TACTICAL TIMING OF LOW VOLATILITY EQUITY STRATEGIES

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Many investors we speak to are interested in making a strategic allocation to low volatility equities to help them better meet their investment objectives. The appeal of this strategy is clear. Low volatility stocks have historically delivered higher returns with lower risk than the capitalization-weighted market. Moreover, the behavioral and market-structural forces that have been suggested as possible explanations are inherently hard to change, which means the anomaly might not readily disappear[2]. However, we often hear two tactical concerns about the timing of an allocation. The first is that relative valuation of low volatility stocks may be expensive compared to the rest of the market so they should wait for more attractive levels. The second is that low volatility stocks, which tend to pay higher dividends, may underperform against the back-drop of potential rate increases. In this research note we examine the validity of these concerns and also incorporate macro-economic and market considerations by researching which factors have been good drivers and predictors of global low volatility equities' performance relative to the capitalization-weighted index since 1980. We consider valuation levels, the market environment, and the macro-economic backdrop. We find that relative valuation levels have not been a good predictor of low volatility equities' relative return. In addition, while low volatility equities' performance was indeed more sensitive to interest rate changes than the capitalization-weighted index, both delivered similar risk-adjusted returns (Sharpe ratios) in rising-rates environments.

Background: Performance Track Record of Low Volatility Investing

The Global Low Volatility portfolio we considered in this analysis invests in a diversified combination of low volatility capitalization-weighted country-sector baskets of stocks included in the MSCI World Developed Markets Index, e.g. US Financials, UK Telecoms[3]. This approach has been shown to capture the global low volatility effect with less concentration risk and a higher level of liquidity than when using stock specific data with very similar returns[4]. In our analysis, we consider this strategy's performance from 1980 through 1Q 2014.

Low volatility investing has exhibited a strong track record versus the capitalization-weighted (cap-weighted) market index, as shown in **Exhibit 1**. Since 1980, the low volatility portfolio has delivered higher returns at lower risk; over the most recent 3 and 5 years, it delivered higher risk-adjusted returns as measured by the Sharpe Ratio. Only over the past year, when the cap-weighted index delivered a strong return with unusually low volatility, did

[2] For an overview thereof, see Baker, M., B. Bradley, and J. Wurgler. "Benchmarks as Limits to Arbitrage: Understanding the Low-Volatility Anomaly." Financial Analysts Journal, vol. 67, no. 1, 2011.

[3] Detailed descriptions of the low-volatility portfolio construction process are provided in the appendix.

[4] De Boer, S., Campagna, J. and Norman J., "Country and Sector Drive Low-Volatility Investing in Global Equity Markets," Journal of Index Investing, Spring 2014.

the low volatility portfolio underperform while not delivering a risk reduction benefit. **Exhibit 2** shows that this result is consistent with past market rallies when low volatility strategies have the highest likelihood of lagging. The silver lining is that low volatility strategies did have positive performance during these time periods.

This performance pattern is not surprising for a more defensive portfolio with a beta of 0.69. It is, in fact, consistent with a particularly attractive feature of low volatility investing: the asymmetry of relative performance. Low volatility equity strategies have avoided more of the downside in falling markets than they have lagged on the upside in rising markets. As illustrated in **Exhibit 2**, in the worst third of cap-weighted market performance, the low volatility portfolio captured only 57% of the downside while in the best third it captured 74% of the upside. This asymmetry helps to explain not only the appeal, but also the long-term cumulative outperformance of low volatility strategies.

Exhibit 1: HISTORICAL PERFORMANCE
Global Low Volatility portfolio and the Cap-Weighted Index

as of March 2014		per 1980	10YR	5YR	3YR	1YR
Capitalization-Weighted Equities Index	return	10.67%	7.44%	18.98%	10.89%	19.69%
	volatility	15.19%	16.10%	15.77%	14.05%	10.84%
	Sharpe Ratio	0.39	0.37	1.20	0.77	1.81
Low Volatility Equities	return	12.82%	10.04%	15.49%	10.66%	11.22%
	volatility	12.12%	11.30%	10.44%	9.96%	10.87%
	Sharpe Ratio	0.66	0.75	1.47	1.06	1.03

Annualized performance statistics; Sharpe ratio uses 3-month treasury bills as risk-free rate

Exhibit 2: AVERAGE MONTHLY EXCESS RETURN:
GLOBAL LOW VOLATILITY PORTFOLIO VERSUS CAP-WEIGHTED INDEX
Performance in Different Market Regimes: Top, Middle and Bottom Third of
Cap-Weighted Index Returns

January 1980 – March 2014

(57% downside capture)   **(74% upside capture)**

1.6%   0.1%

-1.4%

bottom third   middle third   top third

Tertile of monthly capitalization weighted market return
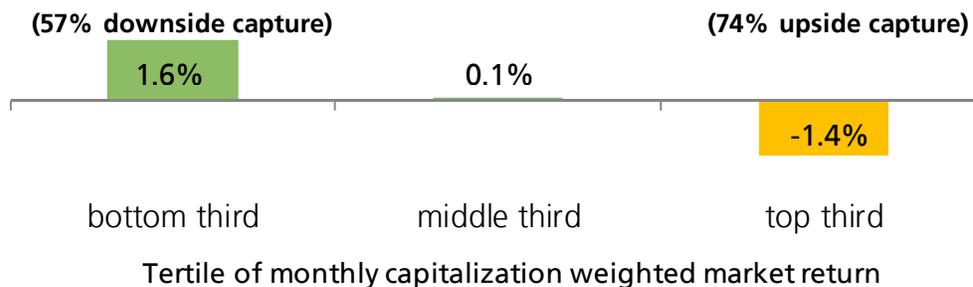
Predictive Indicators of Low volatility Equities Performance: Results

Exhibit 3 illustrates the relationship of the relative performance of low volatility equities to various predictive indicators from January 1980 through March 2014. These indicators fall into three categories: valuation factors, market environment factors (sentiment), and macro-economic factors[5]. We note that:

1. **Valuation** factors had little predictive power
2. Some **market environment** factors had predictive power
3. Some **macro-economic** factors had predictive power

More specifically, we note that our three **valuation** metrics, dividend spread, book-to-price spread and earnings-to-price spread, had little efficacy as predictors. Thus, the concern that a current high relative valuation of low volatility stocks presents a sub-optimal environment for allocating to low volatility strategies appears to be unfounded. This result is counter to the common wisdom that valuation levels are significant predictors of future performance; we explore this in more detail in the next section.

Our three **market environment** metrics, the slope of the yield curve, turbulence, and the TED spread, show mixed results both in terms of sign and consistency over the entire time period. The TED spread, for example, appears to be a forward-looking indicator of market fear, resulting in a positive correlation with low volatility outperformance. While it did not have strong predictive power over the entire period it did have significant predictive power over the last ten years, primarily driven by the period of the Global Financial Crisis[6]. Alternatively, recent market turbulence has consistently been a strong contrarian predictor; when elevated this bodes poorly for low volatility relative performance, since the market was set up for a relief rally after a period of negative returns.

The rearview-mirror **macro-economic** indicators (inflation, GDP growth and change in medium-term interest rates) are also contrarian indicators. When they were benign or overheating, with strong economic growth accompanied by rising interest rates and prices, this was a positive predictor for the forward performance of low volatility equities as it indicated overenthusiasm for equities leading to an eventual fall. While inflation was not a very strong predictor over the full analysis period, it was quite relevant over the past ten years.

Exhibit 3: PREDICTIVE ANALYSIS
Quarterly correlation of Low Volatility excess return with predictive trailing indicators

January 1980 – March 2014
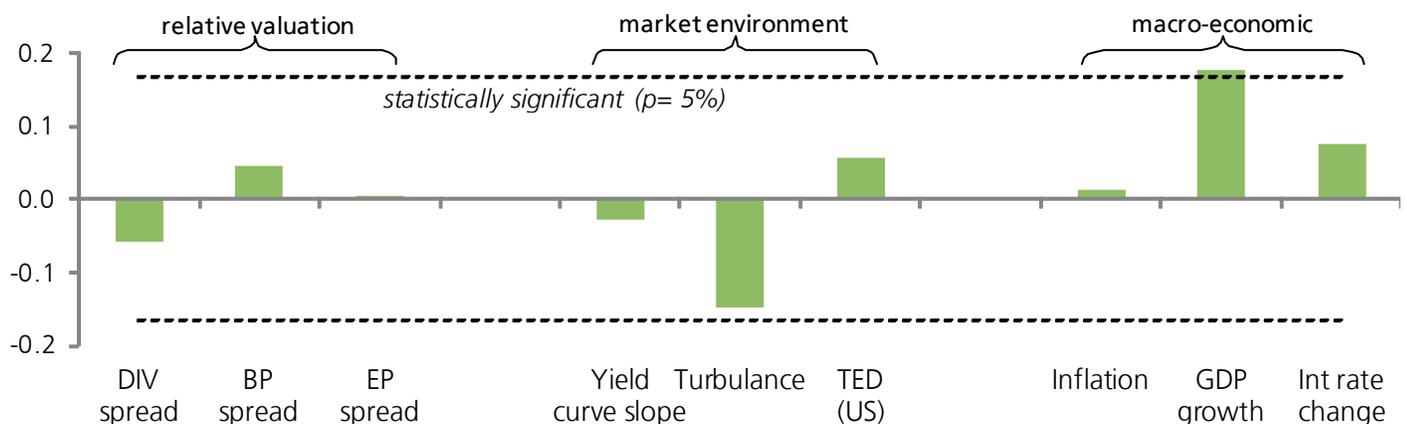
[5] See Appendix "Definition of Predictive Variables" for complete descriptions of each.
[6] We have included the results for the ten years ending March 2014 in the Appendix for comparison.

Because recent market turbulence and economic growth appear the strongest predictors when considering the timing of an allocation to a low volatility portfolio, we set out to explore them in more depth. In order to do so, we divide our back-test data into two periods; when each predictor was relatively high and when it was relatively low, using the median as the separation point. The results are illustrated in **Exhibit 4**.

We note that the low volatility strategy outperformed the cap-weighted index most when markets had recently been calm, as measured by a low turbulence score (by 3.60% excess return per annum, compared to 0.75% per annum following periods with elevated turbulence). This indicates investor complacency, which could precede a market reversal in which a defensive strategy will do well. Similarly, the low volatility strategy clearly outperformed the cap-weighted index following periods of high economic growth (by 5.02% per annum), but underperformed on average following periods of low growth (by 0.80%). However, subsequent to such periods of low growth, the low volatility strategy still outperformed on a risk-adjusted basis, as shown by the higher Sharpe Ratio (by 0.11) in that regime. This evidence confirms the trailing economic environment as a contrarian indicator for low volatility strategies. Later in this report we will discuss the current market and economic backdrop and how this could feature, in any consideration, to allocating to low volatility equities.

Exhibit 4: SEGMENTATION ANALYSIS OF PREDICTIVE INDICATORS
Trailing Turbulence and Growth Regime

January 1980 – March 2014

Annualized return
Low Volatility versus Cap-Weighted Index

indicator regime (top/bottom 50%)			Spread
GDP growth	hi		5.02%
	lo		-0.80%
turbulence	hi		0.75%
	lo		3.60%

avg. annual total return

Annualized Sharpe Ratio
Low Volatility versus Cap-Weighted Index

| indicator regime (top/bottom 50%)			Spread
GDP growth	hi		0.43
	lo		0.11
turbulence	hi		0.16
	lo		0.39

annualized Sharpe Ratio
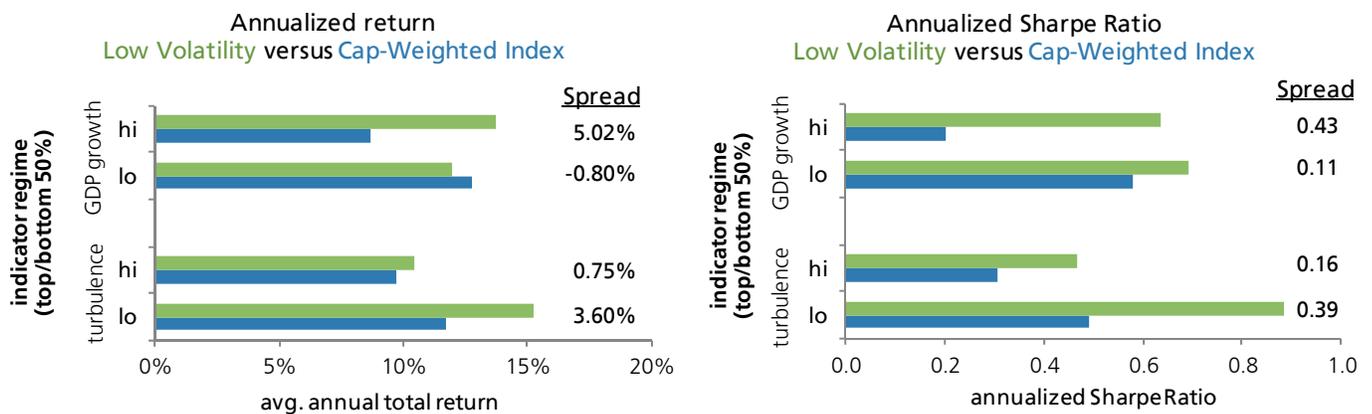
Drivers of Relative Valuation of the Low Volatility Portfolio

Since valuation has historically been a good predictor of stocks' relative performance, it is surprising that it is not a better predictor of the low volatility portfolio's relative performance. In trying to understand this, we found that the relative valuation of the Global Low Volatility portfolio is primarily driven by its dynamic country and sector positioning rather than the valuation changes of static holdings[7]. One clear historical example that illustrates this point is Japan over the period 1980 through 1Q 2014, though other macro effects such as the portfolio's energy sector exposures were important contributors too.

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[7] We emphasize that this insight might be specific to our top-down implementation of low volatility investing, which is less sensitive to "crowding" in individual low volatility stocks. In the appendix we illustrate how low volatility stocks being expensive appears to be a sign of investor fearfulness, which as we have seen would be a bearish signal for the strategy. However, after the recent market rally their relative valuations are in fact back in line with historical averages.

Exhibit 5 shows that Japanese equities have been structurally expensive since the 1980s (dotted blue line). Since the advent of the Global Financial Crisis in 2007, Japan has acted as a safe haven with low return volatility. Therefore, the weight of Japan in the low volatility portfolio increased (red line), and the portfolio consequently became more expensive (shaded green area). Since this shift was primarily caused by macro effects rather than existing holdings having been bid up, we believe this to be less of a concern. We see this as part of a true expression of identifying lower volatility, "safer" assets.

Exhibit 5: YIELD SPREAD
Low Volatility versus Cap-Weighted Index and Japan

cor(JP active weight, LowVo yield spread) = -0.77

yield spread of DBI LowVo over CW (standardized)
yield of Japan (standardized)
active weight of Japan in DBI LowVo versus CW
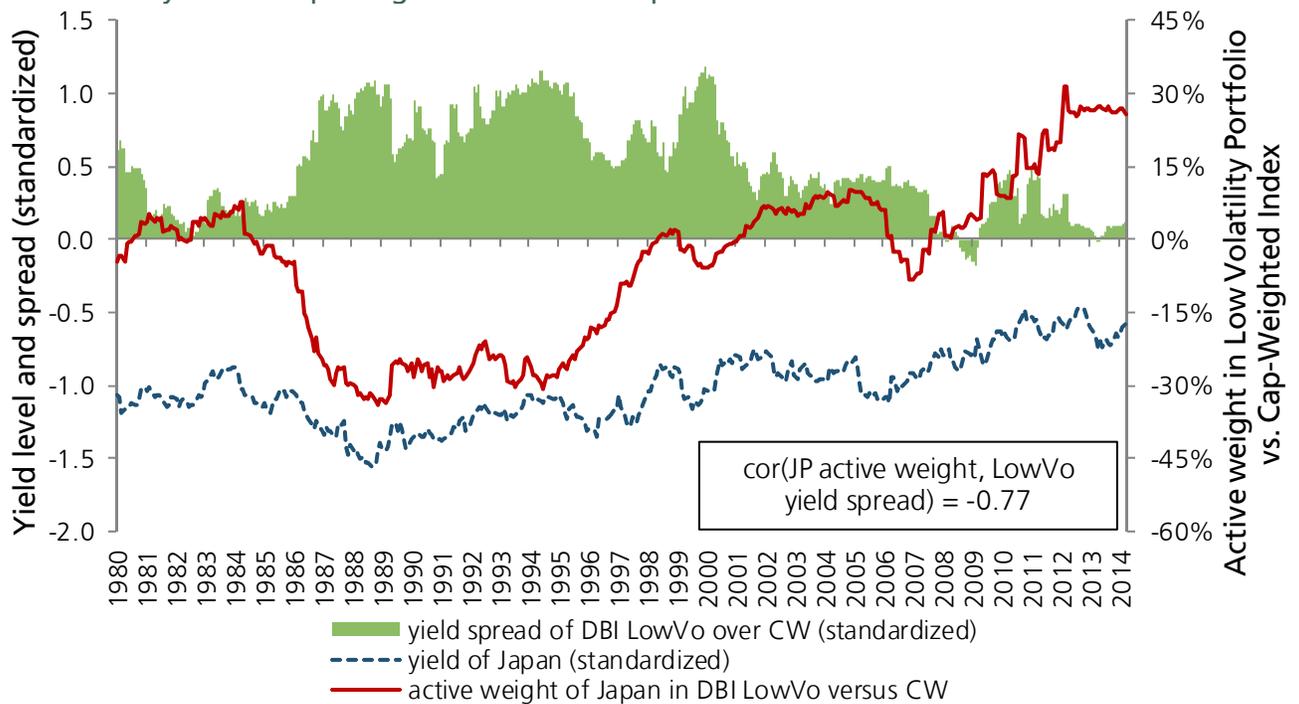
The Concurrent Macro Environment

We have seen that the rearview-mirror macro environment is a contrarian indicator of the relative performance of low volatility investing. Many investors also have predictions about the upcoming macro environment. This raises the question about how low volatility performance relates to its concurrent macro environment, with a rising rate environment being of particular interest at this time as many investors expect a normalization to higher rates sometime in the future. To answer this, **Exhibit 6** shows the correlation of the low volatility strategy's quarterly performance with the change in medium-term interest rates, CPI indicator and global GDP growth during that same period[8]. We see that low volatility underperformed during economic booms when strong real GDP growth and elevated inflation were accompanied by interest rate increases.

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[8] To be clear, Exhibit 3 shows how the recent economic environment relates to low volatility's subsequent relative performance, while Exhibit 6 shows the concurrent relation between the two. The former directly provides a prediction for low volatility's relative performance as the past environment is known, while the latter can be used to translate macro-economic forecasts into such performance predictions.

Exhibit 6: SENSITIVITY ANALYSIS
Quarterly correlation of Low Volatility Equities excess return* with macro environment

January 1980 – March 2014

| Inflation	GDP growth	Int rate change
-0.08	-0.16	-0.19

statistically significant (p= 5%)
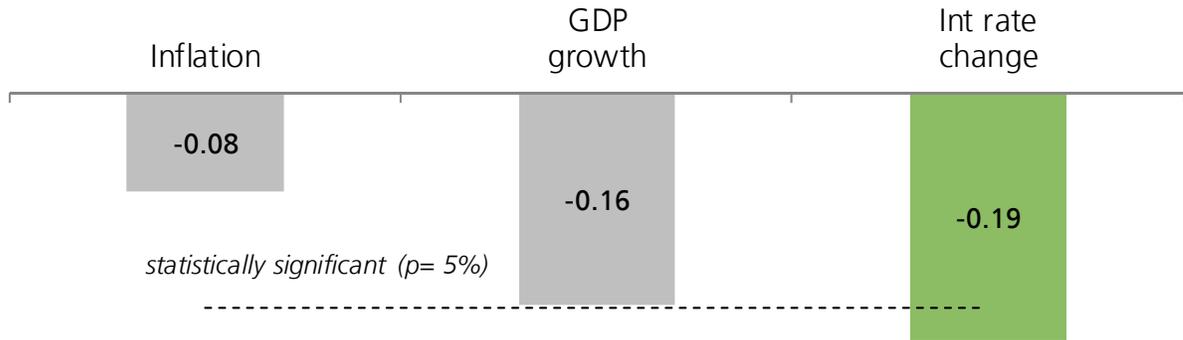
*Excess return versus the capitalization-weighted index

The interest rate environment had the strongest relation to low volatility performance among the economic indicators considered. **Exhibit 7** breaks down low volatility relative performance by quarters of increasing and decreasing interest rates. Clearly low volatility equities underperformed the cap-weighted index during periods of rising rates. However, the return difference is not large, 2% on an annualized basis, and the average total return to the low volatility strategy was still above 9%. Moreover, in terms of risk-adjusted returns as measured by the Sharpe Ratio the two were even closer (0.09 difference). Though the expectation of interest rates increasing further might be widespread, generally central banks have indicated that this will only happen if the economy supports it. It's not far-fetched to believe that even if low volatility strategies might trail the broad market index in such an environment, they will still deliver sufficient total return for investors to meet their goals with similar or lower volatility. Conversely, interest rate expectations not coming true might lead to or result from an environment in which low volatility strategies have historically performed well.

Exhibit 7: CONCURRENT RATE CHANGE REGIME

January 1980 – March 2014
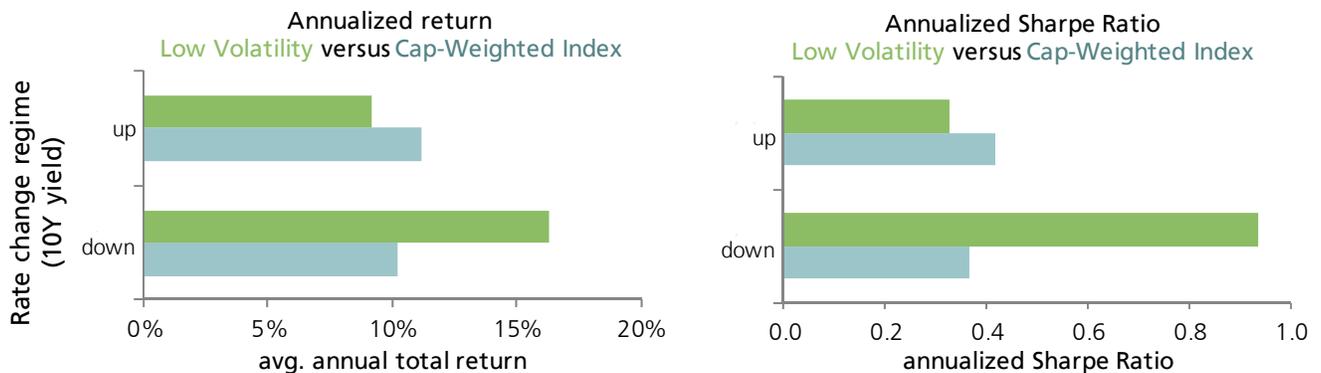
The Current Backdrop

Exhibit 8 considers the current backdrop of our predictive indicators and gives some perspective on what we believe this may indicate about the performance of low volatility equities in the near future. The picture is mixed. The relative valuation of the low volatility portfolio versus the cap-weighted index is indeed expensive compared to its historical levels. However, we have seen historically this reflects its macro positioning and has not been a good predictor of its impending performance. Investors appear to have become complacent, which historically has been a positive indicator for low volatility performance[9]. However, the economy only appears to have completed the early phase of its recovery. Economic growth has been moderate, inflation remains low, and interest rates barely rose before falling again. This explains recent underperformance of the low volatility strategy in a strongly rising market.

The market rally could certainly have legs if economic fundamentals continue to improve. However, this might prompt the Fed to normalize its interest rate policy, potentially tempering the upside. Conversely, if economic growth disappoints, a correction might ensue as investors may conclude markets have gotten ahead of fundamentals. The risk might be asymmetric, and we note low volatility equities have historically performed relatively well compared to the cap-weighted index during moderate up markets and during down markets.

Exhibit 8: CURRENT BACKDROP (as of August 31, 2014)

predictive indicator	value	percentile (vs. history, 100=highest)	perspective
DIV spread (standardized)	0.14	14	Low volatility equities are relatively expensive versus index, compared to history, but historically this had little predictive power
BP spread (standardized)	-0.09	13	
EP spread (standardized)	-0.04	25	
Yield Curve slope	1.66%	44	Complacent environment, historically generally a positive signal for low volatility strategy
Turbulence	4.74%	1	
TED Spread	20 bps.	10	
Trailing inflation	1.94%	11	With moderate economic growth and interest rates as well as inflation still low, only part of the economic recovery (historically a negative for low volatility) might have played out.
Real GDP growth	2.83%	44	
Trailing interest rate change	-44 bps.	41	

Conclusions

Investors understand the appeal of low volatility equity investing but have expressed concerns about the tactical timing of making an allocation, primarily related to valuation levels and the interest rate environment. We have illustrated that valuation levels of the portfolio primarily reflect its dynamic country and sector positioning more than the valuation of its existing holdings. This can explain relative valuation being a poor predictor of future relative performance. Our research showed that low volatility strategies have tended to underperform during periods of rising interest rates. However, rate increases don't happen in isolation and in such a rising rate environment the strategy may still deliver the total return needed for investors to achieve their goals, while reducing volatility. We believe these are relevant considerations for investors looking to make an allocation to low volatility equities at this time.

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[9] We should emphasize some of the predictive indicators we considered, for instance turbulence and the valuation spreads, might be particular to Developed Markets. While we believe our general insights into the drivers of low volatility equities' relative performance versus the corresponding capitalization-weighted index will extend to Emerging Markets too, to the extent they are decoupled the predictive indicators might currently look very different for that segment. We have not yet looked at that in detail.

Appendix: Low Volatility Portfolio Construction

The strategy we used to conduct this research creates a global low volatility equity portfolio by allocating capital among country-sector baskets which are cap-weighted baskets of the stocks in that market segment, e.g. US HealthCare, UK Telecommunications or Japanese Consumer Staples. A recent study shows that such a top-down approach to low volatility investing historically delivered the same performance benefits as low volatility stock selection, with some implementation benefits[10].

The portfolio construction process is iterative to temper reliance on historical returns and to seek a diversified portfolio across countries, sectors and individual stocks. First, we created the portfolio of country-sector baskets with the lowest predicted risk, based on the trailing 5-year covariance matrix of weekly returns. The portfolio must be sufficiently diversified based on the Herfindahl index – a measure of concentration. If not, we create a second portfolio with the lowest predicted risk among those country-sector baskets not yet selected, and equal-weight between the two low volatility portfolios. If that portfolio is sufficiently diversified it is used, if not a third low volatility portfolio is included in the mix based on the as-of-yet unselected country-sector indices.

Appendix: Predictive Variable Definitions

The definitions of our predictive variables are as follows:

For all country-sector indices in our investable universe, we calculate the dividend yield, earnings yield and book-to-price ratio. Each month we cross-sectionally z-score these valuations. We use these standardized valuation scores to create the weighted average valuation score of a portfolio. We then take the month-end spread between the low volatility portfolio's valuation and that of the cap-weighted index.

For the global yield curve slope we used the difference between the Barclays Global Aggregate bond index yield versus the 3M US treasury starting in 1991. Prior to that time, we used the 10Y and 3M US treasury rates.

Our turbulence indicator is the volatility of monthly country-sector index returns pooled over the past 6 months. This is a broader measure of investor disagreement than trailing market return volatility, since it also captures cross-sectional return dispersion between country-sector indices.

The TED spread is the difference between 3M US LIBOR rates and 3M treasury rates. This reflects credit risk, particularly among financial institutions.

Trailing inflation is measured as the Year over Year (henceforth YoY) percentage change in OECD's price index, lagged by 1 month.

Real GDP growth is measured as the YoY change in the OECD's Gross Domestic Product by Expenditure in Constant Prices, lagged by a quarter. An adjustment is made for growth in non-OECD member states using World Bank data.

The trailing interest rate change is measured as the YoY difference in medium-term sovereign rates. Starting in 1991, we use the Barclays Global Aggregate bond index yield. Before that, we use the 10Y US treasury rate.

Data was sourced from MSCI (country-sector index returns as well as valuation data), Datastream (return data for low volatility portfolio construction, interest rate data), Bloomberg (TED spread), the OECD and the World Bank (inflation, global economic growth)

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[10] De Boer, S., Campagna, J. and Norman J., "Country and Sector Drive Low-Volatility Investing in Global Equity Markets," Journal of Index Investing, Spring 2014.

Appendix: Analysis Results for Recent History

Exhibit A1 shows the correlation of predictive indicators with future low volatility equities excess returns over the most recent 10 years. During this period, **inflation** and the **TED spread** were more predictive than they were over the entire analysis period.

Exhibit A1: QUARTERLY CORRELATION
Excess Return of Low volatility Equities* with Predictive Trailing Indicators

March 2004 – March 2014
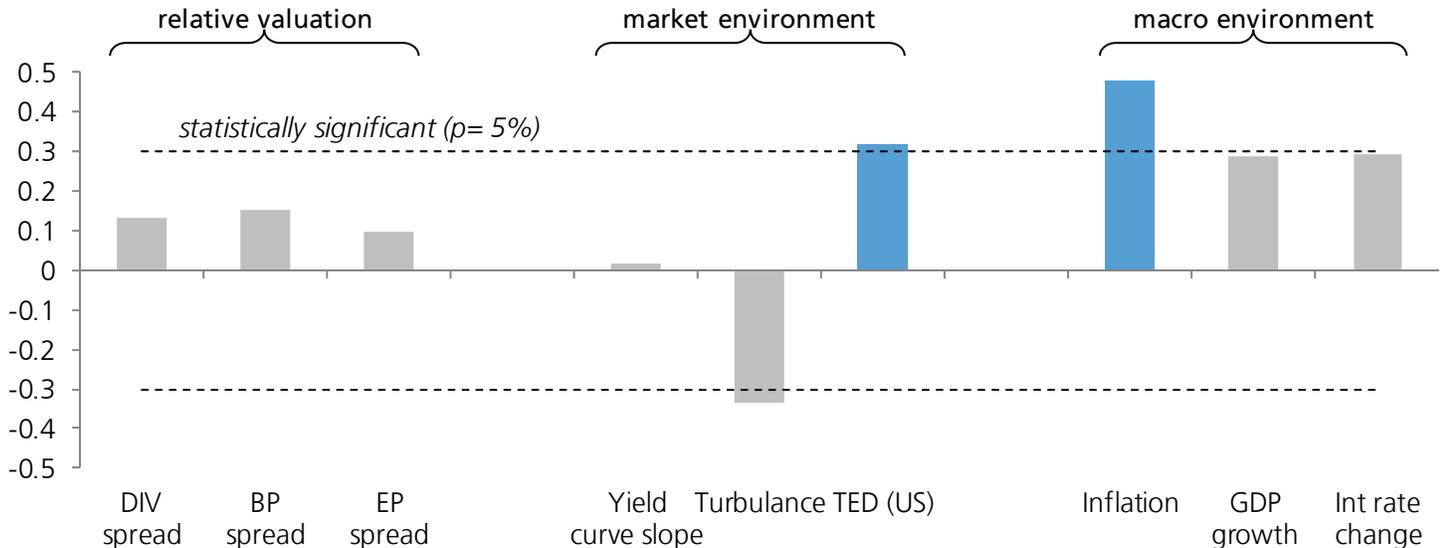
*Excess return versus the capitalization-weighted index

Exhibit A2 confirms that the findings of Exhibit 4 persisted in the most recent 10 year period: the performance of Minimum Volatility was relatively stronger following periods of low market turbulence and high economic growth.

Exhibit A2: SEGMENTATION ANALYSIS OF PREDICTIVE INDICATORS
Trailing Turbulence and Growth Regime

March 2004 – March 2014
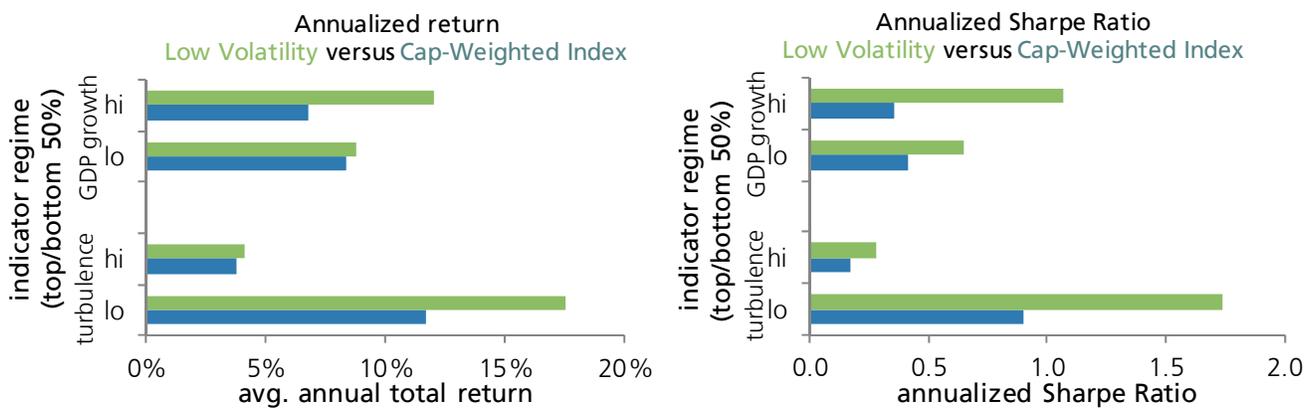
Exhibit A3 segments the entire analysis period as well as the past 10 years into periods of high and low inflation as well as TED spread levels, using the respective period median as the divider. Following periods when the TED spread was high, Low Volatility generally delivered higher excess returns than following periods when the TED spread was low, though the reverse was true for the difference in Sharpe Ratio due to elevated return volatility levels during such times. Over the past 10 years, low volatility actually under-performed subsequent to periods of low inflation, though it still delivered a higher Sharpe Ratio during such times.

Exhibit A3: SEGMENTATION ANALYSIS OF TED SPREAD AND INFLATIONARY REGIME

March 2004 – March 2014
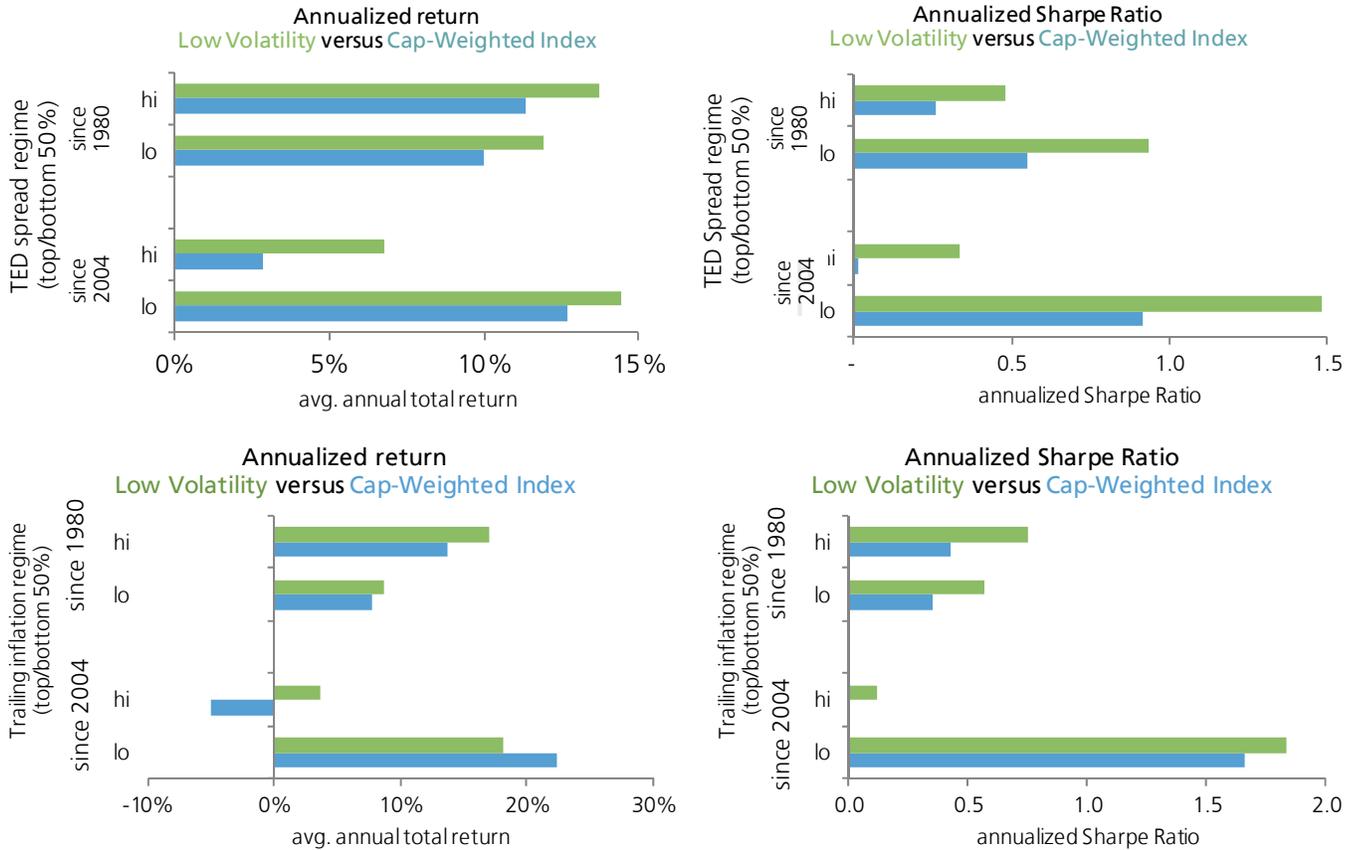
Exhibits A4 and A5 confirm that the findings of Exhibits 6 and 7 persisted in the most recent 10 year period: low volatility equities tended to under-perform the capitalization-weight index during periods of rising rates (by 2.05% per annum, on average), though its annualized total return over such periods still exceeded 10% and the Sharpe Ratios were nearly identical (difference of 0.03).

Exhibit A4: SENSITIVITY ANALYSIS
Quarterly correlation of Low Volatility Equities excess return* with macro environment
March 2004 – March 2014
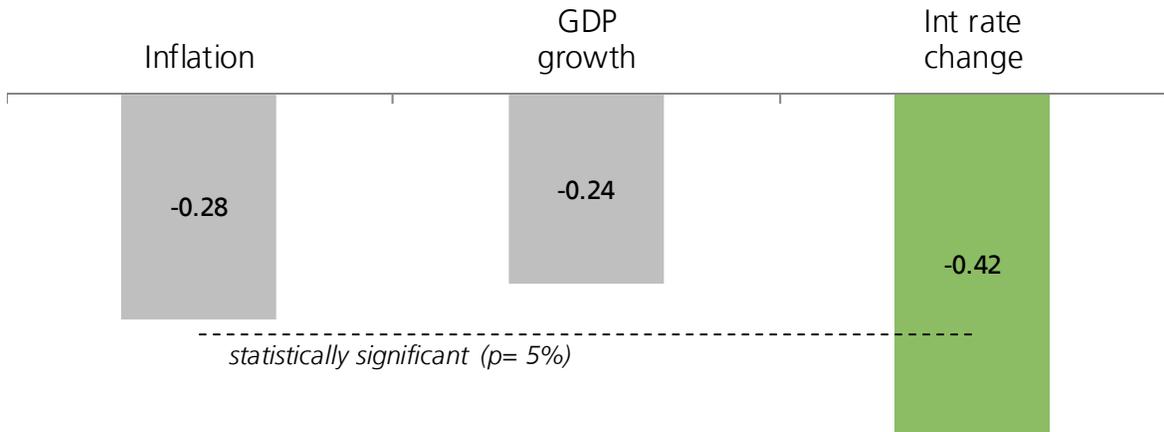
*Excess return versus the capitalization-weighted index

Exhibit A5: CONCURRENT RATE CHANGE REGIME
March 2004 – March 2014
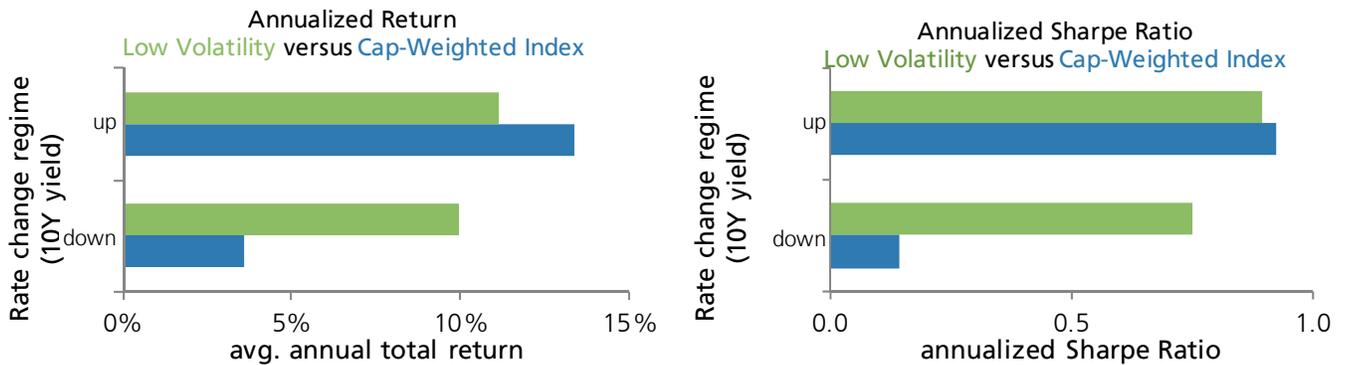
Appendix: Micro versus Macro Perspective

Our top-down implementation of the low volatility strategy invests in cap-weighted country-sector sub-indices and avoids individual stock-selection therein. Therefore, the portfolio's relative valuation might have missed select low volatility stocks within those sub-indices having become expensive. To address this, Exhibit A6 shows the relative valuation of the 20% lowest-beta stocks[11] within the MSCI World universe over time, both on an overall as well as a country-sector neutral basis. Some relevant insights are:

1. The country-sector neutral portfolio of low-beta stocks historically had less of a valuation advantage than the overall low-beta portfolio, confirming our insight that macro-positioning was an important driver.

2. The relative valuation of low-beta stocks within countries and sectors appears to reflect investor sentiment in that they were expensive at times of panic (during Gulf War, after bursting of Tech bubble, at the bottom of the Global Financial Crisis) and cheap during times of complacency (peak of Tech Bubble, just ahead of European Debt Crisis). As we have seen, investor sentiment is a contrarian indicator for low volatility investing. The "micro" valuation of individual low volatility stocks might therefore yet be a useful predictive indicator, particularly after neutralizing the effect of "macro" drivers.

3. While low volatility stocks within countries and sectors were indeed relatively expensive two years ago, the sustained market rally since has re-priced them at nearly their historical average relative valuation.

Exhibit A6: YIELD SPREAD
Low Volatility Stocks versus Market Average, Both Overall and Country-Sector Neutral
MSCI World universe

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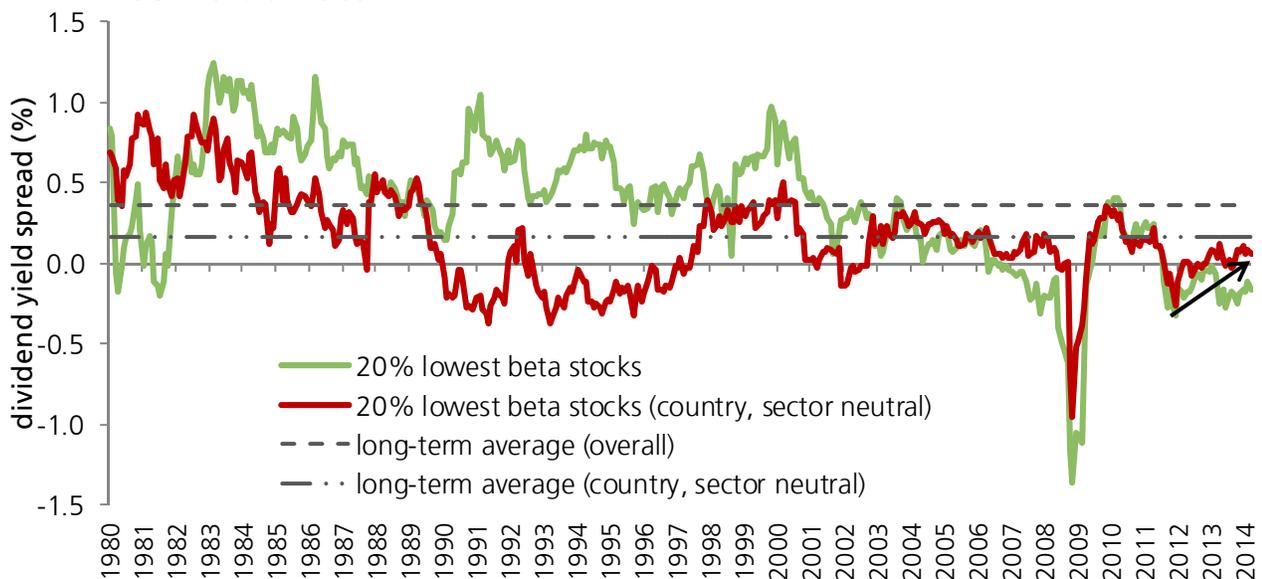
[11] Stock betas were estimated using trailing 60 month regressions.

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