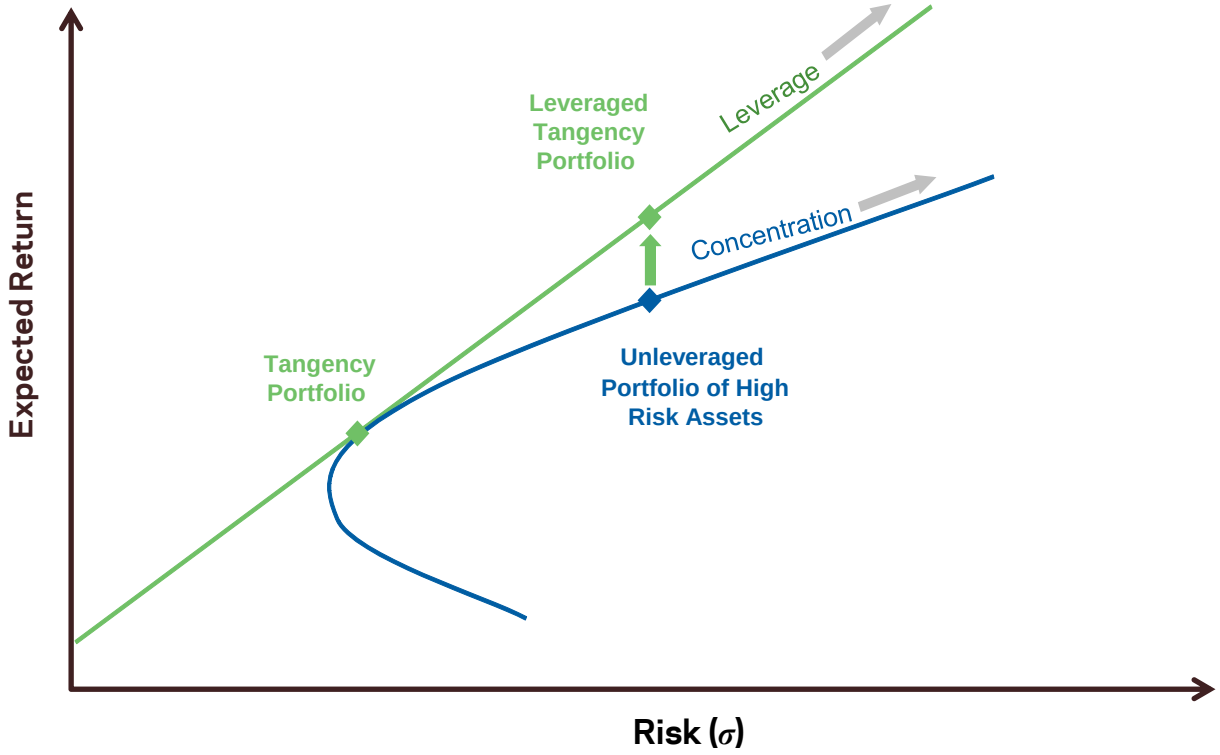
3. Beyond Buffett: understanding alpha more broadly



Betting Against Beta: Why Does it Work?

Investors like high returns, but often cannot or will not use leverage (Black, 1972)

- They overweight **risky** securities, pushing up their prices, and lowering their expected return
- They shun **safe** securities, lowering their price, and increase their expected return



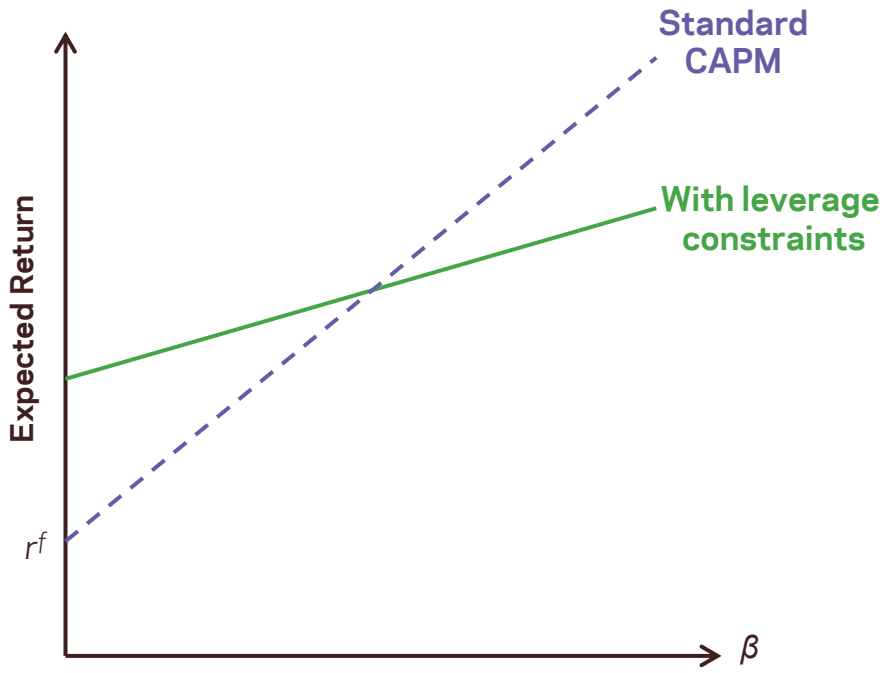
Source: Betting Against Beta. Frazzini, Pedersen (2010). For illustrative purposes only. Please read important disclosures in the Appendix.

Betting Against Beta: Why Does it Work?

Proposition (Frazzini and Pedersen 2014). *In a market equilibrium with leverage constraints, the required return for any security s is:*

$$E_t\left(r^s_{t+1}\right) = r^f + \psi_t + \beta^s_t \lambda_t$$

where the risk premium is $\lambda_t = E_t\left(r^M_{t+1}\right) - r^f - \psi_t$ *and* ψ *is a positive number measuring the importance of leverage constraints*

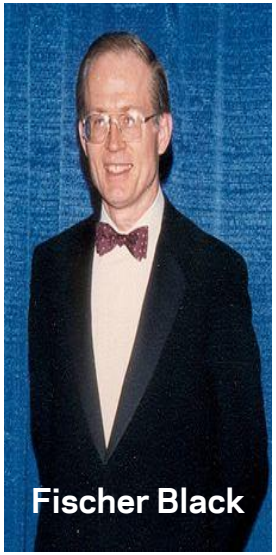


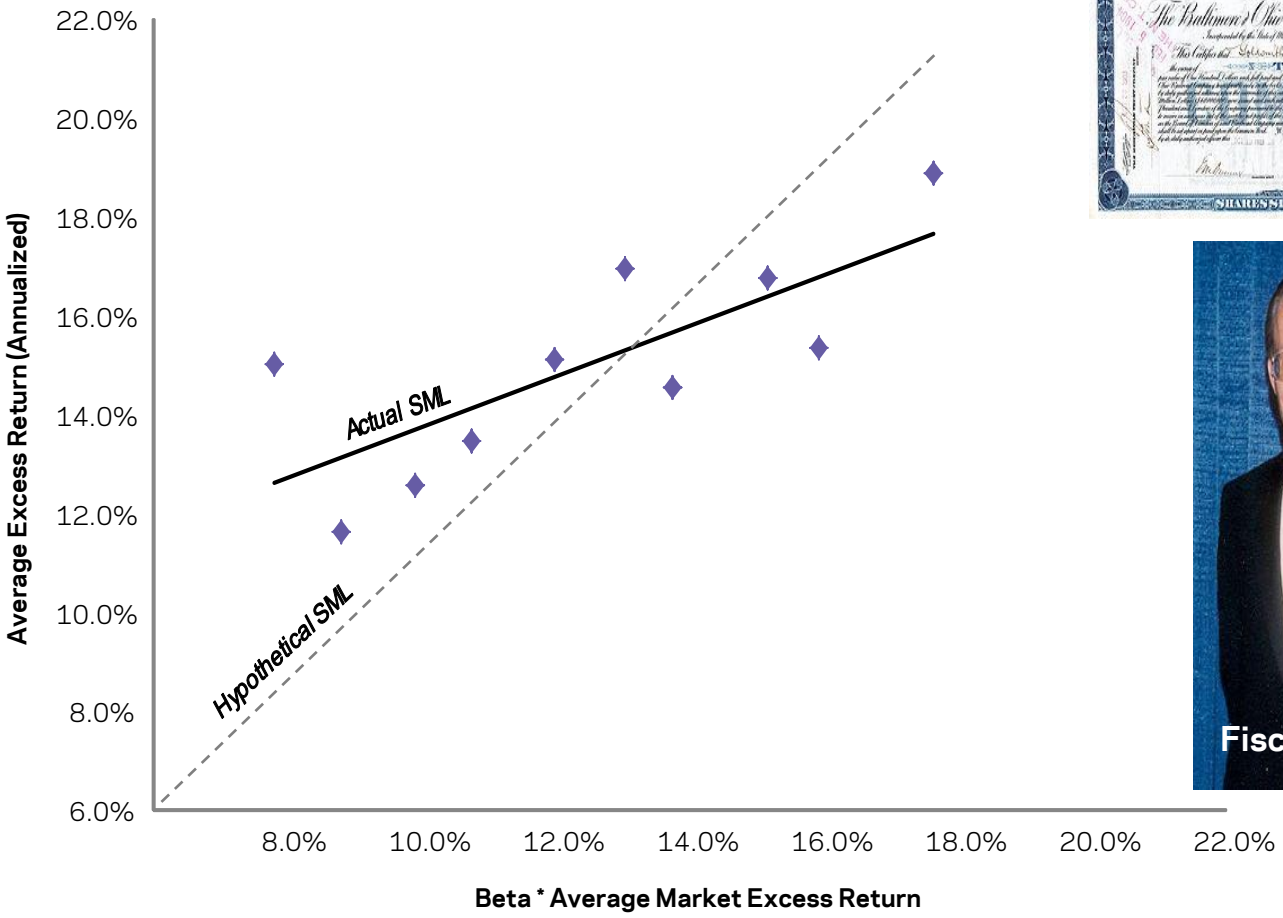
Source: Betting Against Beta. Frazzini, Pedersen (2010). For illustrative purposes only. Please read important disclosures in the Appendix.

Betting Against Beta: The Original Evidence

Theoretical and empirical security market lines:

- Beta-sorted **U.S. equity portfolios, 1931-1965**
- Source: Black, Jensen, and Scholes (1972)



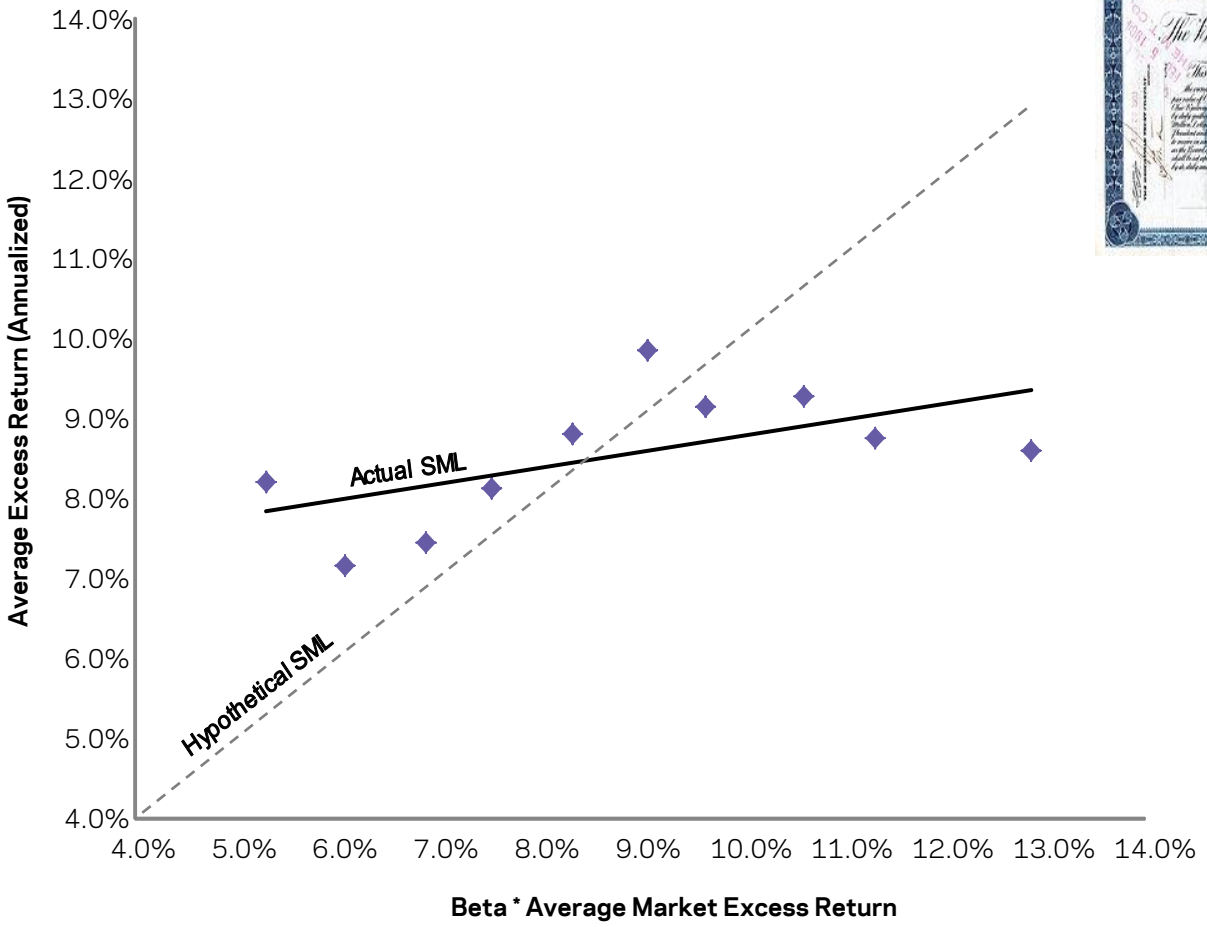


Source: The Capital Asset Pricing Model: Some Empirical Tests Black, Jensen, Scholes (1972). For illustrative purposes only. Please read important disclosures in the Appendix.

Betting Against Beta: Updated Equity Sample

Theoretical and empirical security market lines:

- Beta-sorted **U.S. equity portfolios, 1926-2012**
- Source: Frazzini and Pedersen (JFE 2014)

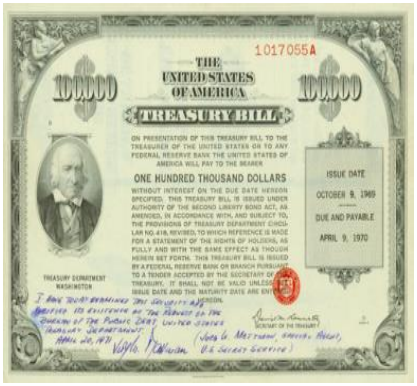


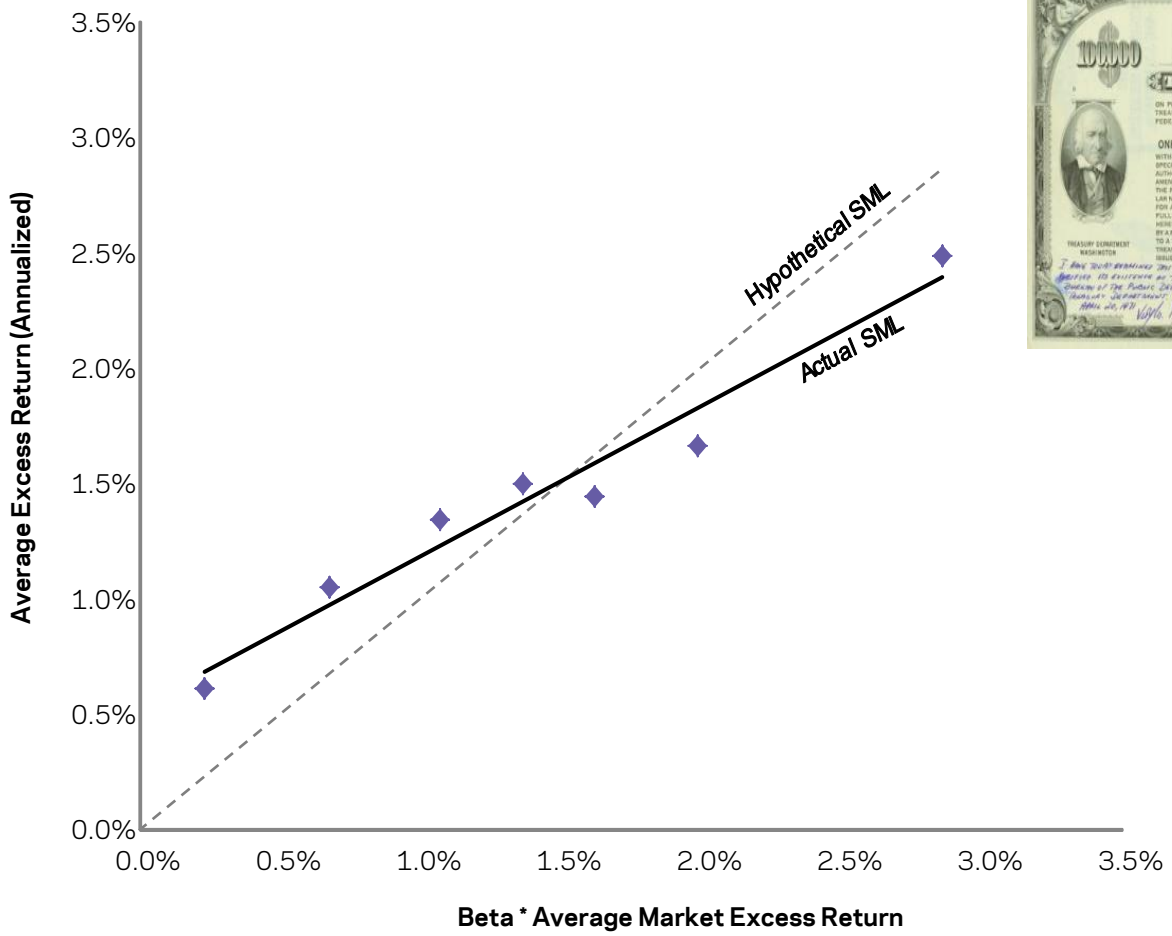
Source: Betting Against Beta. Frazzini, Pedersen (2010). For illustrative purposes only. Please read important disclosures in the Appendix.

Betting Against Beta: Evidence Across Bonds

Theoretical and empirical security market lines:

- Beta-sorted **bond portfolios, 1952-2012**
- Source: Frazzini and Pedersen (JFE 2014)



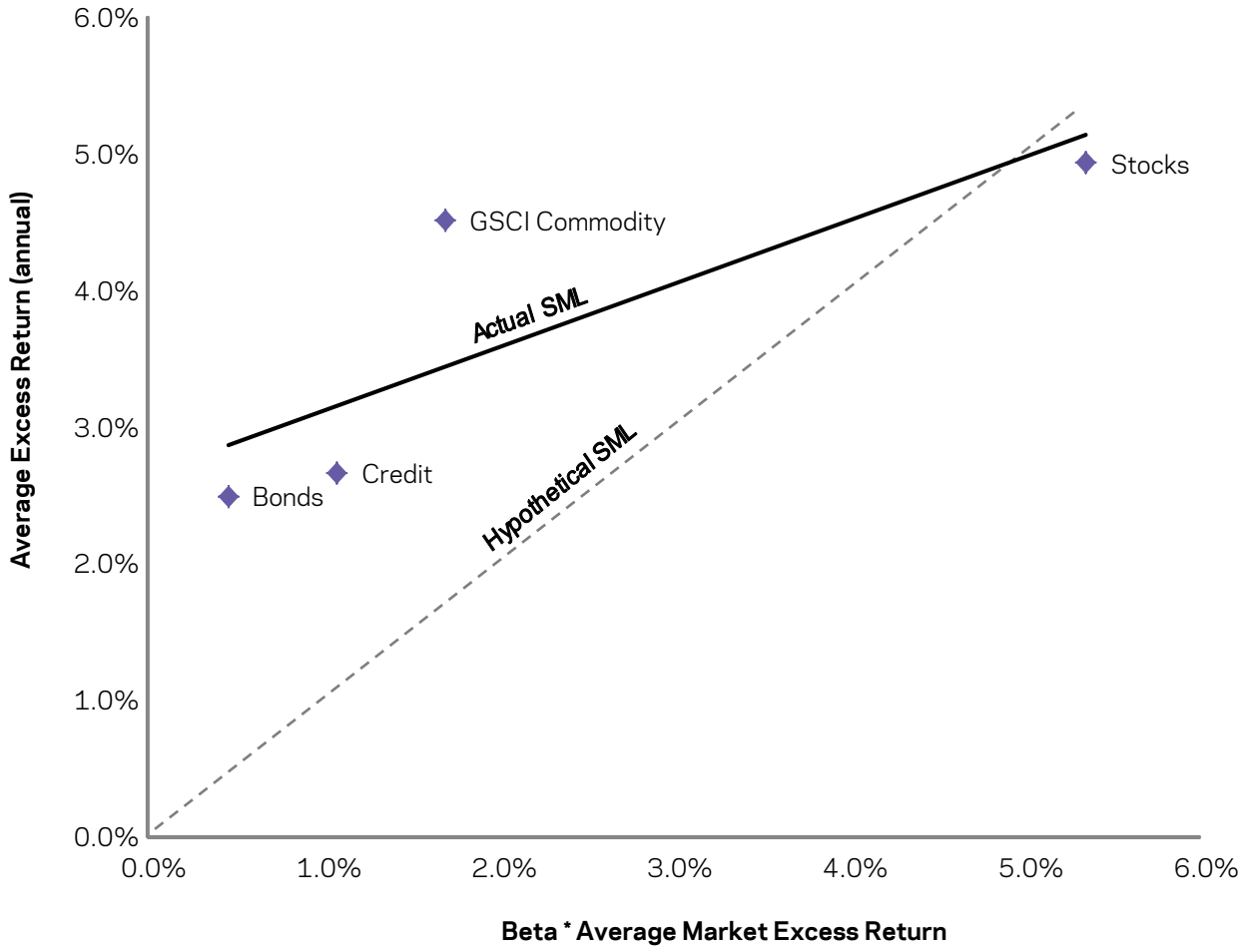


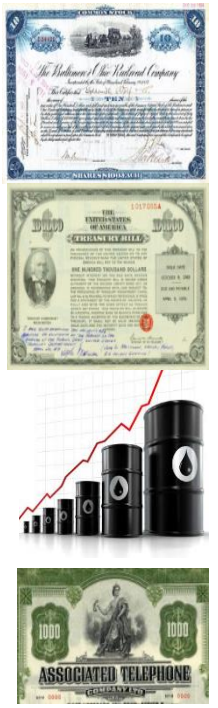
Source: Betting Against Beta. Frazzini, Pedersen (2010). For illustrative purposes only. Please read important disclosures in the Appendix.

Betting Against Beta: Evidence Across Asset Classes

Theoretical and empirical security market lines:

- Overall stock market, overall Treasury bond market, credit market, and commodity market
- Source: "Leverage Aversion and Risk Parity," Asness, Frazzini, and Pedersen (FAJ 2012).





Source: Leverage Aversion and Risk Parity. Asness, Frazzini, Pedersen (2011). For illustrative purposes only. Please read important disclosures in the Appendix.

Betting Against Beta: Long-Short Factor

The low-beta anomaly can be exploited in

- A long only portfolio
- A long/short factor
- Whether you trade long only or long-short, the factor is a useful tool for performance measurement

Betting Against Beta (BAB) factor:

- Long low-beta securities, leveraged to a beta of 1
- Short high-beta securities, de-leveraged to a beta of 1
- Market neutral

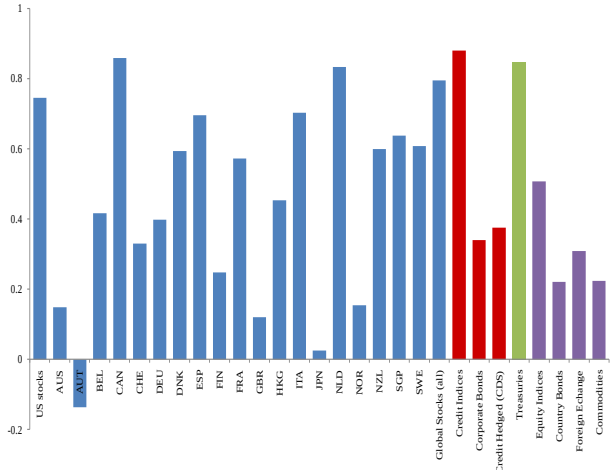
Performance of BAB

- US stocks: 0.78
- International stocks: 0.95
- **Strong performance, consistent across time, regions, and asset classes**

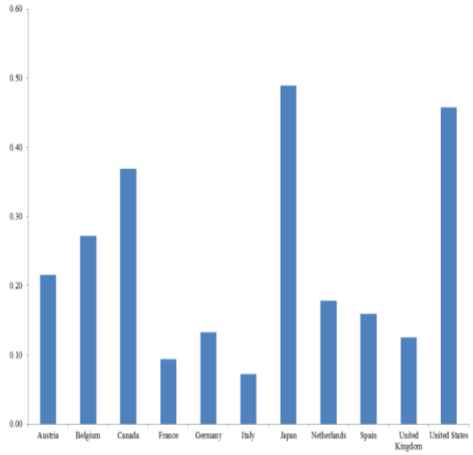
Betting Against Beta

Evidence From More than 100,000 Assets

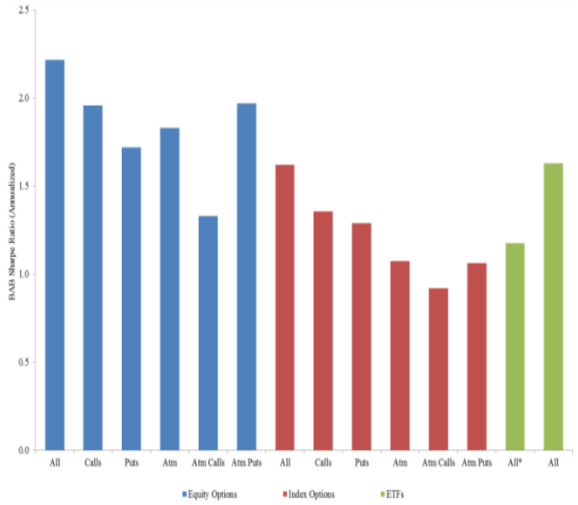
Evidence *within* asset classes: *Betting Against Beta*



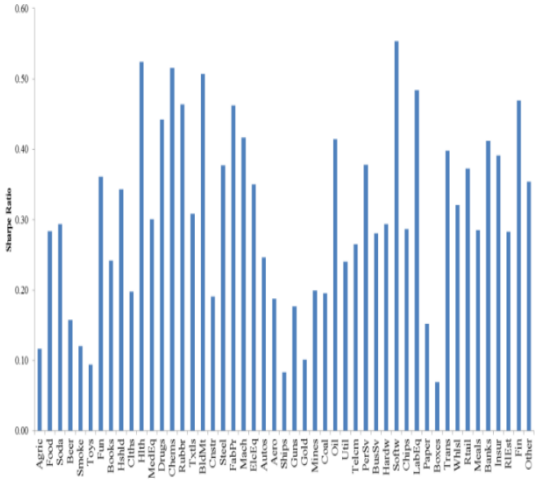
Evidence *across* asset classes: *Leverage Aversion and Risk Parity*



Options and leveraged ETFs: *Embedded Leverage*



Within industries: *Low-Risk Investing Without Industry Risk*



Source: Betting Against Beta (BAB) Frazzini, Pedersen (2010). For illustrative purposes only. Past performance is not a guarantee of future performance. Please read important disclosures in the Appendix.

Quality Minus Junk

So far: risk measured using *stock returns*

Risk and other quality characteristics can also be measured using *balance sheet data*

- Quality Minus Junk (QMJ): a portfolio long high quality and short low quality stocks

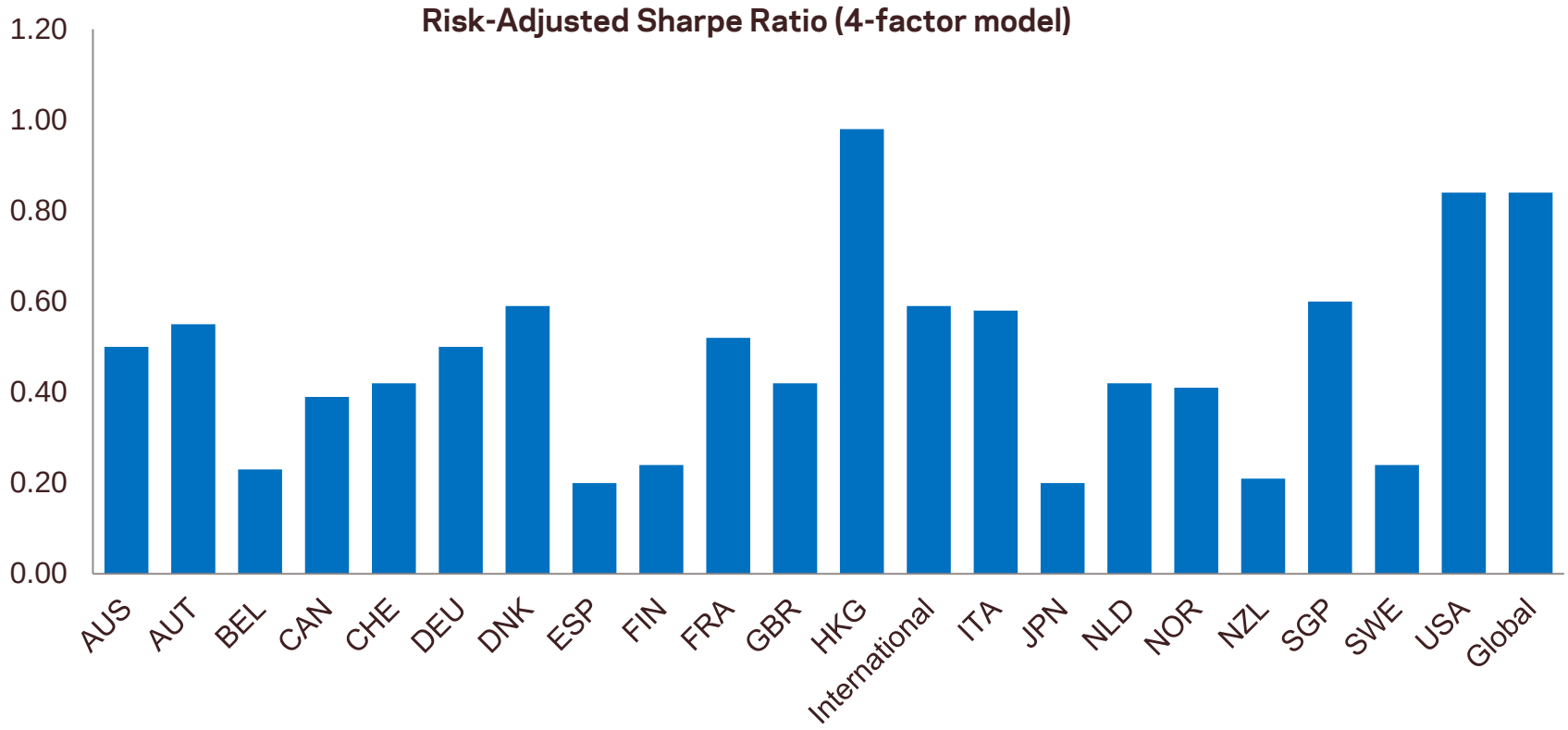
Key quality characteristics

- Profitability
- Safety: stable profits
- Growing profits
- Profits paid out to shareholders

The Low Risk Anomaly: Quality Minus Junk

Global evidence that high-quality stocks deliver greater risk-adjusted returns than "junk" stocks

- Quality Minus Junk (QMJ): a portfolio long high quality and short low quality stocks

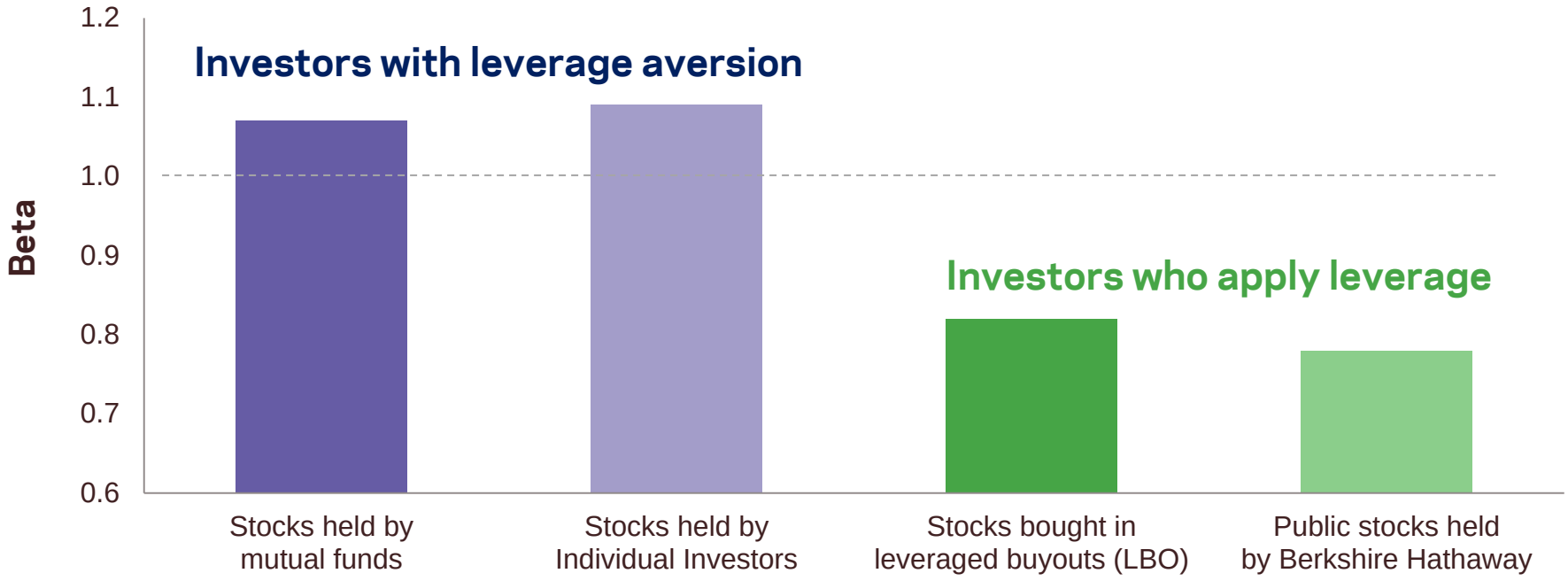


Outperformance appears especially strong in bear markets – flight to quality

- Source: Asness, Frazzini and Pedersen (2013).

Who Bets Against Beta: Evidence From Actual Portfolios

- Standard CAPM predicts that everyone holds the same portfolio (the market):
  - Violated empirically in a systematic way
- Evidence consistent with theory of leverage constraints
  - Stock selection evidence from Frazzini and Pedersen (2011):



Is the Low Risk Anomaly Relevant to Buffett's portfolio ?

What Makes a Stock a "Buffett Stock"?

What the world reads:

"It's far better to buy a wonderful company at a fair price than a fair company at a wonderful price"

What a quant sees:

Value	The tendency for relatively cheap assets to outperform relatively expensive ones	**Well-known, well-studied**
Low Beta	The tendency for low risk assets to generate higher risk-adjusted returns than high risk assets	**New understanding, both require leverage to matter**
Quality	The tendency for assets with more stable, sustainable earnings, and lower leverage to outperform	

Quote from Warren Buffett, Berkshire Hathaway Inc., Annual Report, 1989.

Understanding Buffett's Alpha: Outline

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  - Betting against Beta and Fundamental Risk

2. Can this theory also explain Buffett?
- Track record: How good is Buffett?
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- Decomposing Buffett: CEO vs. stock picker
- Exposures: What type of stocks?
- Systematic Buffett strategy

How Good is Buffett's Record?

Sharpe ratio: SR = excess return / volatility

- Berkshire Hathaway (1976-2011): 0.76
- Berkshire's public stock holdings: 0.69

Information ratio: $IR = SR(r_t - \hat{\beta}\ MKT_t)$

- Berkshire Hathaway (1976-2011): 0.66
- Berkshire's public stock holdings: 0.56

How does this stack up?

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How Good is Buffett's Record?

Buffett's track record has been exceptional

- Berkshire Hathaway has a higher Sharpe ratio than any stock or mutual fund with a history of more than 30 years
- If you could travel back in time and pick one stock, Berkshire Hathaway would be your pick

	Sample Distribution of Sharpe Ratios					Buffett Performance	
	# of Stocks/Funds	Median	95th Percentile	99th Percentile	Maximum	Rank	Percentile
Panel A: SR of Equity Mutual Funds							
All funds in CRSP data 1976 - 2011	3,479	0.242	0.49	1.09	2.99	88	97.5%
All funds alive in 1976 and 2011	140	0.37	0.52	0.76	0.76	1	100.0%
All funds alive in 1976 with at least 10-year history	264	0.35	0.51	0.65	0.76	1	100.0%
All funds with at least 10-year history	1,994	0.30	0.47	0.65	0.90	4	99.8%
All funds with at least 30-year history	196	0.37	0.51	0.72	0.76	1	100.0%
Panel B: SR of Common Stocks							
All stocks in CRSP data 1926 - 2011	23,390	0.195	0.61	1.45	2.68	1360	93.9%
All stocks alive in 1976 and 2011	598	0.32	0.44	0.56	0.76	1	100.0%
All stocks alive in 1976 with at least 10-year history	3,633	0.27	0.45	0.61	0.86	7	99.8%
All stocks with at least 10-year history	9,035	0.26	0.48	0.73	1.12	62	99.3%
All stocks with at least 30-year history	1,777	0.31	0.44	0.57	0.76	1	100.0%

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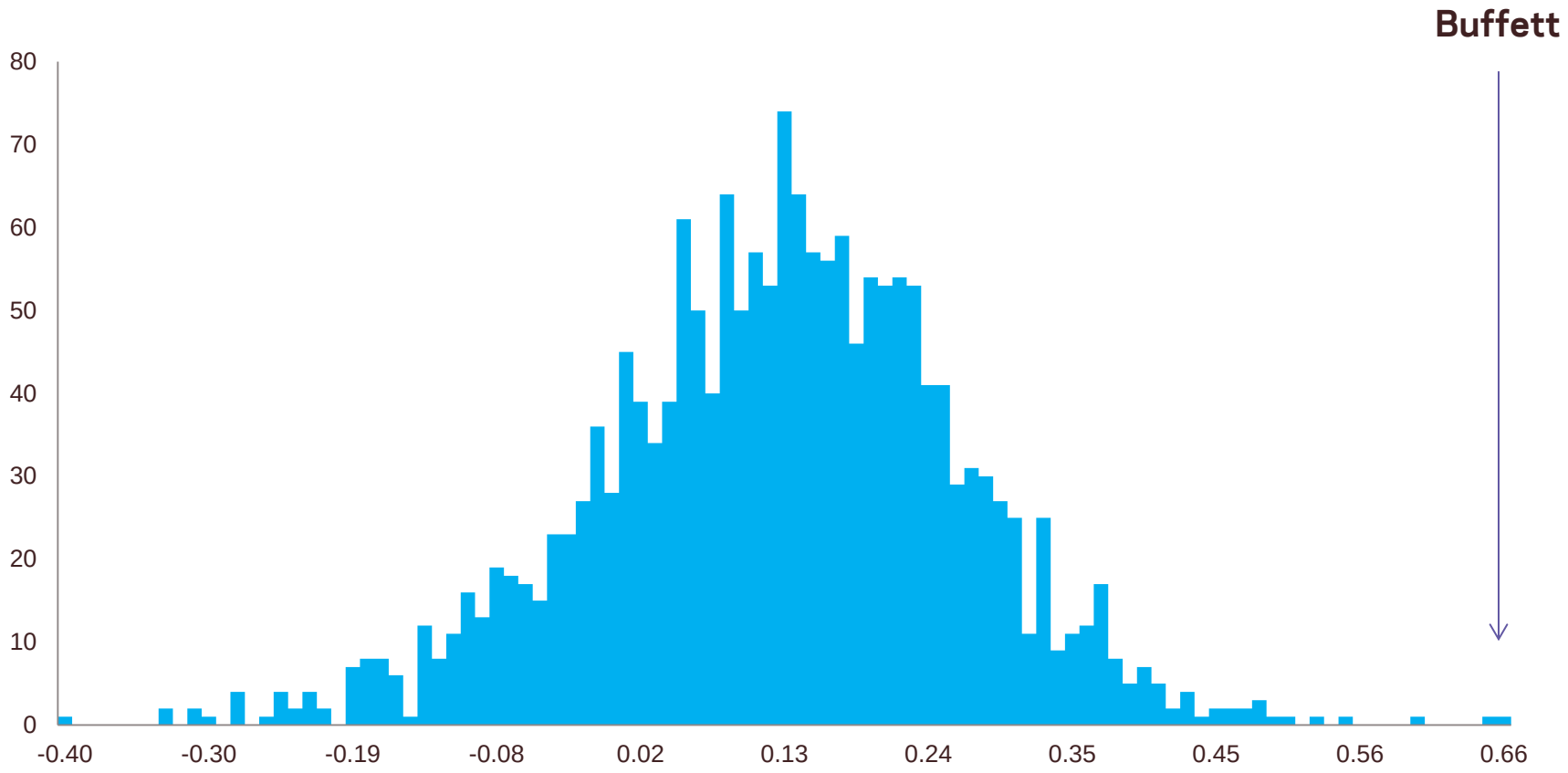
How Good is Buffett's Record ? 1926 – 2011

- Information ratios of all stocks in the CRSP universe with more than 30 years



Buffett's Leverage: The Magnitude of Leverage

Buffett: *"I've seen more people fail because of liquor and leverage"*

Stylized balance sheet of Berkshire Hathaway:

Assets	Liabilities and Shareholders' Equity
Publicly traded equities	Liabilities
Privately held companies	Equity
Cash	
Total Assets	**Total Liabilities**

Leverage: $L_t = \frac{\text{Total Assets} - \text{Cash}}{\text{Equity}} = 1.6$

Does Buffett's risk reflect the use of leverage?

- Volatility of Berkshire Hathaway = 25%
- Volatility of the portfolio of Berkshire's public stocks: 17%

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Buffett's Leverage: The Cost of Leverage

36% of liabilities come from insurance float. Cost:

	Fraction of years with negative cost	Average cost of funds (Truncated)*	Spread over benchmark rates				
			T-Bill	Fed Funds rate	1-Month Libor	6-Month Libor	10-Year Bond
1976-1980	0.79	1.67	-4.59	-5.65			-5.76
1981-1985	0.20	10.95	1.10	-0.27			-1.28
1986-1990	0.00	3.07	-3.56	-4.61	-4.80	-4.90	-5.30
1991-1995	0.60	2.21	-2.00	-2.24	-2.46	-2.71	-4.64
1996-2000	0.60	2.36	-2.70	-3.10	-3.33	-3.48	-3.56
2001-2005	0.60	1.29	-0.82	-0.96	-1.05	-1.19	-3.11
2006-2011	1.00	-4.00	-5.84	-6.06	-6.29	-6.59	-7.67
Full sample	**0.60**	**2.20**	**-3.09**	**-3.81**	**-3.69**	**-3.88**	**-4.80**

Other sources of financing include

- Debt
- Deferred income taxes (e.g., based on property, plant and equipment)
- Accounts payable
- Derivatives:
  - Selling options
  - Collects premia up front with no margin requirement
  - Provides Embedded Leverage (Frazzini and Pedersen (2011))

* In years when cost of funds is reported as "less than zero" and no numerical value is available we set cost of funds to zero
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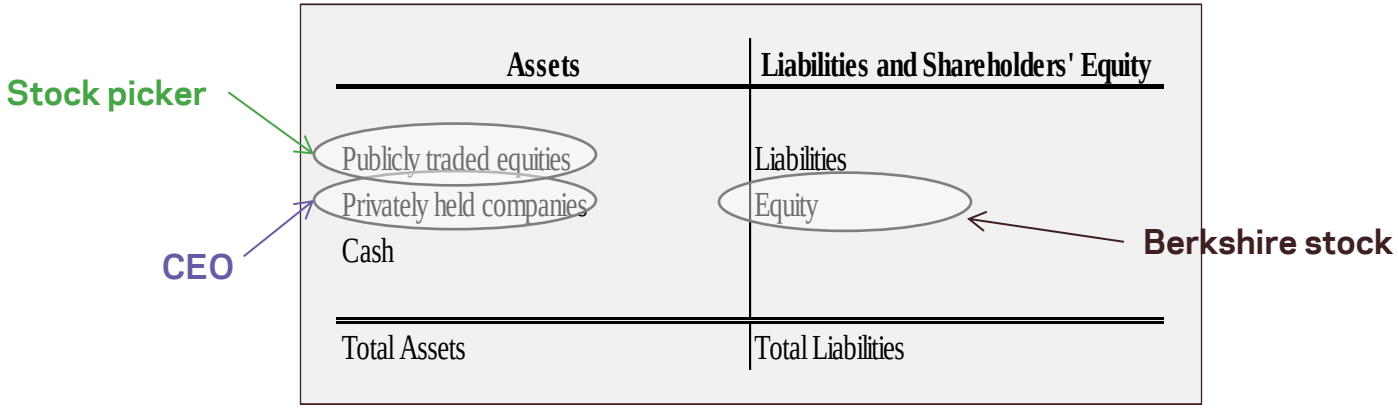
Buffett's Alpha: CEO or Stockpicker?



Returns of

- Berkshire stock: observed directly
- Publicly traded equities: observed via 13F filings and stock return data
- Privately held companies inferred:

$$r_{t+1}^{Private} = \frac{r_{t+1}^{f} Liabilities_t^{MV} + r_{t+1}^{Equity} Equity_t^{MV} - r_{t+1}^{Public} Public_t^{MV} - r_{t+1}^{f} Cash_t^{MV}}{Private_t^{MV}}$$

Return decomposition:

$$r_{t+1}^{Equity} - r_{t+1}^{f} = \left[w_t \left(r_{t+1}^{Private} - r_{t+1}^{f} \right) + (1 - w_t)\left(r_{t+1}^{Public} - r_{t+1}^{f} \right) \right] L_t$$

- Leverage: $L_t = \frac{\text{Total Assets} - \text{Cash}}{\text{Equity}}$
- Share of private holdings: $w_t = \frac{Private_t^{MV}}{Private_t^{MV} + Public_t^{MV}}$

Source: Buffet's Alpha: Frazzini, Kabiller, Pedersen (working paper). Please read important disclosures in the Appendix. As of 5/18/13.

What Kind of Companies does Buffett Own?

Regression to determine Buffett's exposures:

$$r_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + \beta_5 BAB_t + \beta_6 QMJ_t + \varepsilon_t$$

BAB = Betting Against Beta (Frazzini and Pedersen (2014))

QMJ = Quality Minus Junk (Asness, Frazzini, and Pedersen (2012))

	Berkshire stock 1976-2011			13F Portfolio 1980-2011		
Alpha	**12.5%** (3.28)	**11.1%** (2.92)	7.0% (1.79)	**5.5%** (2.60)	**4.7%** (2.26)	0.1% (0.04)
MKT	**0.84** (11.49)	**0.78** (10.49)	**0.97** (10.62)	**0.86** (21.33)	**0.83** (19.86)	**1.04** (21.04)
SMB	**-0.30** -(2.91)	**-0.39** -(3.61)	-0.07 -(0.52)	**-0.18** -(3.16)	**-0.23** -(3.97)	0.11 (1..52)
HML	**0.47** (4.24)	**0.30** (2.39)	0.21 (1.72)	**0.30** (4.88)	**0.19** (2.74)	0.10 (1.48)
UMD	0.06 (0.86)	0.02 (0.29)	0.01 (0.16)	-0.02 -(0.60)	-0.05 -(1.34)	-0.06 -(1.69)
BAB		**0.27** (3.12)	**0.18** (2.11)		**0.16** (3.50)	0.07 (1.58)
Quality			**1.40** (3.50)			**1.49** (7.12)
R2 bar	0.24	0.26	0.28	0.56	0.57	0.62

Buffett's Skill

Tendency to buy safe (i.e., low-beta) stocks

Tendency to buy high-quality companies (profitable, growing, and paying out dividends)

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Systematic Buffett-Style Portfolio

We can attribute Buffett's performance to leverage and his focus on safe, high-quality, value stock

- It is natural to consider how well we can do by implementing these investment themes in a systematic way

Regression to determine Buffett's exposures:

$$r_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + \beta_5 BAB_t + \beta_6 QMJ_t + \varepsilon_t$$

Portfolio construction:

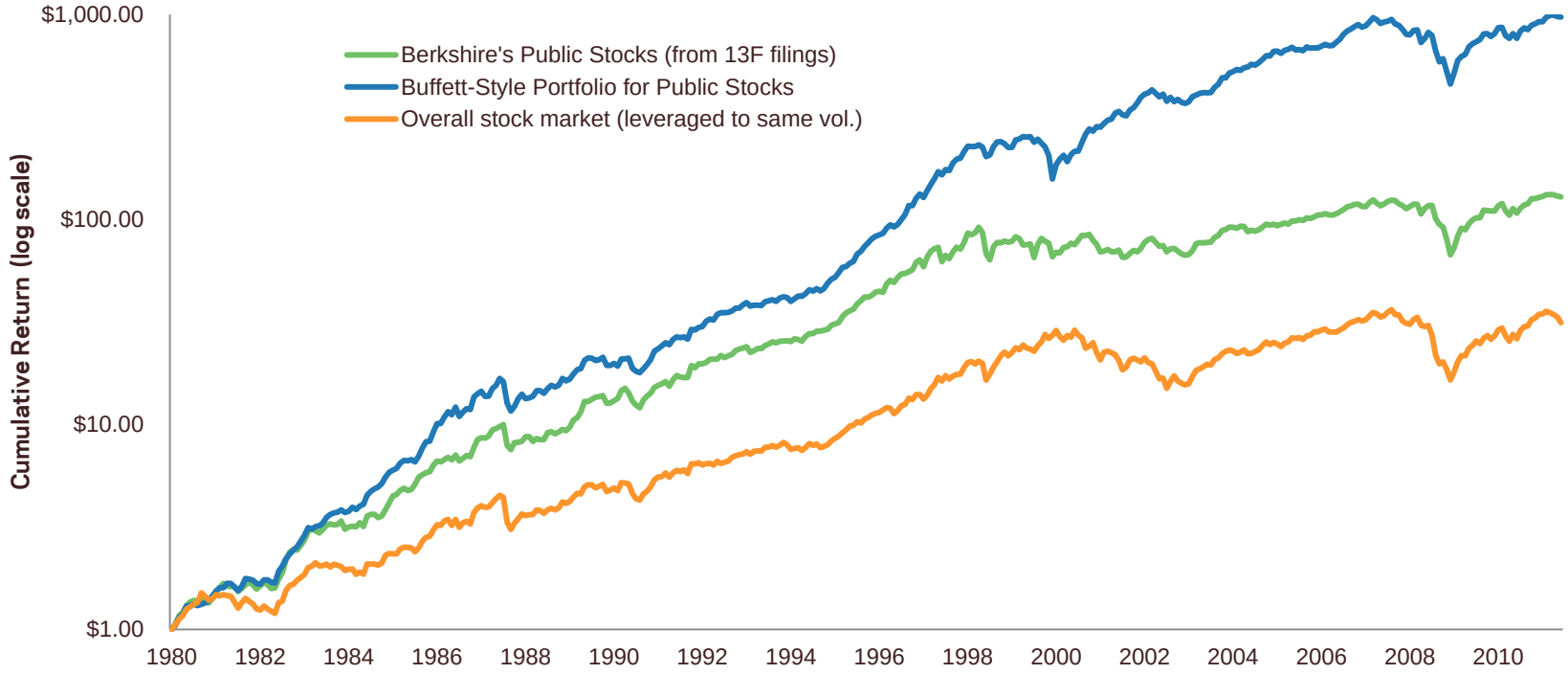
- Use the sub-product of the
  - Estimated regression coefficients and
  - Factor returns
- Rebalance monthly and rescale to hit the same volatility as Buffett to simulate using leverage

Our systematic Buffett-style strategy is a diversified portfolio that we believe matches Berkshire's beta, idiosyncratic volatility, total volatility, and relative active loadings

Systematic Buffett-Style Strategy

A disciplined approach to high quality, low risk stocks may generate strong risk-adjusted and absolute-returns

- Based on Berkshire's public stocks holdings



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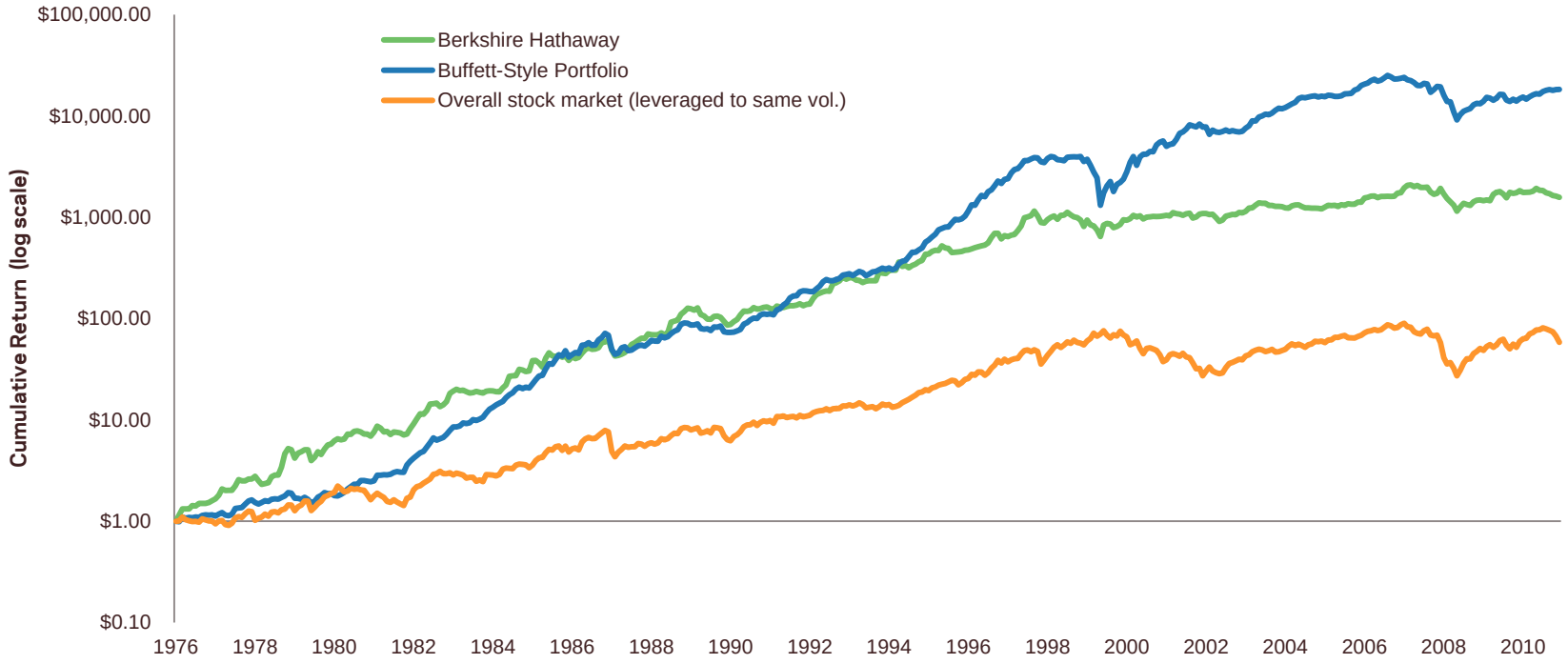
Systematic Buffett-Style Strategy

A disciplined approach to high quality, low risk stocks may generate strong risk-adjusted and absolute-returns

- Based on Berkshire's Hathaway



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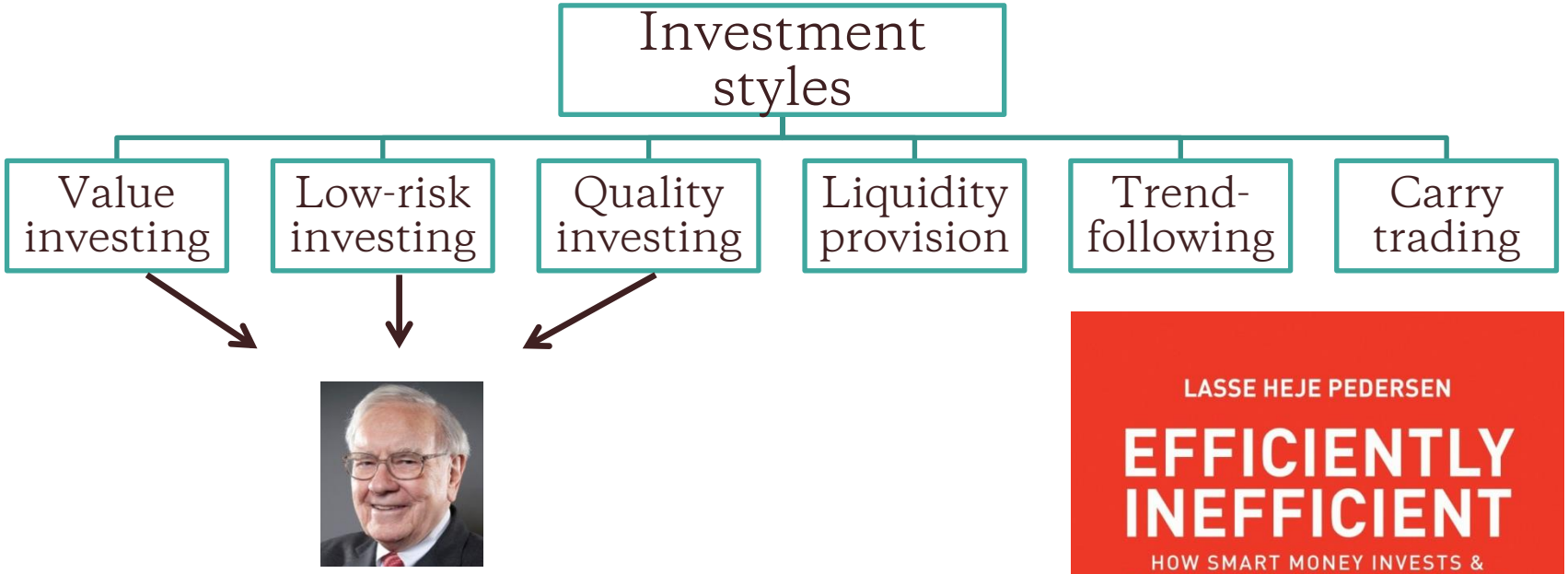
Systematic Buffett-Style Strategy

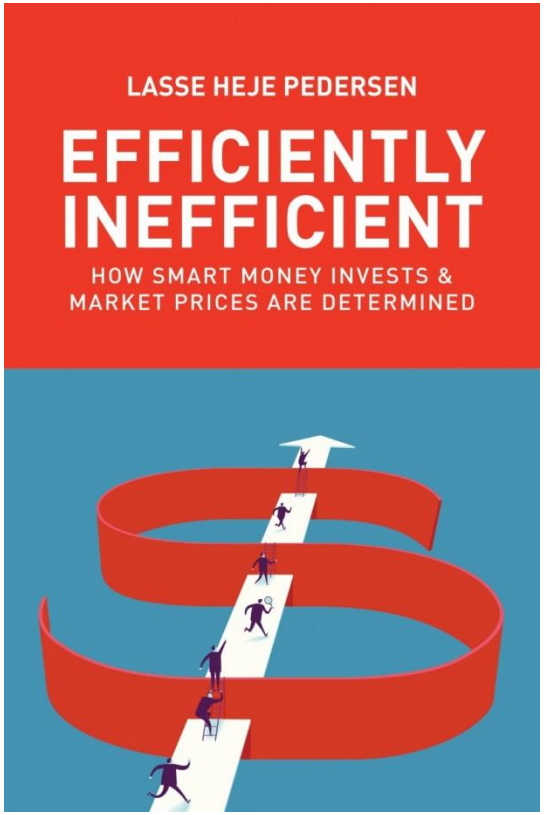
A disciplined approach to high quality, low risk stocks may generate strong risk-adjusted and absolute-returns

	Buffett Performance				Buffett Style Portfolio		
	Berkshire Hathaway	Public U.S. stocks (from 13F filings)	Private Holdings	Overall stock market performance	Berkshire Hathaway	Public U.S. stocks (from 13F filings)	Private Holdings
Sample	1976-2011	1980-2011	1984-2011	1976-2011	1976-2011	1980-2011	1984-2011
Beta	0.67	0.77	0.28	1.00	0.67	0.77	0.28
Average excess return	19.0%	11.8%	9.6%	6.1%	26.4%	18.4%	13.8%
Total Volatility	24.8%	17.2%	22.3%	15.8%	24.8%	17.2%	22.3%
Idiosyncratic Volatility	22.4%	12.0%	21.8%	0.0%	22.4%	12.0%	21.8%
Sharpe ratio	0.76	0.69	0.43	0.39	1.06	1.07	0.62
Information ratio	0.66	0.56	0.36	0.00	0.99	1.11	0.55
Leverage	1.64	1.00	1.00	1.00	3.79	2.46	3.01
Sub period excess returns:							
1976-1980	42.1%	31.4%		7.8%	8.0%	30.7%	
1981-1985	28.6%	20.9%	18.5%	4.3%	46.4%	27.8%	22.1%
1986-1990	17.3%	12.5%	9.7%	5.4%	17.9%	13.1%	7.0%
1991-1995	29.7%	18.8%	22.9%	12.0%	41.7%	24.0%	30.9%
1996-2000	14.9%	12.0%	8.8%	11.8%	39.4%	23.2%	28.8%
2001-2005	3.2%	2.2%	1.7%	1.6%	28.5%	16.8%	10.4%
2006-2011	3.3%	3.0%	2.3%	0.8%	3.3%	5.7%	-8.1%

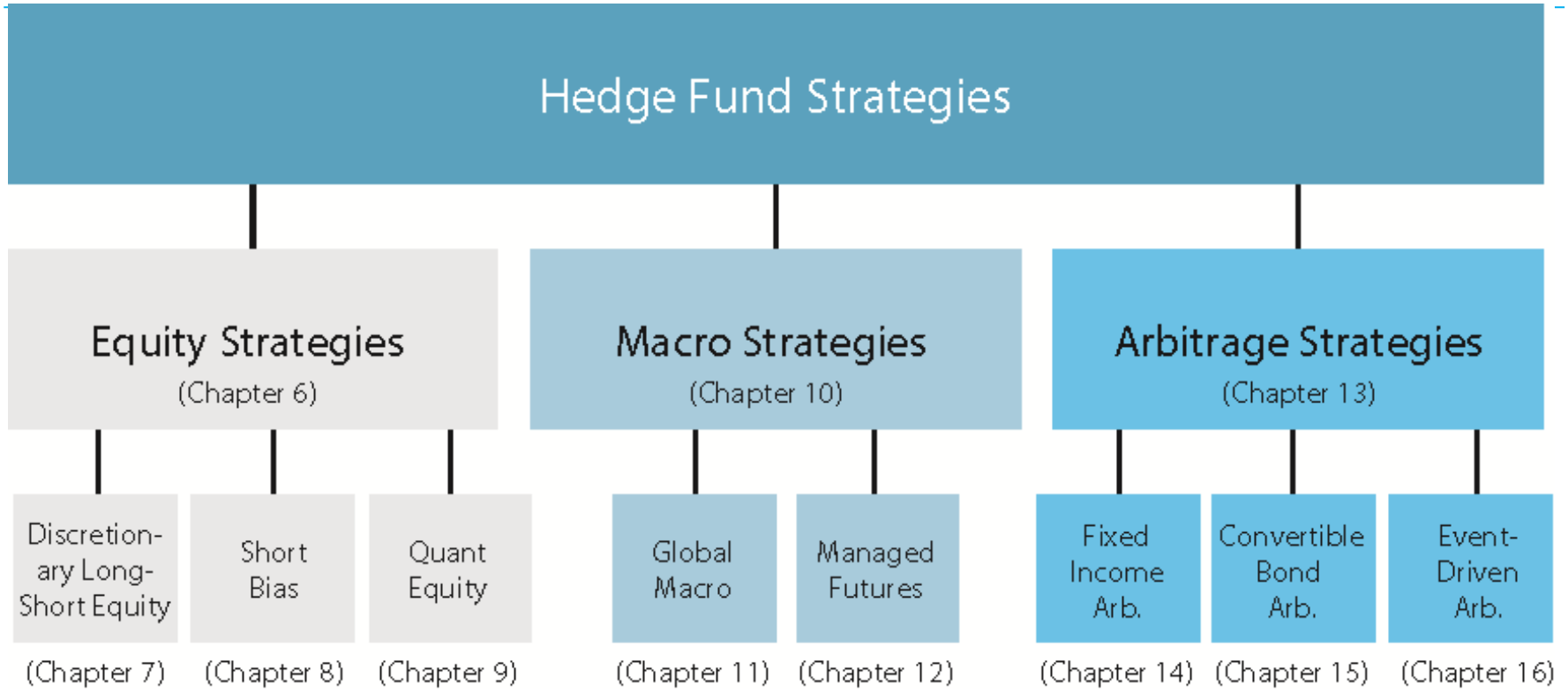
Please see the Appendix for important information. An investment in the above security does not suggest the achievement of a profit or loss, realized or unrealized. This security was selected merely for illustrative purposes.

Beyond Buffett: Understanding Alpha Everywhere





Beyond Buffett: Understanding Alpha Everywhere










PEDERSEN EFFICIENTLY INEFFICIENT

Conclusions

A relatively flat SML can be part of a rational market equilibrium:

- Leverage constrained investors concentrate in risky assets to achieve high unleveraged returns
- Less-constrained investors may earn higher risk-adjusted returns

A few key investment styles drive returns across markets, asset classes, and categories

Buffett's portfolio and performance can be understood using these factors

- Has a unique access to leverage
- Leverages low-risk, high-quality value stocks
- Short sells options (securities with *Embedded Leverage* (Frazzini and Pedersen (2011))