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A Standard & Poor's Business

Leveraging Minimum Variance to Enhance Portfolio Returns

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December 2010

Agenda

- Quick overview of the tools employed in constructing the Minimum Variance (MinVar) Portfolio
- Features of a basic unconstrained MinVar Portfolio and comparative performance against the main benchmarks
- Impact on performance of imposing constraints such as style or sector neutrality
- Alternative methods for imposing style tilts within the minimum variance framework

Capital IQ Alphaworks

- Library of over 400 stock selection signals spanning seminal academic literature and the latest practitioner expertise
- Fully transparent factor definitions describe each signal's formulation right down to the Compustat and Capital IQ data code
- Industry-first built solely off Point-In-Time fundamentals providing a true view of historical factor performance
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- Price Momentum
- Historical Growth
- Analyst Expectations
- Earnings Quality
- Valuation
- Capital Efficiency
- Size
- Volatility

Industry Group Relative

- Price Momentum
- Historical Growth
- Analyst Expectations
- Earnings Quality
- Valuation
- Capital Efficiency

5-Year Group Relative

- Historical Growth
- Earnings Quality
- Valuation
- Capital Efficiency

Indicator

- Price Momentum
- Historical Growth
- Analyst Expectations
- Earnings Quality
- Valuation
- Capital Efficiency
- Size
- Volatility

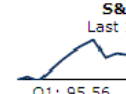
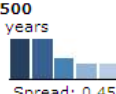
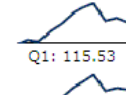
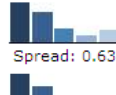
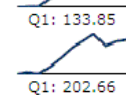
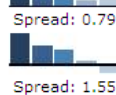
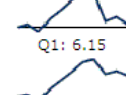
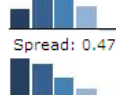
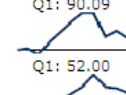
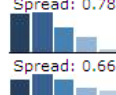
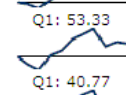
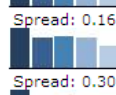
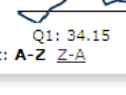
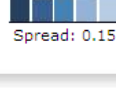
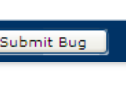



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FACTOR SEARCH

	S&P 500 Last 10 years	Compare 0/10 Clear
<p><u>Adj Forward Free Cash Flow to Price Ratio</u> This valuation ratio compares the company's forward looking annual free cash flow to its market value. Generally, the lower this ratio is, the more expensive the company is.</p>	 Q1: 95.56	 Spread: 0.45
<p><u>Adj Free Cash Flow to Price</u> This valuation ratio compares the company's annual free cash flow to its market value. Generally, the lower this ratio is, the more expensive the company is.</p>	 Q1: 115.53	 Spread: 0.63
<p><u>Adj Growth Flow to Price</u> The growth-flow-to-price ratio indicates how much the company spends on R&D. Note, however, that this does not indicate how profitable the R&D will turn out in the future.</p>	 Q1: 133.85	 Spread: 0.79
<p><u>Adj. EBITDA to Enterprise Value</u> The metric measure how much return the company can generate relative to its enterprise value.</p>	 Q1: 202.66	 Spread: 1.55
<p><u>Assets to Price Ratio</u> This ratio compares the company's assets per share value with the company's stock price. If the ratio is too low (high) relative to other comparable companies, the company's assets are undervalued (overvalued).</p>	 Q1: 6.15	 Spread: 0.47
<p><u>Book to Enterprise Value</u> The metric measures the book value of a company relative to its enterprise value.</p>	 Q1: 90.09	 Spread: 0.78
<p><u>Book to Price</u> This ratio compares the company's book value to its market price.</p>	 Q1: 52.00	 Spread: 0.66
<p><u>Cash Flow to Equity</u> This ratio measures how much net cash flow the company can generate for the common equity holders.</p>	 Q1: 53.33	 Spread: 0.16
<p><u>Cash to Adjusted Enterprise Value</u> This ratio measure the company's cash holding relative to its enterprise value.</p>	 Q1: 40.77	 Spread: 0.30
<p><u>Cash to EV Ratio</u> This ratio measure the company's cash holding relative to its enterprise value.</p>	 Q1: 34.15	 Spread: 0.15

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Capital IQ US Fundamental Risk Model

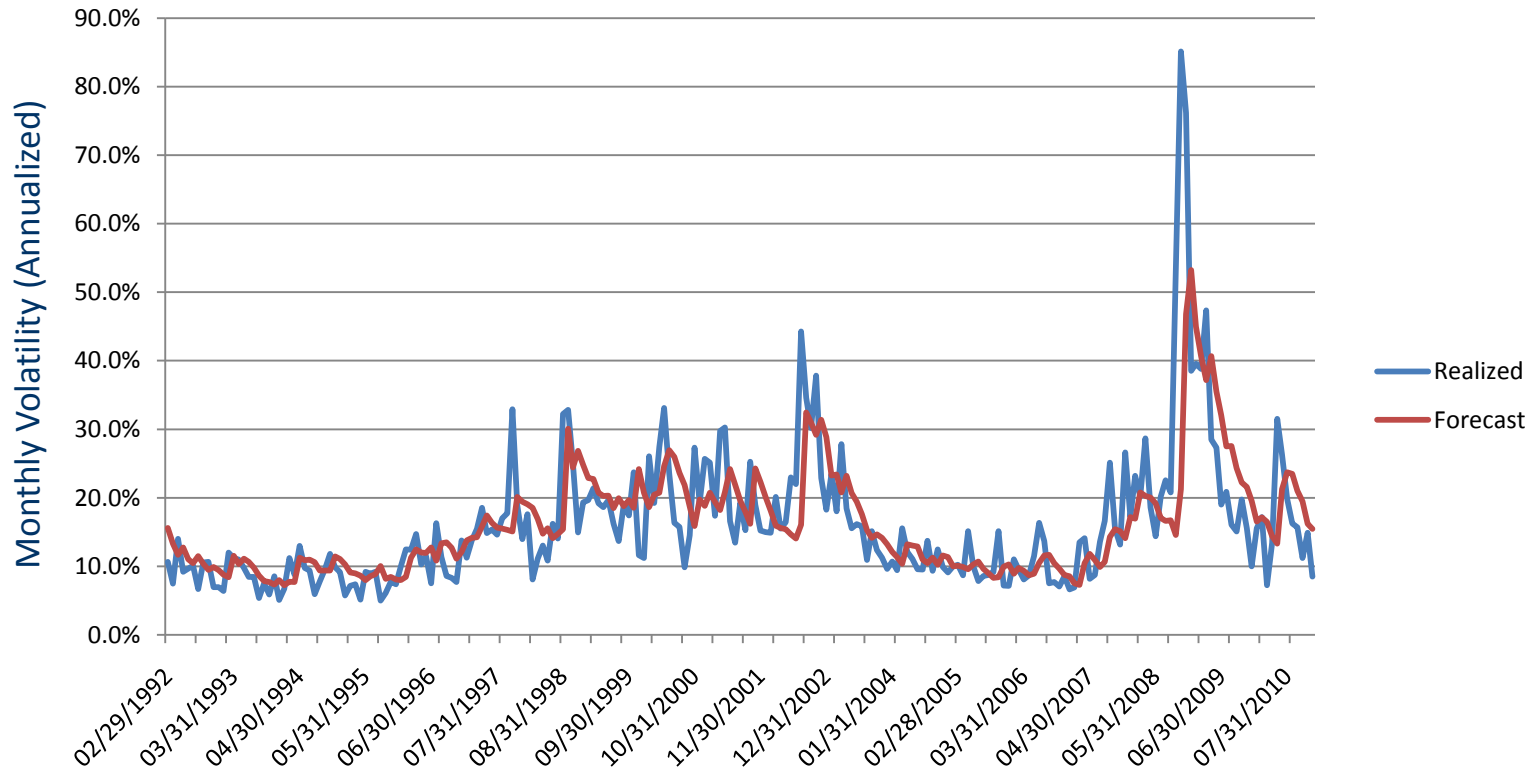
- **Based on**
 - › Alphaworks factor library subset: 130+ factors aggregated into 8 styles
 - › GICS industry classifications: 24 GICS level 2 industry factors
 - › Daily returns with serial correlation adjustment
 - › Estimation universe: S&P 1500
 - › Coverage universe: 7,500 – 10,000 US equity instruments covered by Capital IQ's Xpressfeed including ADRs and ETFs
 - › White Paper documents the research methodology

Capital IQ Risk Model Style Factors

Style Factor	Number of Constituent Indicators	Constituent Indicator Highlights
Analyst Expectation	11	<ul style="list-style-type: none"> Earnings & Sales Forecast Earnings Surprise Analyst Diffusion Analyst Revision
Capital Efficiency	10	<ul style="list-style-type: none"> Return on Equity & Capital Leverage & Interest Coverage Issuance & Buybacks
Earnings Quality	26	<ul style="list-style-type: none"> Balance Sheet Accruals Working Capital & Asset Turnover Capital Expenditure and R&D Intensity Margins, Payout Ratio
Historical Growth	31	<ul style="list-style-type: none"> 1 & 3-year growth of <ul style="list-style-type: none"> - Operating & Free Cash Flow - Earnings - Margins
Price Momentum	20	<ul style="list-style-type: none"> 1, 6, 9 & 12-month Price Momentum Technical indicators over various time frames MACD, RSI, Slope, 52 Week High/Low
Size	2	<ul style="list-style-type: none"> Log of Market Cap. & Sales
Valuation	34	<ul style="list-style-type: none"> Reported & Forward Earnings Yield Dividend Yield Book to Price Sales, EBITDA & Cash Flow to Enterprise Value Inverse PEGY
Volatility	9	<ul style="list-style-type: none"> Realized volatility CAPM Beta Distance from High to Low (1 & 12 months) Short Interest & Trading Volume

Capital IQ US Fundamental Short Term Risk Model

S&P 500 Forecast vs. Realized Risk



Capital IQ ClariFI Mean-Variance Optimizer

- State of the art solver for Mixed Integer Quadratically Constrained Quadratic Programming problems
- Risk (and tracking error) can be in the objective function or treated as constraint. Multiple risk terms/models supported
- Constraints can be hard or soft with penalties (linear or quadratic) including
 - › Holding size constraints
 - › Cardinality constraints (min/max position counts)
 - › Trading constraints including % of ADV and threshold holding and trade size
 - › Exposure constraints, e.g. to sectors or risk model factors
- Full long-short capabilities
- Transaction cost model support
- Integrated in back-testing engine

Historical Evidence

- Early work from HAUGEN/BAKER (1991). For the period covering the years 1972 to 1989 the authors found that a MinVar portfolio would outperform the Wilshire 5000 at lower risk
- Many studies followed the original paper. For the US stock market CHAN/KARCESKI/LAKONISHOK (1999), SCHWARTZ (2000) and JAGANNATHAN/MA (2003) and CLARKE/SILVA/THORLEY (2006) found both higher returns and lower realized risks for the MinVar portfolio versus a capitalization weighted benchmark
- SCHERER (2010) shows that 79% of the variation of the MinVar portfolio's excess return can be attributed to exposure to low market beta and low stock specific risk. Value and size are other characteristics noted

Unconstrained Minimum Variance Portfolio Construction

- Portfolio size \$1.5BN (initial), long only
- Objective: Minimum Variance at each rebalancing
- Risk Model: Capital IQ US Fundamental Medium Term
- Universe: S&P 1500
- Max 100 Holdings (not always binding)
- Monthly rebalancing, Apr. 1998 to Oct. 2010
- Max trade size: 10% of ADV
- Trade costs: 25bps
- Max holding size: 3% of portfolio per name
- Threshold holding and trade size: \$50k

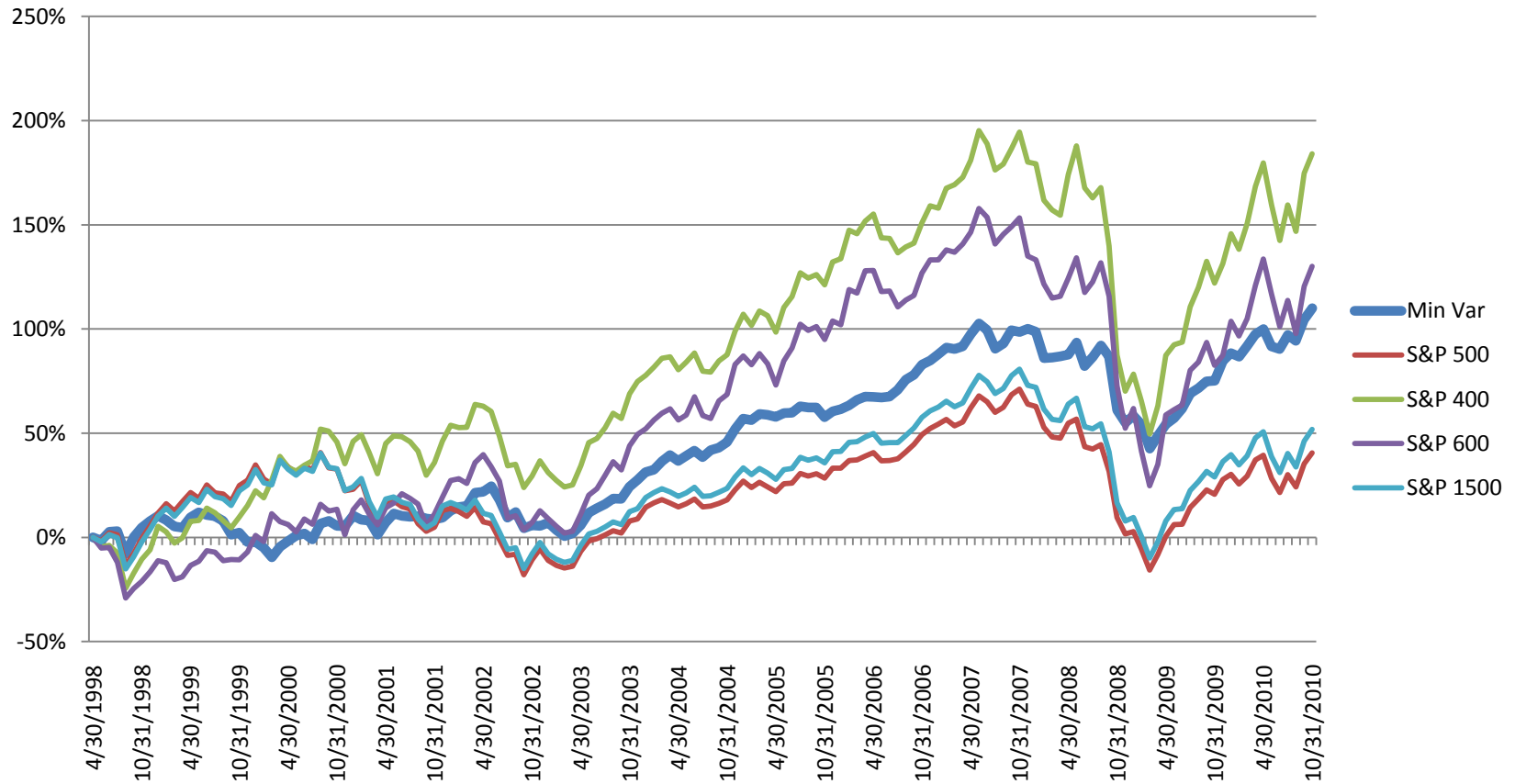
Unconstrained MinVar Portfolio Factor Attribution

Apr. 1998 – Oct. 2010	Portfolio Exposure	Annualized Portfolio Return	Contribution to Portfolio Risk	Percent of Portfolio Risk	Realized Contribution to Portfolio Risk	Realized Percent of Portfolio Risk	Realized Return/Risk Ratio
Factor		1.96%	10.16%	89.67%	9.63%	72.09%	0.20
Market	0.48	2.11%	9.09%	70.37%	8.44%	55.35%	0.25
Styles		-0.58%	3.04%	9.21%	3.11%	7.49%	-0.19
Valuation	-0.08	0.82%	-0.58%	-0.79%	-0.98%	-0.74%	-0.84
Size	-0.17	0.18%	0.41%	-0.30%	1.04%	0.84%	0.17
Analyst Expectation	0.01	-0.28%	0.58%	0.35%	0.94%	0.68%	-0.30
Historical Growth	-0.03	0.07%	0.94%	1.24%	-0.46%	-0.16%	-0.15
Capital Efficiency	-0.21	-0.18%	1.15%	0.81%	2.27%	4.01%	-0.08
Price Momentum	-0.12	0.46%	-0.30%	-0.24%	2.03%	3.19%	0.23
Earnings Quality	0.93	-0.94%	2.27%	5.11%	0.85%	0.56%	-1.11
Volatility	-0.27	-0.71%	1.34%	3.03%	-1.07%	-0.89%	0.66
Sector	0.02	0.43%	3.36%	10.10%	3.45%	9.25%	0.12
Stock Specific		4.07%	3.06%	10.33%	5.99%	27.91%	0.68
Grand Total		6.02%	10.61%	100.00%	11.35%	100.00%	0.53

The unconstrained MinVar portfolio has a low average beta of 0.48 and derives most of its return from stock specific sources

Unconstrained MinVar Performance

Cumulative Performance

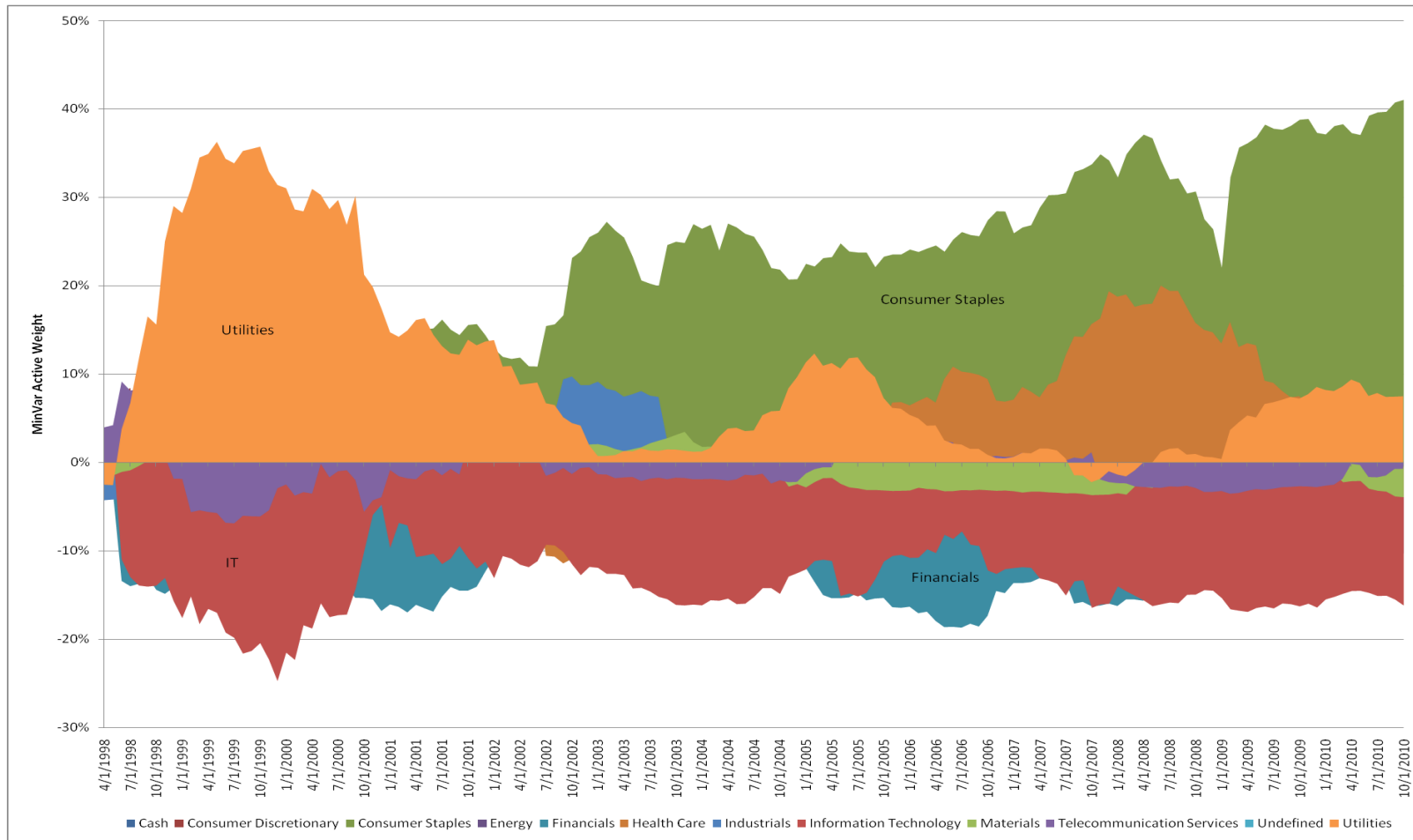


Unconstrained MinVar Performance

Apr. 1998 – Oct. 2010	Ann Return	Ann Risk	Return/Risk Ratio
Min Var	6.0%	11.4%	0.53
S&P 500	2.8%	16.5%	0.17
S&P 400	8.7%	19.3%	0.45
S&P 600	6.9%	20.7%	0.33
S&P 1500	3.4%	16.6%	0.20

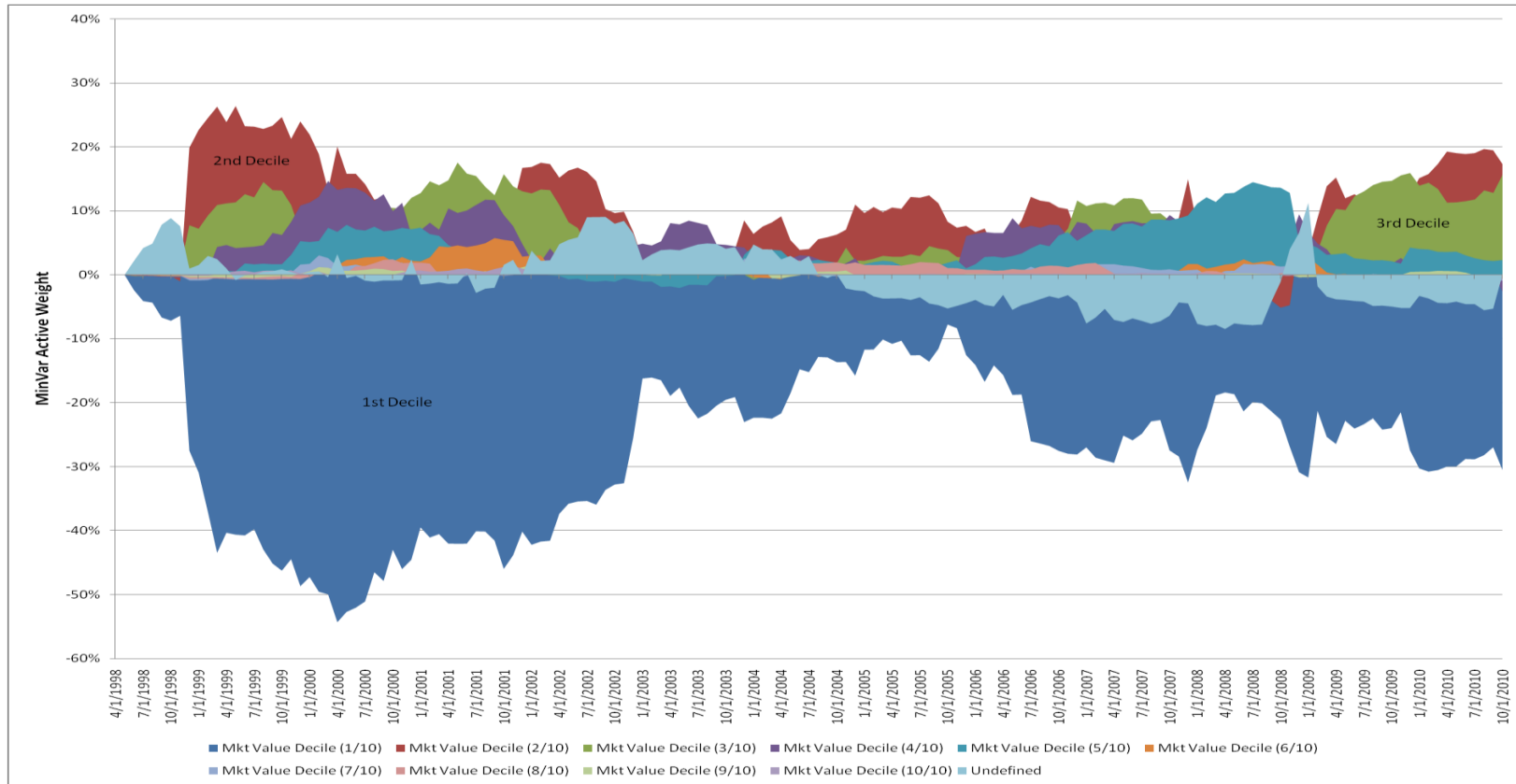
Note: The annualized risk numbers in this presentation are based on monthly returns. Using daily returns, the risk of the unconstrained MinVar portfolio is 13.4% and the S&P 500 is 21.8%

Unconstrained MinVar Sector Attribution against S&P 1500



The unconstrained minimum variance portfolio on average overweights traditionally defensive sectors such as Consumer Staples and Utilities while underweighting IT and Financials

Unconstrained MinVar Cap. Group Attribution against S&P 1500



The unconstrained MinVar portfolio heavily underweights the top market cap. decile while, on average, overweighting decile 2-5 and staying neutral to the bottom half market cap names in the S&P 1500. However on average, the top Market cap. decile still represents 34% of the MinVar portfolio by value

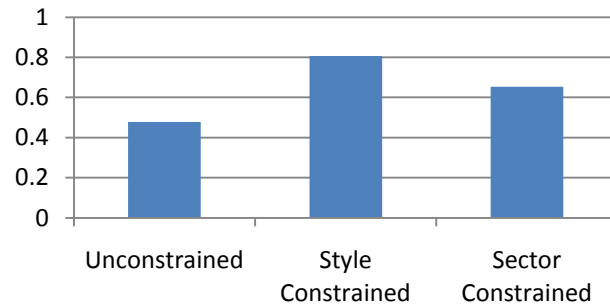
Fully Style Neutral MinVar Portfolio Construction/Attribution

Apr. 1998 – Oct. 2010	Portfolio Exposure	Annualized Portfolio Return	Contribution to Portfolio Risk	Percent of Portfolio Risk	Realized Contribution to Portfolio Risk	Realized Percent of Portfolio Risk	Realized Return/Risk Ratio
Factor		1.27%	16.76%	85.02%	15.49%	70.02%	0.08
Market	0.81	2.36%	16.36%	81.83%	15.05%	66.16%	0.16
Styles		-0.20%	0.21%	0.02%	1.04%	0.31%	-0.19
Valuation	-0.01	-0.02%	-0.18%	-0.01%	0.50%	0.07%	-0.03
Size	0.00	-0.07%	0.52%	0.05%	0.93%	0.25%	-0.07
Analyst Expectation	-0.01	-0.09%	0.14%	0.02%	-0.81%	-0.19%	0.11
Historical Growth	0.00	-0.03%	-0.26%	-0.01%	0.54%	0.09%	-0.06
Capital Efficiency	0.00	0.04%	0.21%	0.02%	0.69%	0.14%	0.06
Price Momentum	0.00	0.19%	0.33%	0.01%	0.53%	0.08%	0.35
Earnings Quality	0.02	0.03%	-0.54%	-0.05%	-0.69%	-0.14%	-0.04
Volatility	0.00	-0.26%	-0.02%	0.00%	0.16%	0.01%	-1.66
Sector	0.02	-0.88%	3.63%	3.17%	3.49%	3.55%	-0.25
Stock Specific		6.65%	8.39%	14.98%	10.13%	29.98%	0.66
Grand Total		7.92%	18.74%	100.00%	18.51%	100.00%	0.43

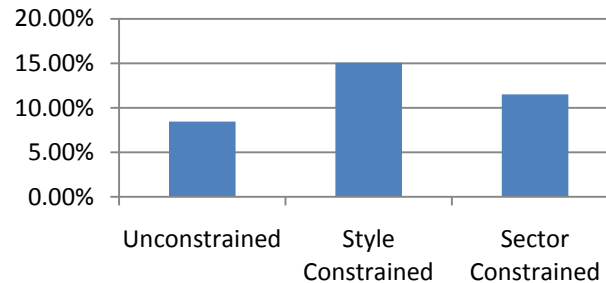
The fully style constrained MinVar portfolio is constructed by constraining all style exposures to near zero at each rebalancing

Effect of Imposing Constraints: Market Exposure & Stock Specific Risk

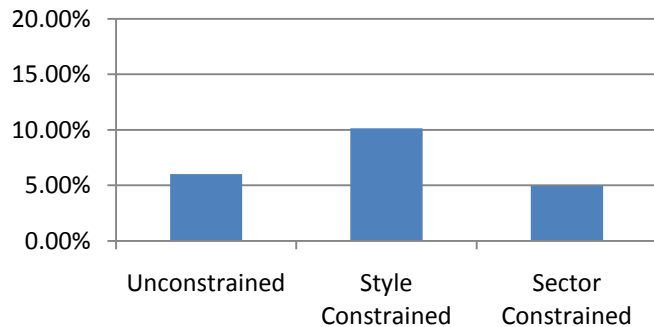
Market Factor Exposure



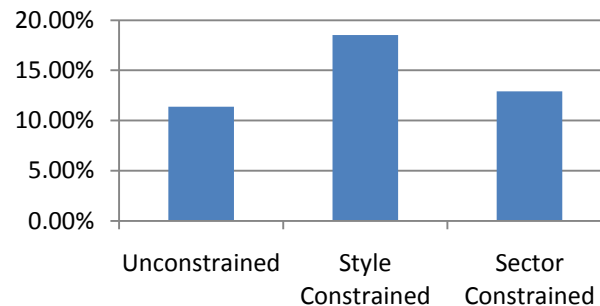
Market Factor Contribution to Risk (p.a.)



Stock Specific Contribution to Risk (p.a.)



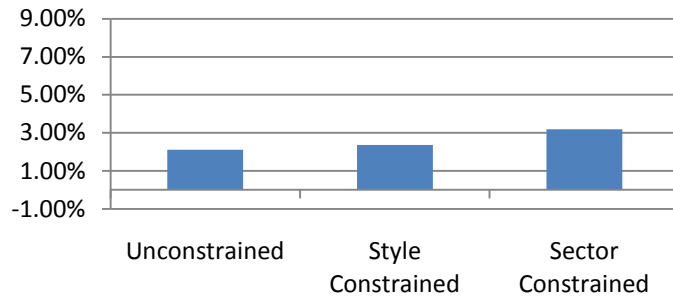
Total Risk (p.a.)



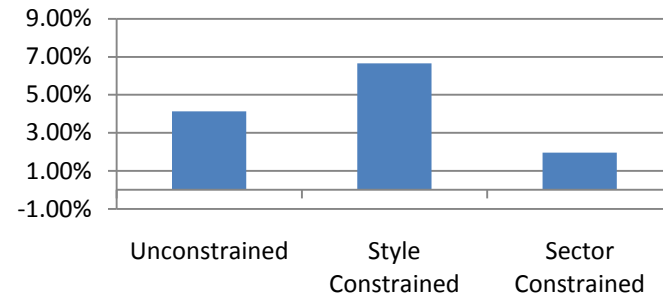
Constraining the MinVar portfolio to make it Style or Sector neutral (to the S&P 1500) increases the market exposure and, by extension, the risk

Effect of Imposing Constraints: Returns

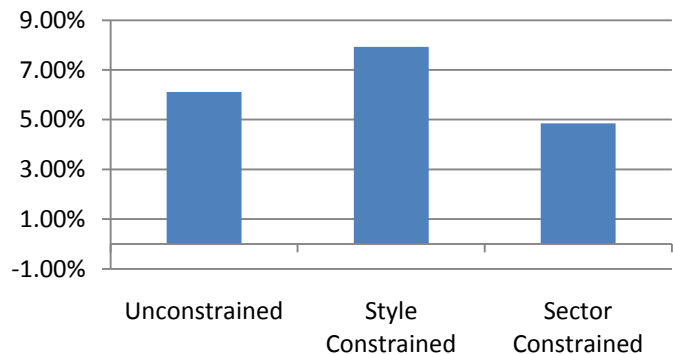
Market Factor Contribution to Return



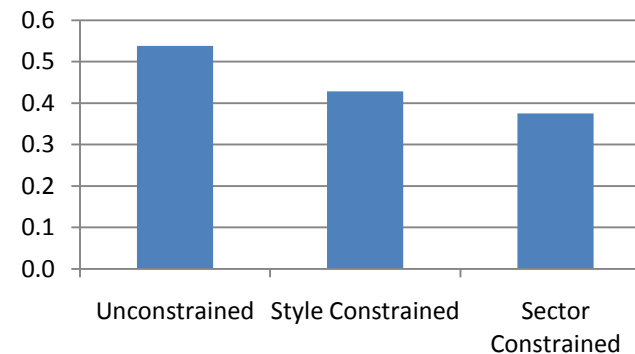
Stock Specific Contribution to Return



Total Return



Return/Risk Ratio



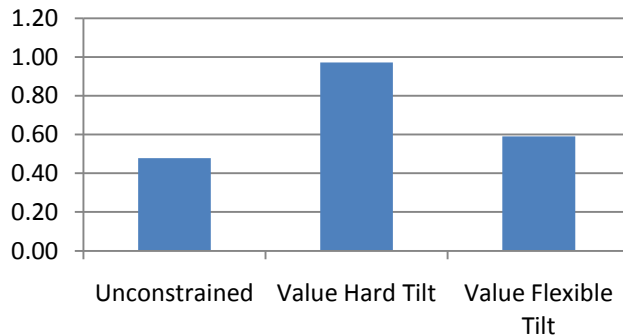
Risk aside, the Style neutral MinVar portfolio outperforms the unconstrained case from stock specific return sources

Implementing Style Tilts

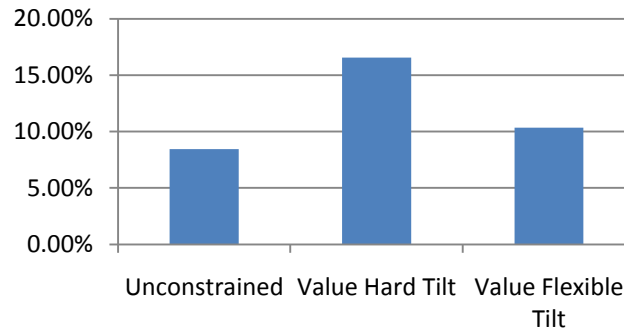
- **Except for the particular Style factor we tilt toward, all Styles are constrained to zero exposure for each rebalancing**
- **We consider two methodologies for implementing tilts**
- **Flexible Style Tilt**
 - › Minimum exposure constraint of zero (with a penalty for allowing the exposure to go to -0.1)
 - › No maximum bound
 - › “Flexible” in the sense that this portfolio, at any given time, can avoid a tilt
- **Hard Style Tilt**
 - › Hard minimum exposure constraint of 0.2 (with a penalty for allowing it to go to 0.1)
 - › No maximum bound
 - › “Hard” in the sense that this portfolio must always have positive style tilt

Risk of MinVar Portfolios with Value Style Tilts

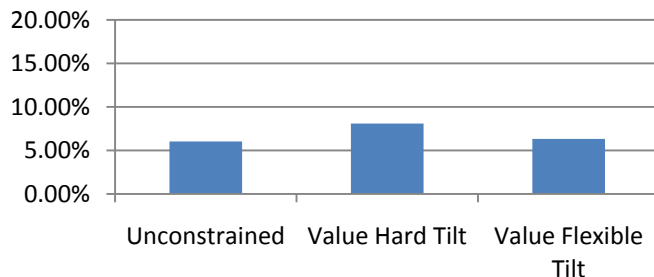
Market Factor Exposure



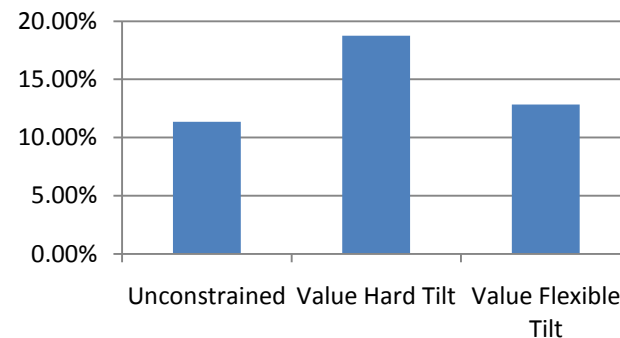
Market Factor Contribution to Risk (p.a.)



Stock Specific Contribution to Risk (p.a.)



Total Risk (p.a.)



The flexible Value tilt MinVar portfolio does not have very significantly higher risk than the unconstrained case

Performance of MinVar Portfolios with Value Style Tilts

Annualized Returns (Apr. 1998 - Oct. 2010)

Factor Contribution	Unconstrained MinVar	Hard Value Tilt MinVar	Flexible Value Tilt MinVar
Market	2.1%	3.6%	4.0%
<i>Return/Risk Ratio</i>	0.25	0.22	0.39
Value	0.8%	-0.1%	-0.1%
Other Styles	-1.4%	-0.2%	-0.3%
Sectors	0.4%	-0.7%	0.8%
Stock Specific	4.1%	5.1%	4.5%
TOTAL	6.0%	7.7%	8.8%
Return/Risk Ratio	0.53	0.41	0.69

The improved Return/Risk ratio of the flexible Value tilt MinVar portfolio is largely a function of the improved Return/Risk ratio of the Market factor contribution. The flexible Value tilt appears to have the effect of bringing down the market exposure in an “intelligent” fashion. Is this an accident?

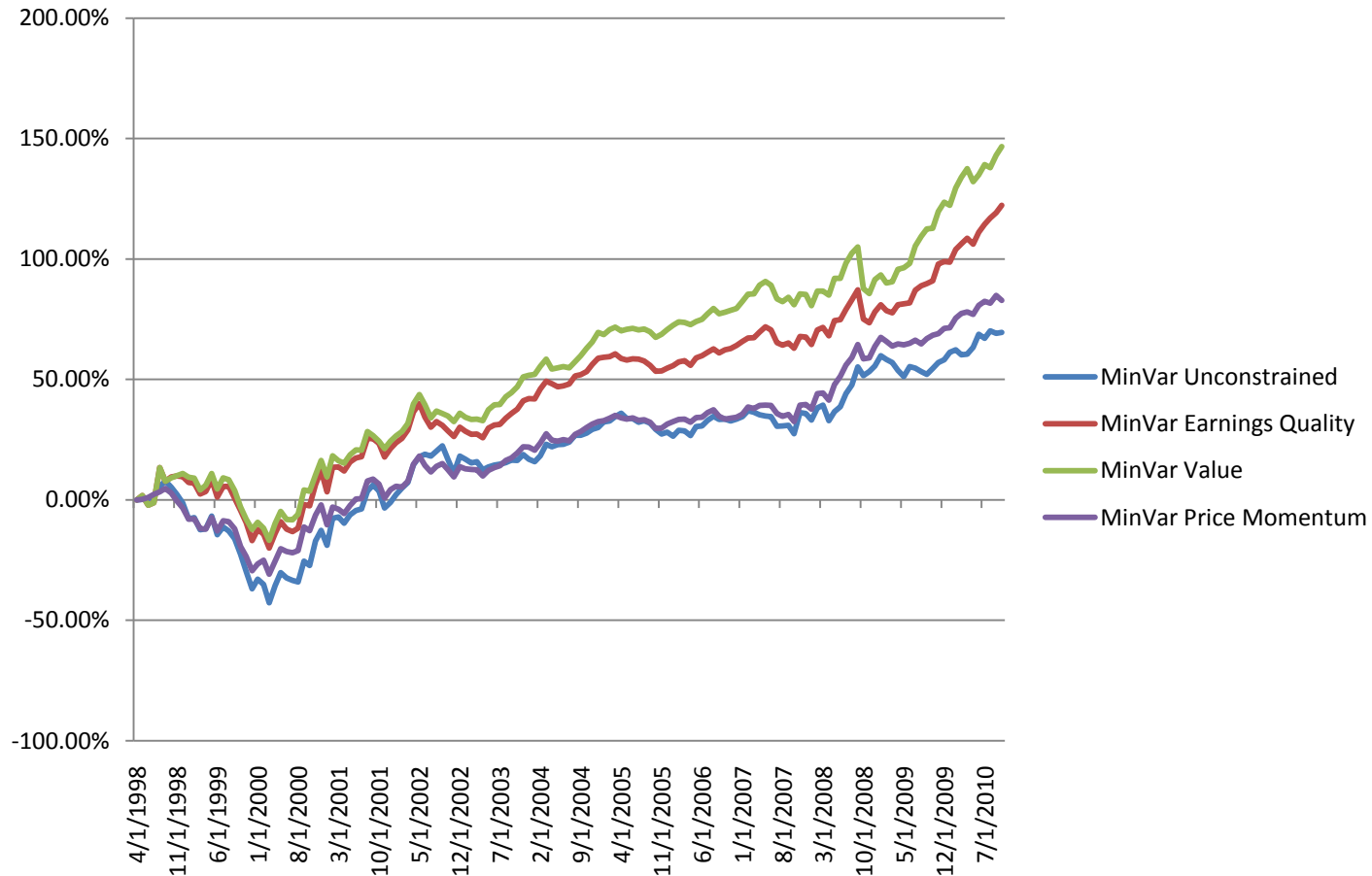
Performance of Other Flexible Style Tilts

Apr. 1998 – Oct. 2010	Ann Return	Ann Risk	Return/Risk Ratio
Unconstrained Min Var	6.0%	11.4%	0.53
Flexible Tilt to Value	8.8%	12.9%	0.69
Flexible Tilt to Earnings Quality	8.0%	12.3%	0.65
Flexible Tilt to Price Momentum	6.6%	12.8%	0.52

A flexible tilt to Earnings Quality provides similar risk adjusted performance to the flexible Value tilt again driven by the contribution by the Market factor. The flexible Price Momentum tilt does not improve performance notably as the Minimum Variance objective appears inconsistent with a significant Price Momentum loading

MinVar with Flexible Style Tilts Spreads

Cumulative Active Return vs. S&P 500



Summary

- Risk appears to be mispriced which is why minimum variance works
 - › Low beta stocks earn more than their beta implies, FAMA/MCBETH (1973)
 - › Investors overpay for volatility (and residual risk) possibly because of leverage restrictions, BLITZ/VLIET (2007) and ANG (2006)
- Unconstrained minimum variance is difficult to beat as “hard” sector or style constraints tend to increase the market beta and push the portfolio toward Sharpe ratios similar to that of the main benchmarks
- However, there appears to be some benefit from style neutrality if risk can be managed. Style neutrality concentrates the exposure and sources of return on stock specific factors but at the expense of a high market beta
- Style neutrality combined with a flexible (but positive) tilt to low risk factors such as Value and Earnings Quality appears to be an attractive way of allowing the market factor loading to come down compared to the fully style constrained and hard tilt portfolios

Appendix



MinVar Attribution with Flexible Value Tilt

Apr. 1998 – Oct. 2010	Portfolio Exposure	Annualized Portfolio Return	Contribution to Portfolio Risk	Percent of Portfolio Risk	Realized Contribution to Portfolio Risk	Realized Percent of Portfolio Risk	Realized Return/Risk Ratio
Factor		4.31%	12.65%	91.07%	11.19%	75.89%	0.39
Market	0.59	3.99%	12.17%	84.06%	10.36%	65.08%	0.39
Styles		-0.48%	1.73%	1.85%	2.38%	3.43%	-0.20
Valuation	0.14	-0.14%	1.75%	1.81%	2.25%	3.08%	-0.06
Size	0.00	0.02%	0.24%	0.02%	0.57%	0.20%	0.03
Analyst Expectation	0.00	-0.03%	-0.17%	0.02%	-0.14%	-0.01%	0.20
Historical Growth	0.01	-0.03%	-0.61%	-0.06%	-1.03%	-0.64%	0.03
Capital Efficiency	-0.02	0.00%	1.00%	0.17%	1.26%	0.96%	0.00
Price Momentum	0.00	0.07%	0.12%	-0.03%	0.67%	0.27%	0.10
Earnings Quality	0.01	-0.13%	0.33%	0.03%	0.70%	0.30%	-0.18
Volatility	-0.01	-0.24%	-0.92%	-0.10%	-1.09%	-0.72%	0.22
Sector	0.02	0.79%	2.99%	5.16%	3.49%	7.38%	0.23
Stock Specific		4.50%	3.40%	8.93%	6.31%	24.11%	0.71
Grand Total		8.80%	13.10%	100.00%	12.85%	100.00%	0.69

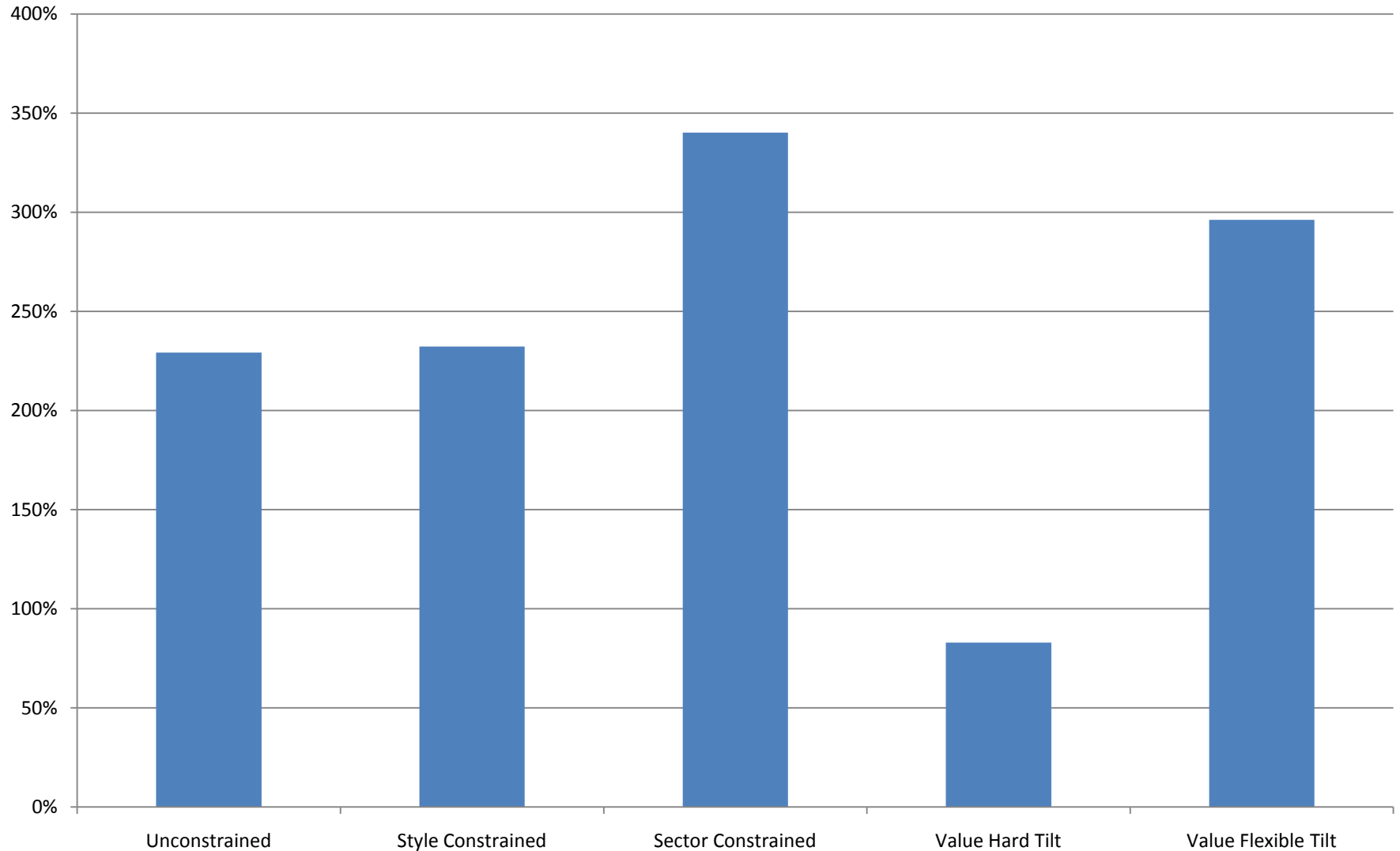
MinVar Attribution with Flexible Earnings Quality Tilt

Apr. 1998 – Oct. 2010	Portfolio Exposure	Annualized Portfolio Return	Contribution to Portfolio Risk	Percent of Portfolio Risk	Realized Contribution to Portfolio Risk	Realized Percent of Portfolio Risk	Realized Return/Risk Ratio
Factor		3.59%	12.12%	90.95%	10.54%	73.27%	0.34
Market	0.57	3.94%	11.65%	82.72%	9.81%	63.46%	0.40
Styles		-0.67%	1.31%	1.99%	0.36%	0.09%	-1.87
Valuation	0.01	0.17%	0.66%	0.10%	0.66%	0.29%	0.26
Size	0.00	0.01%	0.21%	0.00%	0.54%	0.19%	0.02
Analyst Expectation	0.00	-0.03%	-0.04%	0.01%	0.27%	0.05%	-0.11
Historical Growth	0.01	-0.01%	-0.51%	-0.03%	-0.97%	-0.61%	0.01
Capital Efficiency	-0.02	-0.03%	0.92%	0.13%	1.22%	0.99%	-0.02
Price Momentum	0.00	0.04%	0.08%	-0.02%	0.63%	0.27%	0.07
Earnings Quality	0.72	-0.68%	1.15%	1.84%	-0.68%	-0.30%	1.00
Volatility	0.01	-0.15%	-0.82%	-0.04%	-1.08%	-0.78%	0.14
Sector	0.02	0.32%	3.09%	6.24%	3.84%	9.73%	0.08
Stock Specific		4.44%	3.30%	9.05%	6.36%	26.73%	0.70
Grand Total		8.03%	12.56%	100.00%	12.31%	100.00%	0.65

MinVar Attribution with Flexible Price Momentum Tilt

Apr. 1998 – Oct. 2010	Portfolio Exposure	Annualized Portfolio Return	Contribution to Portfolio Risk	Percent of Portfolio Risk	Realized Contribution to Portfolio Risk	Realized Percent of Portfolio Risk	Realized Return/Risk Ratio
Factor		3.16%	11.83%	90.38%	10.97%	73.32%	0.29
Market	0.60	2.50%	11.33%	83.71%	10.32%	64.85%	0.24
Styles		0.12%	0.63%	0.34%	-0.72%	-0.32%	-0.16
Valuation	0.03	0.26%	1.05%	0.29%	0.98%	0.59%	0.27
Size	-0.01	0.00%	0.69%	0.12%	1.01%	0.62%	0.00
Analyst Expectation	0.00	0.06%	-0.37%	-0.02%	-0.48%	-0.14%	-0.13
Historical Growth	0.01	-0.04%	-0.63%	-0.07%	-1.07%	-0.70%	0.04
Capital Efficiency	-0.02	-0.01%	1.07%	0.26%	1.28%	1.01%	-0.01
Price Momentum	0.10	0.43%	0.58%	0.23%	0.86%	0.45%	0.50
Earnings Quality	0.01	-0.13%	-0.27%	0.00%	0.44%	0.12%	-0.30
Volatility	-0.03	-0.44%	-1.43%	-0.46%	-1.92%	-2.26%	0.23
Sector	0.02	0.54%	3.35%	6.33%	3.80%	8.79%	0.14
Stock Specific		3.48%	3.49%	9.62%	6.62%	26.68%	0.53
Grand Total		6.64%	12.33%	100.00%	12.81%	100.00%	0.52

Annual 2-Way Turnover



Unconstrained MinVar Sector Attribution

Group ▲	Port Avg Wt	Port Return	Port Contribution	Bench Avg Wt	Bench Return	Bench Contribution	Active Avg Wt
▶ Cash	2.37%	0.00%	0.00%	0.00%	0.00%	0.00%	2.37%
▶ Consumer Discre...	9.05%	-23.93%	-8.81%	11.53%	76.17%	9.73%	-2.48%
▶ Consumer Staples	32.58%	124.00%	38.98%	9.58%	74.45%	5.32%	22.99%
▶ Energy	2.58%	234.49%	3.19%	8.26%	204.79%	6.77%	-5.69%
▶ Financials	6.15%	173.91%	12.45%	17.74%	-5.18%	1.03%	-11.59%
▶ Health Care	14.47%	402.09%	23.02%	12.77%	54.48%	6.30%	1.70%
▶ Industrials	8.28%	-1.17%	8.63%	11.20%	82.21%	6.00%	-2.92%
▶ Information Tec...	4.08%	-31.10%	-8.35%	17.90%	49.26%	12.47%	-13.82%
▶ Materials	3.92%	109.93%	7.79%	3.28%	99.55%	2.09%	0.64%
▶ Telecommunicati...	3.16%	63.25%	3.53%	4.10%	-7.38%	0.22%	-0.94%
▶ Utilities	13.37%	202.22%	29.54%	3.64%	91.62%	1.89%	9.73%
Total	100.00%	109.97%	109.97%	100.00%	51.82%	51.82%	0.00%

Group ▲	Asset Allocation	Stock Selection	Total Effect
▶ Cash	4.77%	0.00%	4.77%
▶ Consumer Discretionary	-5.04%	-8.91%	-13.95%
▶ Consumer Staples	3.27%	13.49%	16.77%
▶ Energy	-5.84%	0.63%	-5.21%
▶ Financials	11.58%	6.46%	18.04%
▶ Health Care	6.77%	20.17%	26.94%
▶ Industrials	-1.57%	-3.10%	-4.66%
▶ Information Technology	-11.76%	2.24%	-9.52%
▶ Materials	4.13%	3.36%	7.49%
▶ Telecommunication Services	5.31%	0.65%	5.96%
▶ Utilities	0.03%	11.51%	11.54%
Total	11.66%	46.50%	58.16%

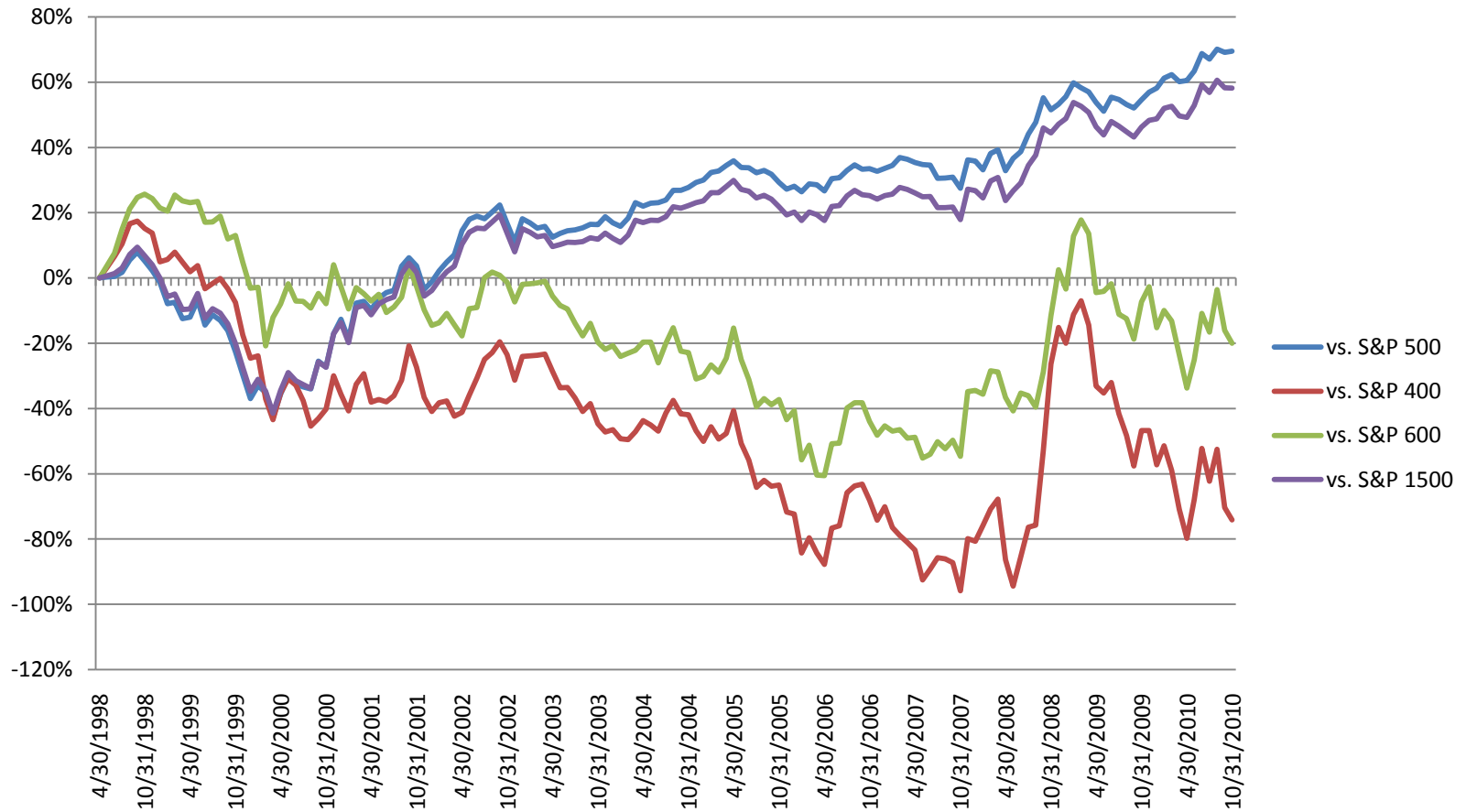
Unconstrained MinVar Cap. Group Attribution

Group ▲	Port Avg Wt	Port Return	Port Contribution	Bench Avg Wt	Bench Return	Bench Contribution	Active Avg Wt
▶ Mkt Value Resampled (1/10)	33.81%	39.60%	15.69%	60.85%	48.71%	11.52%	-27.03%
▶ Mkt Value Resampled (2/10)	21.68%	102.25%	24.62%	11.73%	138.90%	11.71%	9.95%
▶ Mkt Value Resampled (3/10)	13.04%	238.38%	20.20%	5.82%	180.21%	6.42%	7.22%
▶ Mkt Value Resampled (4/10)	8.66%	110.93%	14.43%	3.49%	181.39%	5.08%	5.17%
▶ Mkt Value Resampled (5/10)	5.85%	188.47%	3.02%	2.30%	165.63%	2.85%	3.55%
▶ Mkt Value Resampled (6/10)	2.18%	12.27%	3.45%	1.59%	198.40%	2.25%	0.60%
▶ Mkt Value Resampled (7/10)	1.57%	-46.88%	-0.50%	1.11%	148.34%	1.44%	0.46%
▶ Mkt Value Resampled (8/10)	1.35%	139.94%	1.01%	0.79%	244.78%	1.38%	0.56%
▶ Mkt Value Resampled (9/10)	0.71%	146.59%	1.77%	0.53%	166.45%	0.86%	0.18%
▶ Mkt Value Resampled (10/10)	0.50%	71.20%	0.05%	0.26%	276.03%	0.53%	0.24%
▶ Undefined	10.65%	49.72%	26.24%	11.53%	-8.21%	7.76%	-0.88%
Total	100.00%	109.97%	109.97%	100.00%	51.81%	51.81%	0.00%

Group ▲	Asset Allocation	Stock Selection	Total Effect
▶ Mkt Value Resampled (1/10)	8.60%	4.40%	13.01%
▶ Mkt Value Resampled (2/10)	8.02%	-9.72%	-1.70%
▶ Mkt Value Resampled (3/10)	9.91%	2.79%	12.71%
▶ Mkt Value Resampled (4/10)	11.12%	-3.91%	7.21%
▶ Mkt Value Resampled (5/10)	4.64%	3.58%	8.23%
▶ Mkt Value Resampled (6/10)	2.63%	-1.47%	1.16%
▶ Mkt Value Resampled (7/10)	0.80%	-2.51%	-1.71%
▶ Mkt Value Resampled (8/10)	1.80%	-3.25%	-1.45%
▶ Mkt Value Resampled (9/10)	1.08%	-0.05%	1.03%
▶ Mkt Value Resampled (10/10)	1.26%	-2.14%	-0.88%
▶ Undefined	3.48%	17.08%	20.55%
Total	53.35%	4.81%	58.16%

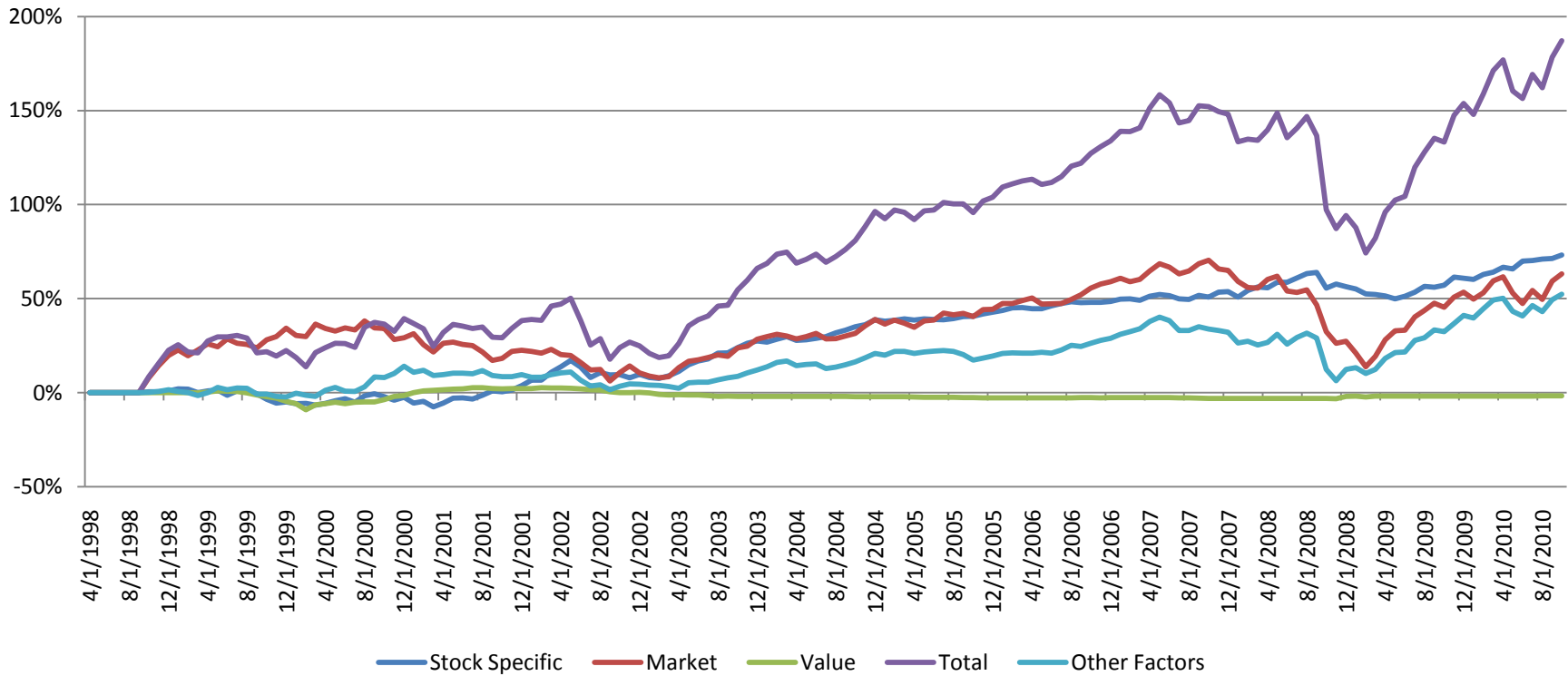
Unconstrained MinVar Performance Spreads

Cumulative Active Return



MinVar with Flexible Value Style Tilt

Cumulative Factor Contributions to Return



Compared to the unconstrained case, the Value tilt does not directly contribute to return (or detract from risk)