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Low Volatility Investing
A closer look at finance theory versus empirical reality

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Topics for Discussion

- Introduction to Low Volatility Investing
- What is important when trying to manage volatility?

See "Important Information" for a discussion of performance data, some of the principal risks related to any of the investment strategies referred to in this presentation and other information related to this presentation.

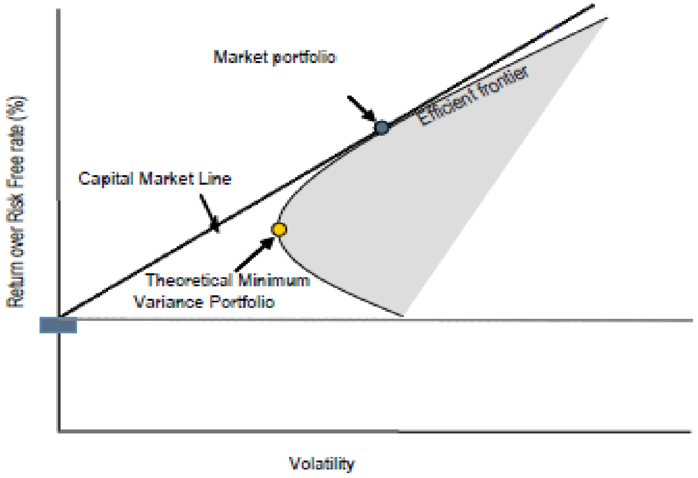
Introduction to Low Volatility Investing

Introduction to Low Volatility Equity Investing

Finance theory vs empirical reality

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f)$$

CAPM & The Risk-return Relationship



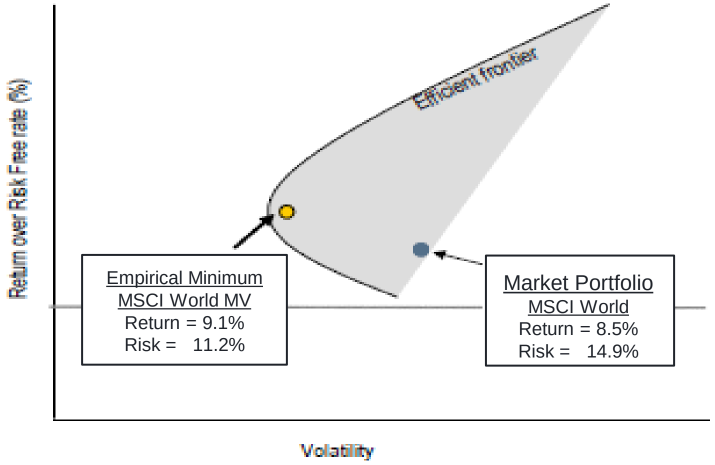
Capital market theory suggests…

- An asset's return is a function of its sensitivity to systematic risk (i.e., non-diversifiable risk or Beta) , the risk-free rate and the market return.
- There is a positive risk-return relationship, implying investors are rewarded for taking on greater risk through greater returns.
- In the presence of a risk free asset, the minimum variance portfolio is inefficient.

Empirically it is hard to support the CAPM

- The risk-return relationship is flat at best.
- Higher volatility assets do not compensate investors for the higher risk with higher returns.
- Low volatility assets offer more compelling returns relative to their risk.
- Over many decades and across many geographies, the minimum variance portfolio has been more efficient than the market portfolio.

The Empirical Reality
Date Range: 7/1988 – 8/2021



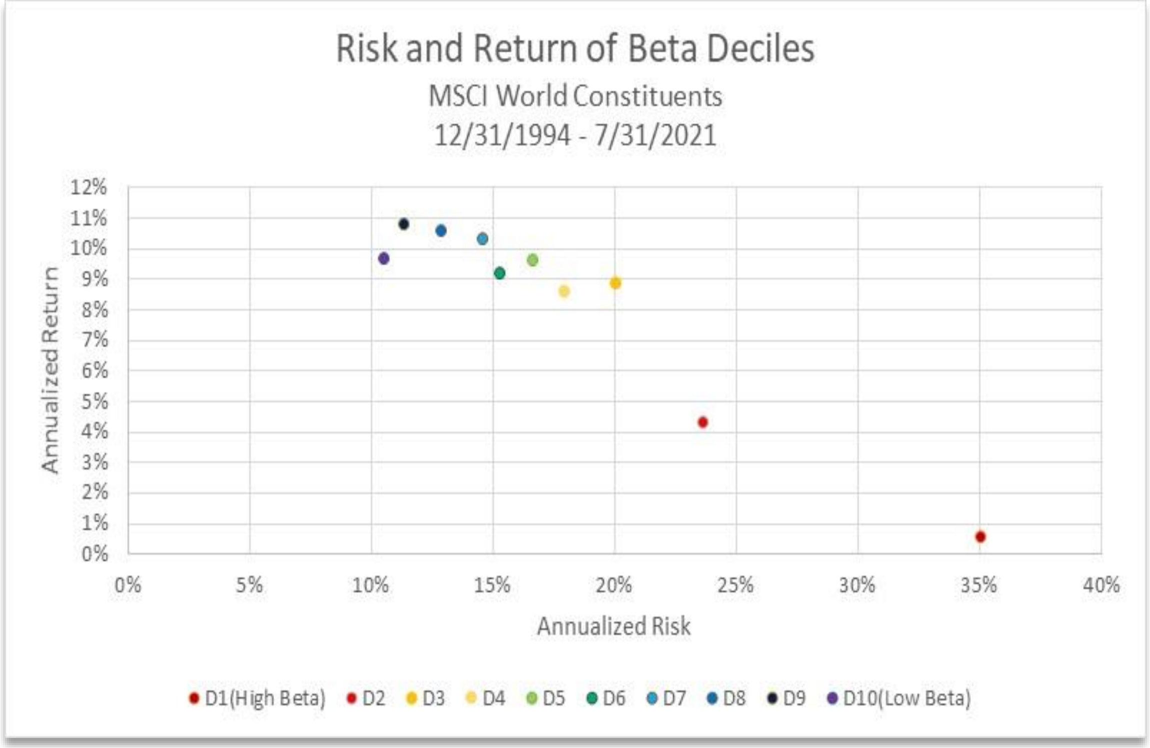
For illustrative purposes only. Source: Fidelity.

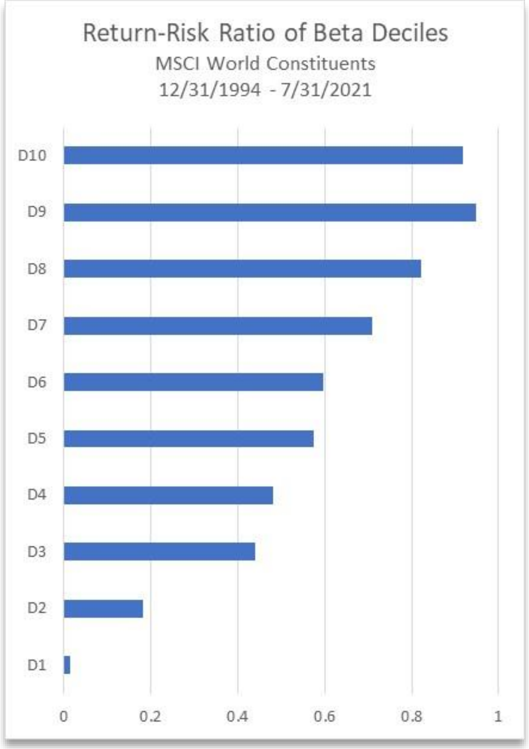
Introduction to Low Volatility Equity Investing

What is the Low Volatility Anomaly?

The Low Volatility Anomaly = stocks exhibiting lower volatility achieve higher returns than can be explained by CAPM and the efficient market theory.

Stock Returns By Predicted Beta Deciles:





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Introduction to Low Volatility Equity Investing

More efficient equity exposure

Minimum variance portfolios have a long history of providing more efficient equity market exposure: market-like returns with less risk.

80+ year study in the U.S. market

EXHIBIT 2 PERFORMANCE CHARACTERISTICS OF LOW-VOLATILITY MODEL PORTFOLIO VS. CAP-WEIGHTED EQUITIES, 01/1929–03/2012

	Low-Volatility Model Portfolio, U.S. Largest 500	Cap-Weighted Equities, U.S. Largest 500
Annualized Geometric Return	10.4%	7.3%
Annualized Volatility	10.1%	17.4%
Return/Risk Ratio	1.03	0.42

30+ year MSCI Index comparison

MSCI World vs MSCI World Minimum Volatility Index
7/31/1988 – 8/30/2021

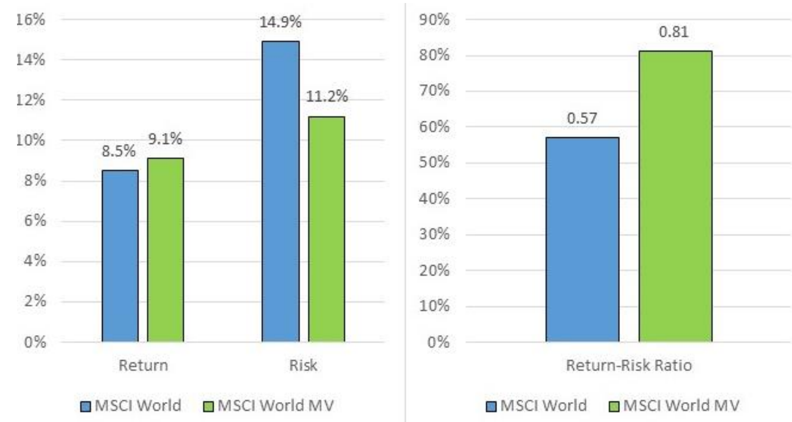
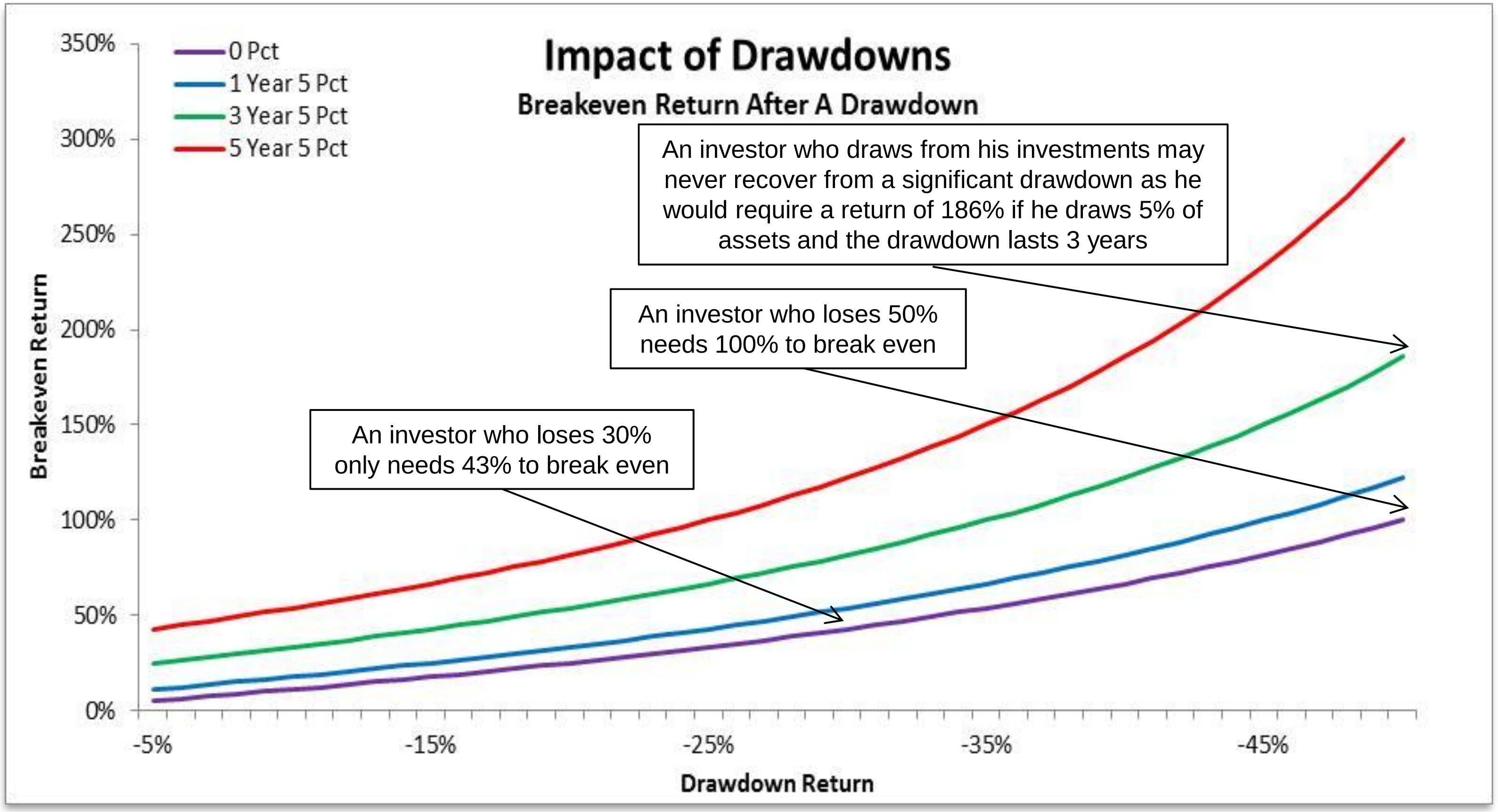


Exhibit 2 Source: CRSP, Fidelity Investments. Hypothetical back-tested data has inherent limitations due to the retroactive application of a model designed with the benefit of hindsight and may not reflect the effect that any material market or economic factors may have had on Fidelity's use of the model during the time periods shown. Thus, Model Performance is speculative and of extremely limited use to any investor and should not be relied upon. Hypothetical performance of the model is no guarantee of future result. See methodology page for additional details.
For illustrative purposes only.
Index performance does not reflect the deduction of advisory fees, transaction charges, and other expenses, which would reduce performance. Investing directly in an index is not possible.
Past performance is no guarantee of future results.
Source: Fidelity Institutional Asset Management, as of 8/30/21.

Introduction to Low Volatility Equity Investing

Importance of downside protection

Downside protection is critical to long-term investors



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Introduction to Low Volatility Equity Investing

Minimum variance portfolios & investor expectations

Minimum variance portfolio expectations

Downside Protection

- Expect strong downside protection during market turmoil
- MSCI World MV has achieved 60% downside capture over the past 30+ years

Upside Participation

- Expect solid upside participation in normal market environments
- MSCI World MV has captured 72% of market upside over the past 30+ years

More Efficient Equity Exposure

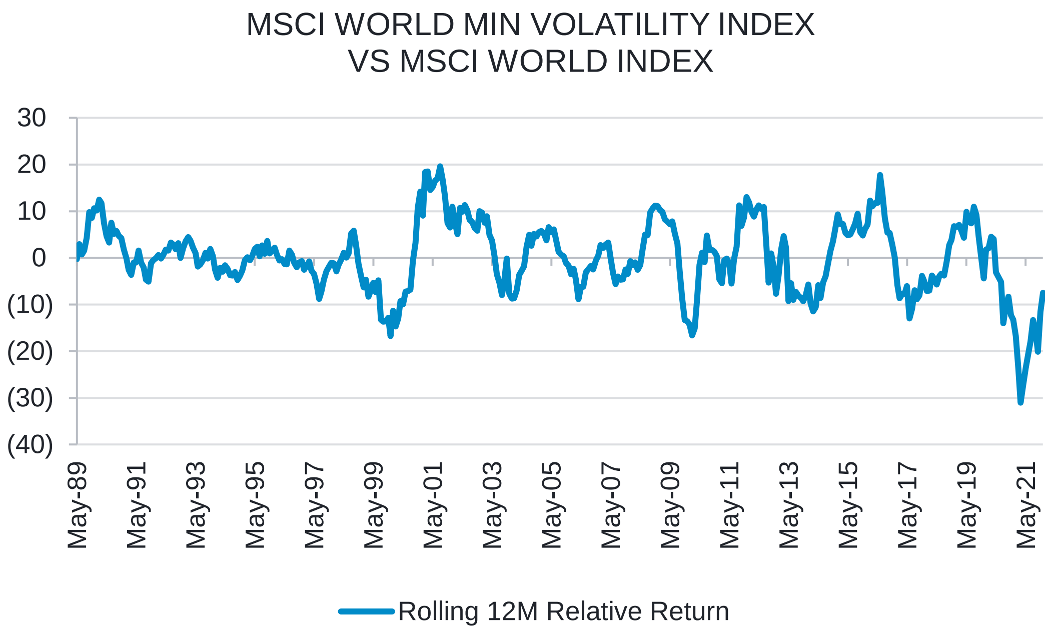
- Expect returns on par with the cap-weighted benchmark but with 20-30% less risk
- MSCI World MV has generated a risk-return ratio of 0.81 versus MSCI World’s 0.57 over the past 30+ years

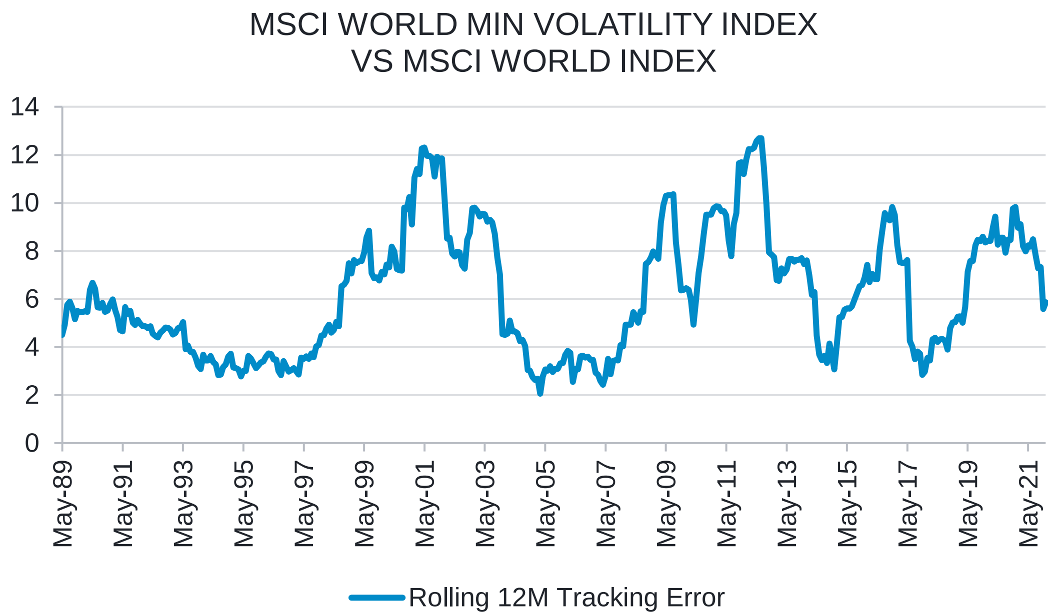
Index performance does not reflect the deduction of advisory fees, transaction charges, and other expenses, which would reduce performance. Investing directly in an index is not possible.

Introduction to Low Volatility Investing: Not a Panacea

Low Volatility Investing offers strong merits but it's not perfect

- Despite the long-term merits of low volatility investing & it's ability to provide historically better risk adjusted returns, it does not always deliver desirable short-term return outcomes
- As a client's return horizon grows, the odds of winning with a low-volatility allocation grows, especially when viewed from an absolute return standpoint
- While the downside protection of low volatility strategies can help clients sleep well, large swings in relative returns can create higher tracking error that may be undesirable
- For those clients with higher sensitivity to the wide swings in relative returns, perhaps introducing constraints aimed at reducing tracking error may be desirable



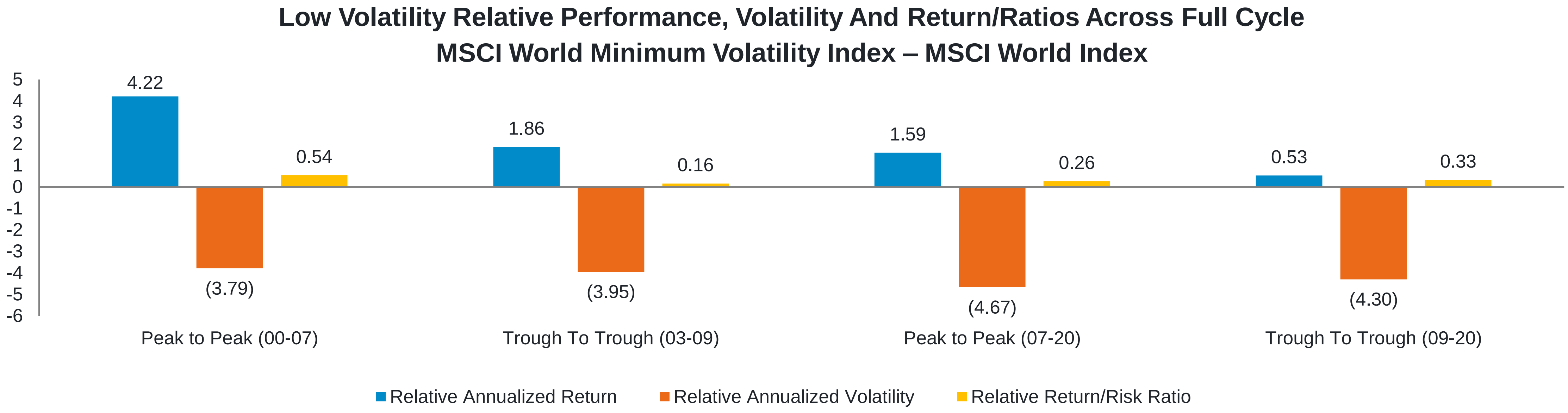


For illustrative purposes only. Index performance does not reflect the deduction of advisory fees, transaction charges, and other expenses, which would reduce performance. Investing directly in an index is not possible. Sources: FMR Co., MSCI.

Introduction to Low Volatility Equity Investing

The benefits of low volatility strategies should be viewed through an entire market cycle

- Equity markets have distinct cycles that include period of positive and negative returns. A full cycle should capture performance from a peak to peak or from a trough to a trough.
- Low volatility equity strategies seek to provide equity market-like returns over a full market cycle with lower risk
- Low volatility strategies, when viewed across an entire cycle, either from market peak to peak or market trough to trough, have delivered on expectations.

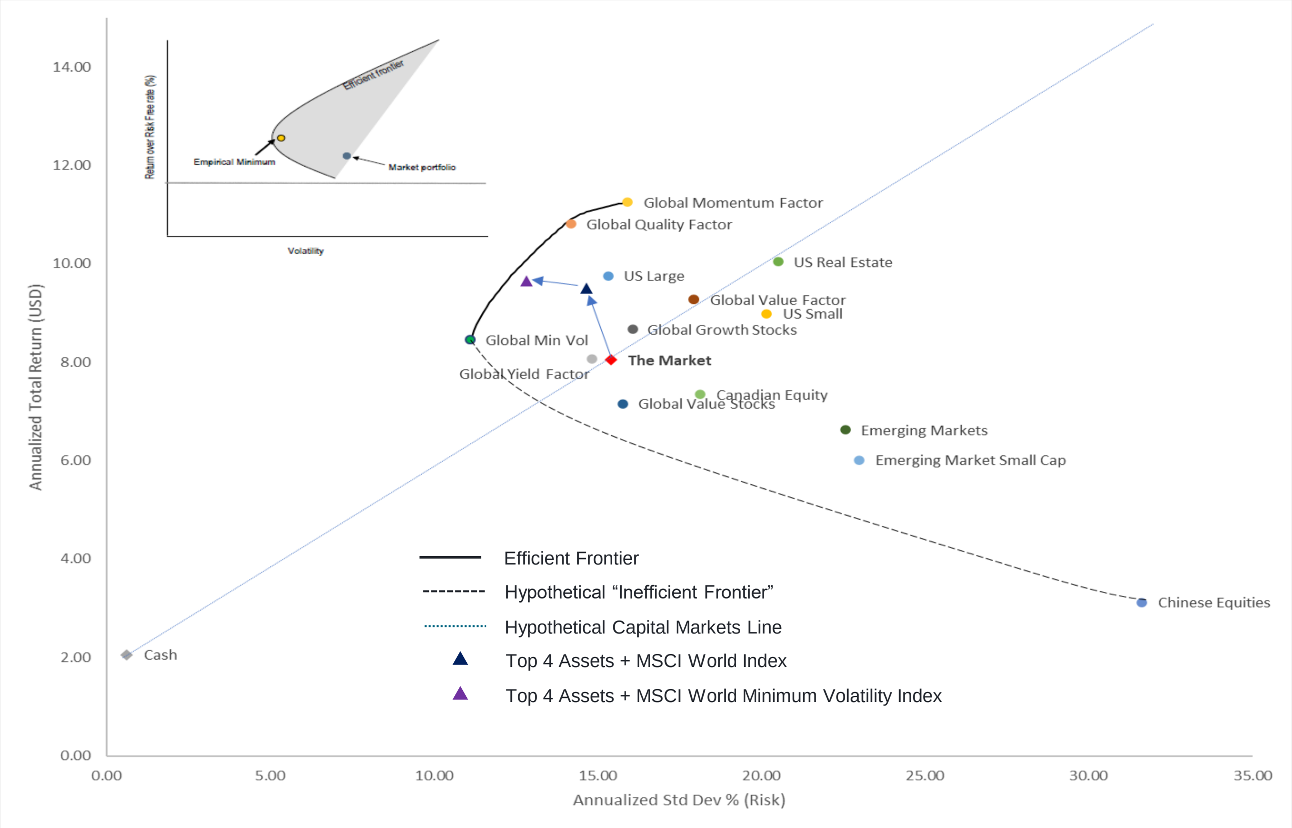


Figures are shown in USD.
Index performance does not reflect the deduction of advisory fees, transaction charges, and other expenses, which would reduce performance. Investing directly in an index is not possible.
Benchmark is MSCI World (N) and MSCI World Minimum Volatility Index (N).
Source: Fidelity Institutional Asset Management, as of 2/11/21.

Introduction to Low Volatility Equity Investing

Empirical reality for asset allocation

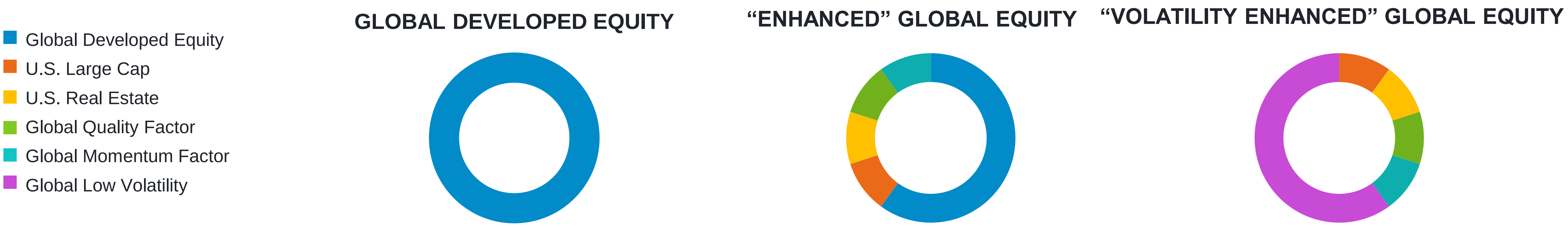
EFFICIENT FRONTIER 25 YEARS ENDING DECEMBER 31, 2021



The Top 4 Assets refer to the 4 top performing asset classes over the period: U.S. Real Estate, US Large Cap Global Momentum and Global Quality.
Index performance does not reflect the deduction of advisory fees, transaction charges, and other expenses, which would reduce performance. Investing directly in an index is not possible. Past performance is no guarantee of future results. Asset classes are represented by the following indexes: The Market-MSCI World Index, Global Momentum Factor-MSCI World Momentum, Global Quality Factor-MSCI World Quality, Global Value Factor-MSCI World Enhanced Value, Global Min Vol-MSCI World Min Vol, US Large-S&P 500, US Small Cap-Russell 2000, US Real Estate-Wilshire RESI, Global Growth-MSCI World Growth, Global Value-MSCI World Value, Emerging Markets-MSCI EM, Emerging Markets Small Cap-MSCI EM Small Cap, Canadian Equities-S&P TSX, Chinese Equities-MSCI China, Cash-30 Day US T-Bill.
All performance gross of fees and shown in USD. For illustrative purposes only.

Introduction to Low Volatility Equity Investing

Diversification impact of low volatility on equity portfolio



Risk/Return	**100 % Developed Market Equity**	**40% Dev Mkt / 60% Enhanced Mkt**	**40% Low Vol / 60 % Enhanced Mkt**
Return	8.05	9.19	9.46
Volatility	15.41	14.85	12.15
Sharpe Ratio	0.46	0.54	0.65
Downside Measures			
Beta	1.00	0.96	0.74
Downside Capture	100.00	93.23	66.82
Sortino Ratio	1.25	1.60	2.29
Performance in GFC	(53.65)	(53.60)	(47.41)
Volatility in GFC	21.65	22.47	19.55

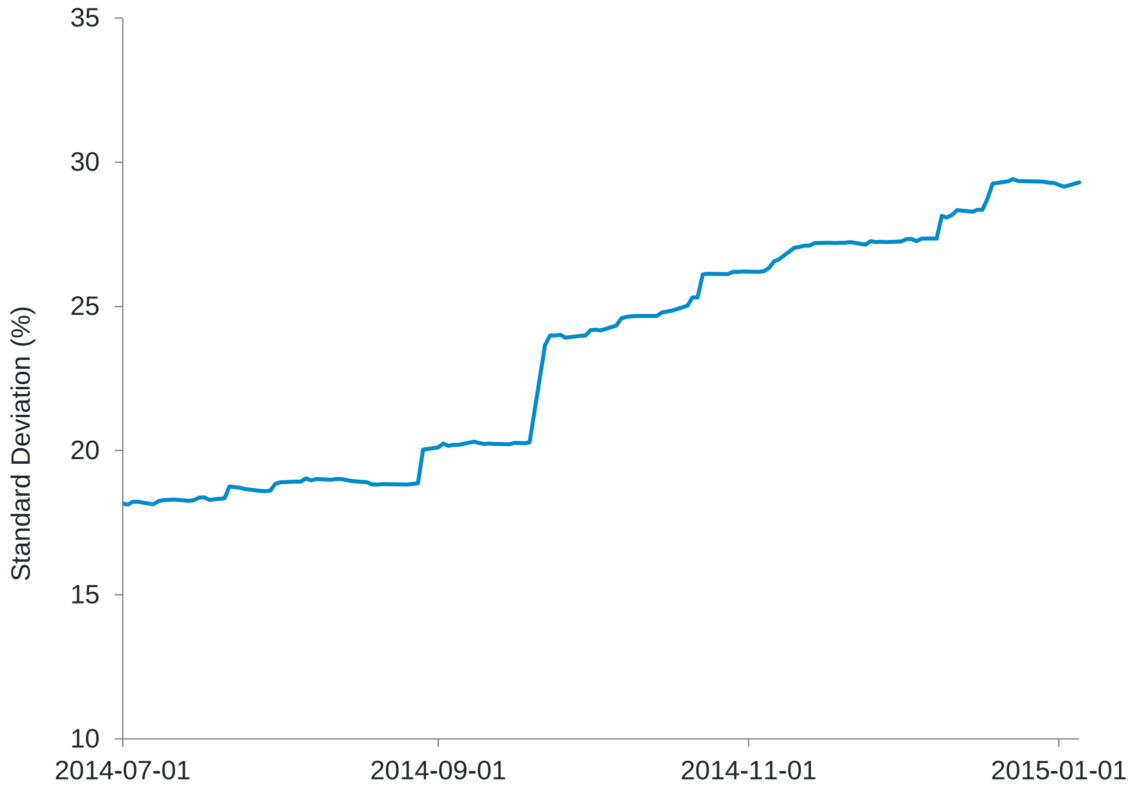
For illustrative purposes only.
Source: Fidelity Investments. Global Equity allocation represented by MSCI World Index, “Enhanced” allocations are US Large Cap represented by S&P 500 Index, US Real Estate represented by Wilshire Real Estate Securities Index, Global Quality Factor represented by the MSCI Global Quality Index, Global Momentum Factor represented by MSCI World Momentum Index, Global Low Volatility equity allocation represented by MSCI World Minimum Volatility Index. Returns reflect quarterly rebalancing for the last 25-years ending March 31, 2018. Index performance does not reflect the deduction of advisory fees, transaction charges and other expenses, which would reduce performance. Investing directly in an index is not possible. Past performance is no guarantee of future results.

What is important when trying to manage volatility?

Low Volatility Investing: Looking Forward

Risk model accuracy

What could go wrong? Trailing volatility



- Risk models are historically estimated.
- Risk models can be inaccurate at times.
- Need more fundamental, forward-looking insights.

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Example of investment research process is shown for illustrative purposes only and is not representative of manager's entire portfolio or all recommendations for time periods shown. Not a recommendation or offer to buy or sell any securities.
Past performance of investment research process is no guarantee of future results.
Source: Fidelity Management and Research Company.

Low Volatility Investing: Looking Forward

Decomposition of risk

Total Stock Risk =

$$\text{Exposure} \times \underbrace{\textbf{Factors' Risk}}_{\text{E.g, valuation, interest rates or other quant/macro/industry factors}} + \underbrace{\textbf{Stock Specific Risk}}_{\text{Unique to each stock's fundamental drivers}}$$

If I know the risk estimates ahead of time, how well can I do?

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Source: Fidelity Management and Research Company.

Low Volatility Investing: Looking Forward

Effect of perfect foresight

	Low Vol	With future factors' risk	With future stock-specific risk	With future total risk
Return	12.70%	12.75%	15.70%	15.67%
Volatility	12.80%	12.57%	12.62%	12.46%
Ratio	0.99	1.01	1.24	1.26

1. Both returns and risk-adjusted returns improve with knowing future risk
2. Surprisingly, the only driver is stock-specific risk information

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Source: Fidelity Management and Research Company.

Low Volatility Investing: Looking Forward

What does matter?

- Forward-looking insights on **factor risk** seems less material
  - Historical factors risk seems good enough
  - Results may be unique to risk model
- Forward-looking insights on **stock-specific risk** matters !
  - Difficult to capture quantitatively
  - Requires in-depth fundamental research on a per stock basis

Summary

- Low volatility equities offer a unique performance pattern versus other asset classes. However low volatility is not a panacea, it typically has higher tracking error vs the market and can underperform in strong rallies.
- Combining low volatility equities with other strong performing equity alternatives can increase the efficiency of your equity portfolio.
- Understanding stock specific risk is important when trying to manage volatility.
- A strategy that combines the forward-looking insights on alpha and risk from fundamental analysis with the discipline of quantitative portfolio construction may deliver investors the benefits of low volatility equities in a consistent manner.

Questions?

Appendix

Methodology

- For the purposes of this research, a Fidelity in-house risk model was used. All simulations begin on January 1, 1929, and end on March 31, 2012. Results are included for U.S. largest 500 stocks by market capitalization and reconstituted annually using data provided by the Center for Research in Security Prices at the University of Chicago Booth School of Business. The model portfolio employs a relative position size constraint, a notional position size constraint, and a monthly turnover constraint. The total return is calculated daily and annualized using geometric compounding. Cash is not included in the performance calculations. Transaction costs, management fees, performance fees, custodial fees, other administrative fees, and applicable taxes have not been deducted. All results reflect realized and unrealized appreciation. All dividends are reinvested.

HYPOTHETICAL TRADING AND MANAGEMENT CHARACTERISTICS OF LOW-VOLATILITY MODEL PORTFOLIO, 1/1929–3/2012

	Low Volatility Model Portfolio
Investment Universe	U.S. largest 500 by market capitalization, annually reconstituted
Average Stock Holdings	90
Average Annual Portfolio Turnover	82%
Portfolio Trading Frequency	Monthly
Portfolio Simulated Returns	Daily
Single Security Position Limit	No more than 1.5% of portfolio
Market Capitalization Constraint	No portfolio holding is allowed to exceed 1% of market capitalization
Market Liquidity Constraint	No portfolio holding is allowed to exceed twice the security's average daily trading dollar volume
Portfolio Trading Constraint	Each month, portfolio cannot trade more than half of any security's average daily trading dollar volume
Starting Portfolio Value in 1929 ($MM)	$0.5
Ending Portfolio Value in 2012 ($MM)	$1,871

Sources: CRSP, Fidelity Investments. Hypothetical data has inherent limitations due to the retroactive application of a model designed with the benefit of hindsight and may not reflect the effect that any material market or economic factors may have had on Fidelity’s use of the model during the time periods shown. Thus, Model Performance is speculative and of extremely limited use to any investor and should not be relied upon. Hypothetical performance of the model is no guarantee of future results.

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The value of a strategy's investments will vary day to day in response to many factors, including in response to adverse issuer, political, regulatory, market or economic developments. The value of an individual security or a particular type of security can be more volatile than the market as a whole and can perform differently from the value of the market as a whole. Nearly all accounts are subject to volatility in foreign exchange markets.
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