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MINIMUM VARIANCE INVESTING AND THE TRACKING-ERROR CONUNDRUM

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Consultants and advisors recommend minimum variance (MV) strategies because of their potential to lower absolute fund level risk while producing returns at least in line with a capitalization-weighted benchmark. Be that as it may, investors contemplating low volatility strategies are faced with a conundrum – although these strategies deliver less absolute risk than corresponding capitalization-weighted benchmarks, they can be a source of tracking error and represent an active bet for many investors.

Tracking error (ex-ante) represents the risk budget that investors who own underlying assets provide asset managers to beat a performance benchmark. Although investors may have strong convictions about MV strategies, high tracking error may give them pause since they require higher risk budgets. Some investors, for example, may have hard manager-level tracking error restrictions while others may be limited by the availability of tools or lack the required investment expertise to manage complex equity structures. Conversely, investors who are better equipped may prefer higher tracking error strategies that provide more concentrated investment exposure.

STOXX provides benchmark solutions for both sets of investors based on MV portfolios. *Minimum variance provides a systematic way to build portfolios with the lowest possible ex-ante volatility without the need for subjective choices of stock selection parameters and weighting schemes, thus avoiding unintended bets that might ultimately degrade the effectiveness of the strategy.* One index implements MV in its "purest" form, with a few rules to ensure liquidity and diversification. The other index is constrained to deliver lower tracking error relative to the capitalization-weighted parent index. Exposure restrictions on the constrained index limit the degree to which the index optimization algorithm is allowed to deviate from the market capitalization-weighted benchmark along industry and style dimensions.

The unconstrained index has better absolute performance and higher Sharpe ratios while the constrained index has lower tracking error and higher information ratios. Which index version should investors use? We explore this question in the remaining paragraphs.

A Tale of Two Minimum Variance Portfolios

We believe investors should evaluate low volatility strategies based on their ability to faithfully capture the returns inherent in low volatility assets. Attractive returns alone are not sufficient to demonstrate the superiority of a given low volatility strategy. It may well be the case that the strategy takes unintended bets on risk factors unrelated to low volatility, allowing other sources of risk to "pollute" any genuine returns coming from low volatility.

The MV approach employed by STOXX maximizes low volatility exposure without making ex-ante judgments about factor exposures. We use the Axioma Optimizer and US Fundamental Factor Risk Model to construct the US minimum variance indices. Axioma's toolkit is well known in the investment management industry and used by practitioners around the world to construct portfolios and control risk. We construct the MV indices by allowing the optimizer to identify the portfolio composition that minimizes predicted index volatility. Although both indices have strong active returns relative to the capitalization-weighted benchmark, we believe the unconstrained MV approach best adheres to the investment objective of capturing systematic sources of return from low volatility investments.

Figure 1 breaks down the performance of the STOXX USA 900 MV Unconstrained Index relative to the STOXX USA 900 Index by risk factor contributions. On an annualized basis, the MV index outperformed the capitalization-weighted index by 4.55%. The negative active exposure to Axioma's volatility risk factor

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of -0.75 was the key driver of performance. The volatility factor in Axioma's model is designed to capture the return to equity volatility net of other factors in the US equity market. The 7.97% contribution to return is the single largest contributor to performance by a significant margin and, we believe, validates the index premise to capture the low volatility anomaly by providing concentrated exposure to the MV strategy.

Figure 1: Using monthly gross returns, Jan. 2002 to May 2013
Source: Axioma

	STOXX USA 900 MV Unconstrained	
Source of Return	Contribution	Avg. Exposure
Portfolio	10.75%	
Benchmark	6.20%	
Active	4.55%	
Factor Contribution	5.49%	
Style	6.74%	
Exchange Rate Sensitivity	-0.48%	0.14
Growth	-0.45%	-0.10
Leverage	0.85%	-0.15
Liquidity	-1.49%	-0.55
Market Sensitivity	-0.62%	-0.79
Medium-Term Momentum	-0.87%	0.03
Short-Term Momentum	-0.83%	0.05
Size	2.66%	-0.82
Value	0.01%	-0.10
Volatility	7.97%	-0.75
Industry	-1.25%	
Specific Return	-0.93%	

The constrained MV approach employs the same portfolio construction technique as the unconstrained but sets explicit limits on important risk factor exposures to lower tracking error. Like the unconstrained version, it has negative active exposure to the volatility factor but the exposure is less concentrated.

Figure 2 breaks down the performance of the two MV indices by performance contributions from risk factors. Both outperform the capitalization-weighted index by a significant margin and the unconstrained version outperformed the constrained version by almost 1%. In both cases, negative exposure to the volatility factor is the dominant contributor, but much more so in the case of the unconstrained index as the low volatility contribution is 3.33% greater (7.97% versus 4.64%). The last point demonstrates the opportunity cost of constraining the important alpha generating investment exposure. Although investors may feel more comfortable with lower tracking error, it comes at the expense of returns from low volatility assets.

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Figure 2: Using monthly gross returns, Jan. 2002 to May 2013
Source: Axioma

	MV Unconstrained		MV Constrained	
Source of Return	Contribution	Avg Exposure	Contribution	Avg. Exposure
Portfolio	10.75%		9.85%	
Benchmark	6.20%		6.20%	
Active	4.55%		3.65%	
Factor Contribution	5.49%		4.89%	
Style	6.74%		5.41%	
Exchange Rate Sensitivity	-0.48%	0.14	-0.23%	0.04
Growth	-0.45%	-0.10	-0.20%	-0.05
Leverage	0.85%	-0.15	0.41%	-0.06
Liquidity	-1.49%	-0.55	-0.39%	-0.24
Market Sensitivity	-0.62%	-0.79	-0.04%	-0.45
Medium-Term Momentum	-0.87%	0.03	-0.18%	0.04
Short-Term Momentum	-0.83%	0.05	-0.76%	0.05
Size	2.66%	-0.82	1.98%	-0.66
Value	0.01%	-0.10	0.18%	0.01
Volatility	7.97%	-0.75	4.64%	-0.39
Industry	-1.25%		-0.52%	
Specific Return	-0.93%		-1.24%	

We also note two additional points. Both MV indices have significant active exposure away from large cap companies and this helps performance, while the other style contributions are small and largely inconsequential. This does not constitute a persistent small-cap bias per se, but rather a direct consequence of deviating from capitalization-based weighting, which is dominated by large caps. In addition, though the MV indices are both more concentrated in industries, the performance contribution is small over the period. Based on the return attribution results, we conclude the indices did not have significant industry and style risk factor exposures that degraded the impact of the low volatility strategy return.

Figure 3: Using monthly gross returns, Jan. 2002 to May 2013
Source: Axioma

	2002 - 2013		
	STOXX USA 900 Index	STOXX USA 900 MV Unconstrained Index	STOXX USA 900 MV Constrained Index
Annualized Return	6.2	10.75	9.85
Realized Volatility	15.33	9.75	11.93
Sharpe Ratio	0.40	1.10	0.83
Tracking Error		9.82	5.91
Information Ratio		0.46	0.62
Beta	1.00	0.50	0.73

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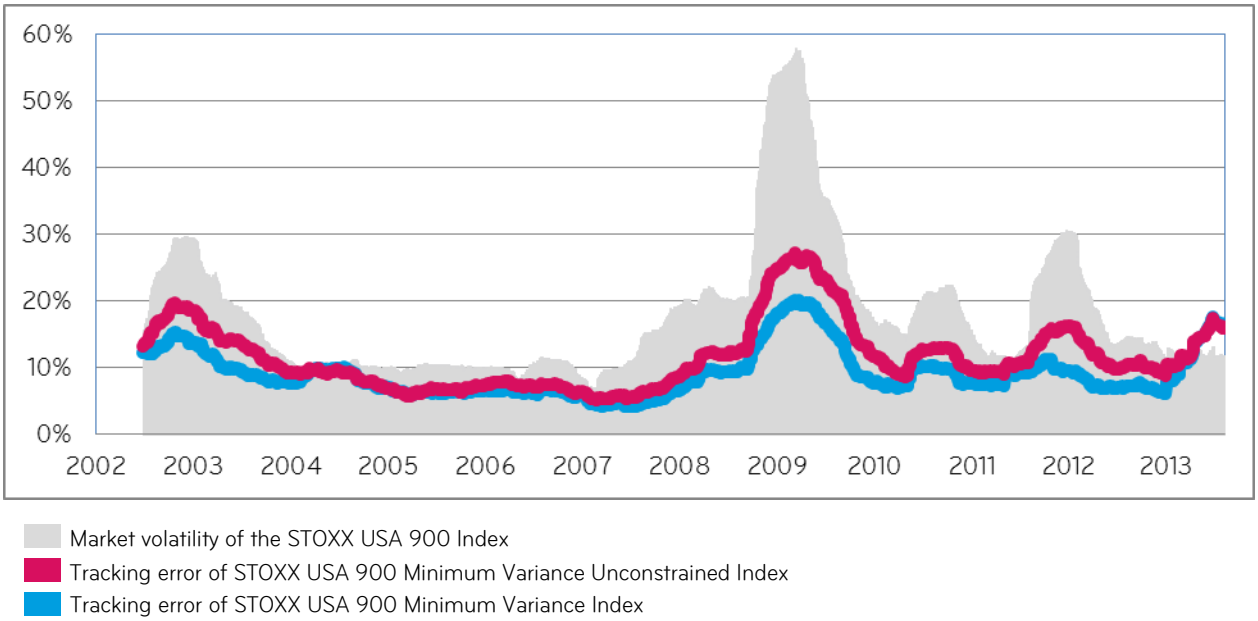
Figure 3 shows the risk / return statistics for the constrained and unconstrained MV indices. While both have significant tracking error, the unconstrained index's tracking error is higher. It is important to note, however, that tracking error can change over time and a lot of the observed difference is explained by the elevated level of market volatility during the financial crisis. Figure 4 shows that as market volatility jumped during the financial crisis, volatility for the unconstrained index did not increase as much as the constrained, since it is not designed to track the market. This resulted in higher tracking error. Conversely, tracking error for the two MV indices was low and similar from mid-2004 to mid-2007 when market volatility was compressed. We observe that when the level of market volatility decreases, it approaches the level of volatility for the unconstrained MV index. As a result, tracking error decreases. The opposite is also true.

Figure 4: Using daily gross returns, Jan.2002 to Jul. 2013
Source: Axioma



Finally we observe that the absolute level of volatility is consistently lower for the unconstrained MV index. The average realized volatility for the unconstrained index was 9.75% over the time period shown in the graph above. That was 18% lower than the constrained index and 36% lower than the capitalization-weighted benchmark. The Sharpe ratio is also consistently higher for the unconstrained version and market exposure is significantly lower. These facts demonstrate that the MV portfolio represented by the unconstrained index was significantly better at delivering higher rates of return in the US equity market than the cap-weighted benchmark over the measurement period and with a higher degree of certainty. This result is in line with important practitioner research.[1]

[1] See Clarke, de Silva and Thornley (Fall 2006), Minimum-Variance Portfolios in the U.S. Equity Market, The Journal of Portfolio Management, Vol. 33

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Summary

Which index version of the MV index should investors use? We believe that investors who want returns from low volatility assets should choose exposure to the unconstrained index over the constrained MV index from an absolute risk and return standpoint as it creates more wealth with lower volatility. In addition, the pure exposure provided by the strategy affords more flexibility for investors who have asset allocation expertise. On the other hand, for investors with fund level tracking error limitations, the constrained MV benchmark remains a powerful investment tool, delivering solid returns alongside significant risk reduction

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