

Low Volatility Equity Strategies – The Greatest Anomaly in Finance?

Author
Sander van Ouwerkerk¹

Traditional finance is based upon the idea that risk is rewarded with higher average returns. It may surprise many investors to learn, however, that over the past 40 years U.S. portfolios comprised of high-risk stocks have substantially underperformed their lower-risk counterparts. This so-called low-volatility anomaly offers intriguing potential opportunities for investors. New investment strategies are rapidly being developed in an effort to take advantage of it, with the objective of delivering equity-like returns at substantially lower risk. This paper provides an introduction to such strategies – typically referred to as low volatility or minimum variance (we use these terms interchangeably). In the case of more actively managed approaches, these are often called managed volatility portfolios.

A Persistent Return Anomaly

The success of low volatility stock portfolios may well be the greatest anomaly in finance. The persistent outperformance of low-risk stocks is inconsistent with much of financial theory, including the efficient market hypothesis and CAPM. As described by Baker, Bradley, Wurgler (2011),² and others, key principles of behavioral finance, as well as structural issues including the widespread use of

cap-weighted benchmarks, may explain why this anomaly persists across markets and across time. The chart nearby shows long-term U.S. equity market returns for the broad market, represented by the S&P 500 index, and a hypothetical minimum variance portfolio constructed to show the performance of the lowest-volatility segment of the U.S. market over time. This data shows that

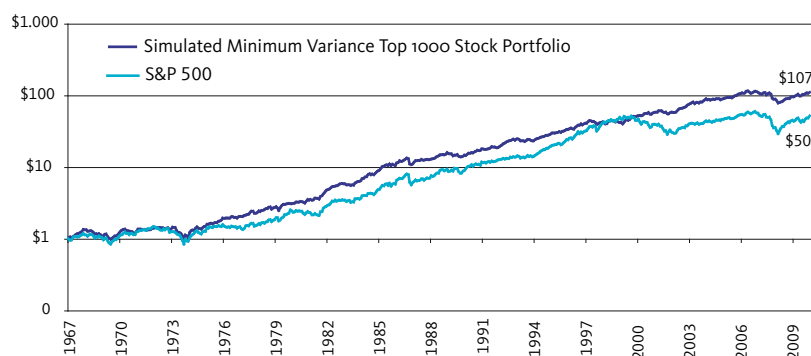
An investor who targeted high volatility stocks over the past 40 years would have underperformed a low-risk stock portfolio substantially

the portion of the market that had the lowest ex ante risk consistently outperformed the higher-risk benchmark portfolio over the full period. \$1 invested in the lowest-risk segment of the market compounded to \$107 from 1968 to 2010, versus \$50 for the full S&P 500. An investor who targeted high volatility stocks over the past 40 years would have underperformed a low-risk stock portfolio by a huge margin – a complete reversal of commonly held assumptions about the relationship between risk and return. This phenomenon is not limited to the U.S. market: while U.S. data goes back the furthest, similar analysis focused on Global, European, EAFE, Japanese and Emerging Markets portfolios have yielded similar results.³

Behavioral and Structural Causes

There is additional evidence that helps explain why the low volatility anomaly has persisted for decades even as investors have become more global and more quantitatively sophisticated. An irrational appetite for high volatility stocks may originate from several behavioral tendencies that affect investors. One of these is the so-called preference for lotteries, in which most people are willing to

Low Volatility Has Outperformed in the U.S. Market for 40 Years
U.S. Market Performance versus U.S. Low-Risk Stocks, 1968-2010⁴





take the chance on a near-certain loss if the potential payoff (however unlikely to occur) is sufficiently large. We also see irrational support for high-risk stocks from “representativeness” bias, which is the tendency for individuals to jump to a simplistic and often incorrect conclusion from just a few observations. A further common behavioral trait that may

Managers tied to cap-weighted benchmarks are more likely to pass up opportunities in low volatility stocks

support high-risk stocks is overconfidence. Even in areas where they have little knowledge, people tend to place tight confidence intervals around their estimates. Stocks that are either growing quickly or those that are distressed – volatile stocks – may elicit the greatest degree of overconfidence.

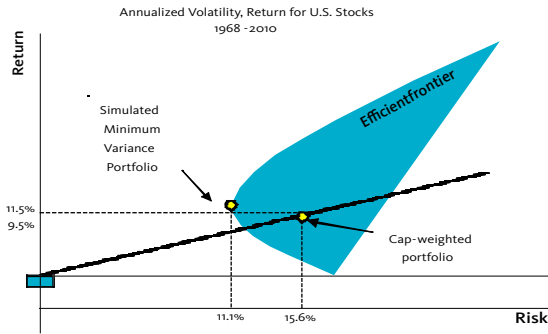
Even if one accepts the assertion that many investors have a psychological preference for high volatility stocks, the question remains why sophisticated institutions do not capitalize on these mistakes. The explanation may be that the asset management industry’s dependence on cap-weighted benchmarks poses too strong a

structural impediment. When a manager moves away from the market to invest in lower beta stocks, it has the potential of higher tracking error versus a cap-weighted index. This acts as a drag on his information ratio (benchmark-relative return divided by benchmark-relative risk), which is often the primary metric used to measure the skill of a manager. An investment manager with a market index benchmark is thus incentivized to exploit mispricings among stocks with close-to-market risk, i.e. beta near 1. As the beta of a stock decreases, the expected alpha must increase in order to make it worthwhile to take an overweighted position. The result is that managers tied to cap-weighted benchmarks are more likely to pass up opportunities in low volatility stocks.

There has been increasing interest in low volatility strategies, raising the question of whether the effect may lessen. In order for the anomaly to be arbitrage away, however, the benchmark-focused nature of institutional investing would have to radically change. This seems unlikely to happen soon, as benchmarks serve a useful purpose and most institutional practices are strongly entrenched. The current flow of assets into low volatility strategies is a tiny fraction of what is currently managed in benchmark-sensitive and passive portfolios.

Inefficiency of Cap-Weighted Indices

The risk-return efficiency of cap-weighted portfolios has been called into question for some time by a number of researchers, including Haugen and Baker (1991), Roll (1992), and Clarke, de Silva and Thorley (2006). One explanation for the persistence of the low-volatility anomaly takes market efficiency as its starting point. Traditional equilibrium arguments suggest that all available



information is impounded into market prices, and that as a consequence the cap-weighted market portfolio makes an optimal tradeoff between risk and return. However, there is strong evidence that many investors make decisions with partial information, that they lack requisite skill, and that they are constrained in their portfolio allocations by external factors. Haugen and Baker point out a number of factors that make the collective cap-weighted market portfolio less than efficient, including the broad divergence of return and risk forecasts used by investors, the many restrictions that exist on short selling, the need to consider taxation, and the participation of foreign investors with differing risk and return objectives. If such investors play an important role in price setting, the cap-weighted market portfolio might not be informationally efficient.

The chart above shows that a hypothetical minimum variance portfolio is able to achieve a greater return with much lower risk than a cap-weighted portfolio, represented by the S&P 500 index. This implies that a cap-weighted portfolio might not be efficient.

From Theory to Practice I – Constructing Low Volatility Portfolios

The lowest risk portfolio is the collection of stocks that in combination have lower risk than any other portfolio. Note that the lowest risk portfolio is not simply a portfolio of the lowest-risk stocks. A low-risk portfolio typically holds low beta and low volatility stocks. These stocks are chosen in such a way so as to take advantage of their correlation structure. The resulting portfolio should be an optimal combination of low risk stocks with lower levels of dependence with one another. This approach is expected to produce a lower risk portfolio than simple sorting approaches.

Taking the low volatility concept a step further, it is possible to construct “managed volatility” portfolios that lie slightly higher on the efficient frontier from the minimum variance point and would therefore have a slightly better risk-adjusted return. These are achieved by applying thoughtful constraints at the time of optimization in order to not overly rely on the risk estimates, as well as through the application of an effective model forecasting stock returns to target low-risk stocks with strong underlying fundamental characteristics, without distinct style tilts.

During the construction phase it is important to actively optimize risk exposure while controlling for transaction costs, liquidity, and other implementation issues. The end result is a low-risk portfolio with significant less volatility than cap-weighted market indices, but with the potential to deliver similar, if not higher, returns over a full market cycle.

From Theory to Practice II – Characteristics of Low Volatility Portfolios

Like cap-weighted index portfolios, low volatility portfolios are transparent, liquid and fully invested in long-only stocks. However, as one would expect, there are some key differentiating characteristics. The beta of a low volatility portfolio is in the range of 0.5 – 0.7 depending on the market environment. As a result the tracking error can be as large as 8-10% relative to a cap-weighted benchmark. A more appropriate benchmark would be a minimum volatility index that also has the objective of lowering volatility, which would reduce the tracking error to circa 4-5%. To best exploit the low volatility anomaly it is important to have exposure to the broadest investment universe. There are in particular many low-risk small-cap stocks that also offer attractive correlation characteristics. Low volatility portfolios can also deviate at the country and industry level. Low volatility portfolios have shown higher weightings to such industries as utilities and staples, and lower weightings to industries that have historically been high volatility, such as financials

— *The ability to limit drawdowns allows low volatility strategies to compound equity returns at a higher rate over time* —

and technology. Sector ranges have been wide and industry weightings have varied over time. It is a perception that low volatility strategies are not able to deliver market returns in rising markets. Both our historical hypothetical testing and actual five year live performance track record dispel that notion. In our experience market regimes are defined less by market direction and more by whether investors are departing significantly from norms in their tendency to reward or punish risky stocks.

Note that low-volatility portfolios are distinct from enhanced return strategies, in which systematic exposure to fundamental characteristics are believed to produce better-than-market returns over time. Rather than tilting toward specific

characteristics believed to enhance *returns*, low volatility portfolios are constructed to minimize *risk*. The goal of these strategies is to generate similar or higher returns to cap-weighted indices at significantly lower risk, resulting in a superior Sharpe ratio. Both low volatility and enhanced return strategies highlight inefficiencies in the cap-weighted index structure, but represent distinctly different paths to an improved risk-adjusted return. Importantly, the ability to limit drawdowns allows low volatility strategies to compound equity returns at a higher rate over time.

Strategies that are often mistakenly associated with low volatility portfolios are maximum diversification and risk-parity approaches. While such strategies may achieve better risk-adjusted returns than a cap-weighted index, it should be noted that these type of strategies do not explicitly exploit the low volatility anomaly.

It has been noted that low volatility portfolios have often displayed value or small-cap characteristics, although these are an incidental outcome – rather than a goal – of the portfolio construction process. This leads to the question of whether low volatility is actually traditional value or small-cap investing in disguise. Recent work (Taliaferro, 2011) based on U.S. data shows that low volatility and conventional active strategies appear to be distinct in important ways. While value and small-cap exposure can explain a portion of the historic returns realized by low volatility approaches, there is an important and significantly large component of low volatility returns that appears to be unrelated to value or small-cap factor exposures. Low volatility’s Sharpe ratio is higher than those of conventional strategies, suggesting that low volatility is not exploiting exactly the same mispricings as the conventional active strategies, because, at least for recent decades, conventional factors, such as value and size, only explains a small portion of low volatility’s return.

From Theory to Practice III – Using Low Volatility Portfolios

The most compelling aspect of a well-executed low volatility strategy is the long-term potential for delivering equity market-level returns at approximately one-third lower absolute risk than a cap-weighted benchmark. Over time, steadily capturing the equity risk premium at lower volatility has the potential to allow for dramatically improved compounded returns with smaller drawdowns (peak-to-trough decline). Not surprisingly, this combination of attributes can have a wide variety of applications in an asset allocation program.

Low volatility strategies are now being employed by a growing number of investors around the world. Assuming the portfolio objectives of lower risk with equity like returns are met, low volatility can be used as a:

1 Risk reducer:

Reduce total portfolio risk by replacing a portion of a traditional equity allocation with low volatility.

The surge in equity market volatility has reduced most plan sponsors’ appetite for asset volatility. As such, many liability-driven investors, specifically mature defined-benefit plans, are seeking to reduce total portfolio risk. Low volatility strategies can potentially be used to accomplish this objective without reducing equity exposure or sacrificing expected return. Industry-wide and corporate pension plans with a range of funding ratios find this approach compelling, because they have the opportunity to reduce shortfalls during significant down markets.

2 Return enhancer:

Increase expected return without increasing expected plan-level volatility.

The current underfunded status of some pension funds necessitates high returns to meet obligations

Historical Risk, Return, and Correlation 1968 - 2010							
	Annualized Returns (%)	Standard Deviation (%)	Stocks	Bonds	Cash	Minimum Variance	
Stocks	9.5	15.6	1.00				
Bonds	8.1	10.2	0.19	1.00			
Cash	5.6	0.8	-0.01	0.06	1.00		
Minimum Variance	11.5	11.1	0.76	0.31	0.01	1.00	

Risk Reducing Asset Allocation						Constant Risk Asset Allocation					
Stocks	50%	40%	30%	20%	10%	Stocks	50%	46%	42%	37%	31%
Bonds	40%	40%	40%	40%	40%	Bonds	40%	34%	28%	23%	19%
Cash	10%	10%	10%	10%	10%	Cash	10%	10%	10%	10%	10%
Minimum Variance	0%	10%	20%	30%	40%	Minimum Variance	0%	10%	20%	30%	40%
Annualized Return	8.6	8.8	9.0	9.2	9.4	Annualized Return	8.6	8.9	9.1	9.4	9.7
Annualized Risk	9.4	8.9	8.5	8.1	7.9	Annualized Risk	9.4	9.4	9.4	9.4	9.4
Sharpe Ratio	0.31	0.35	0.39	0.43	0.47	Sharpe Ratio	0.31	0.34	0.37	0.40	0.43

In the above tables, stocks refer to the S&P 500 Index and bonds refer to the Barclays U.S. Government Aggregate Index. Source: Acadian Asset Management LLC, AAM US, CRSP, CRSP®, Center for Research in Security Prices. Graduate School of Business, The University of Chicago. Used with permission. All rights reserved. crsp.uchicago.edu, S&P Universe of Securities. For illustrative purposes only. This is meant to be an example of asset allocation and is not intended to represent investment returns generated by an actual portfolio. The simulated results do not represent actual trading or an actual account, but were achieved by means of retroactive application of a model designed with the benefit of hindsight for the period specified above. Results are gross would be reduced by advisory fees. Results reflect transaction costs and other implementation costs. Reference to the benchmark is for comparative purposes only. Every investment program has the opportunity for loss as well as profit. Index Source: Copyright © 2011, Standard & Poor’s Financial Services LLC. All rights reserved.

to retirees. Some clients utilize low volatility strategies as a way to potentially increase expected return while maintaining current risk levels. The attractive characteristics of low volatility strategies make this possible. These strategies lie somewhere between equity and fixed income on the risk spectrum, while providing full exposure to stocks. Replacing equal portions of core equity and bond allocations with low volatility portfolios allows a sponsor to increase expected return potential without increasing risk.

3 Equity diversifier: Differentiated return profile within a multi-manager framework.

Most pension funds have their equity exposure either allocated passively or actively to a cap-weighted index. When using multiple active managers with a tracking error limit, the managers' risk profile will look very similar. By introducing alternative beta strategies, such as low volatility, it is likely that their lower correlation will result in greater diversification and a more advantageous risk/return profile.

More recently, pension funds have been increasing their emerging markets equity exposure, as they seek to benefit from the economic growth prospects in this asset class. Unfortunately emerging markets tend to experience higher volatility. A low volatility portfolio focused on emerging markets is a natural solution to capture this equity premium without increasing total portfolio risk.

The data below provides a summary of how low volatility portfolios compare to other asset classes, and some suggested allocations based on return and risk data. As the data shows, an allocation to the minimum variance asset class can either replace part of the allocation to stocks, thereby reducing overall portfolio risk (lower left table) or significantly increase the allocation to equities by taking from bonds in a way which maintains plan level risk while enhancing expected returns (lower right table). The optimal allocation to low volatility varies among pension funds and depends on the risk budget. According to our research, some pension funds have replaced 20-25% of their current equity portfolio to reduce plan volatility.

Summary

Classic finance theory says that investors who buy higher-risk stocks will be compensated with higher returns. The empirical reality is that a positive relationship between risk and return is hard to find, based on over 40 years of U.S. equity market data and more recent evidence from around the world. The low volatility anomaly is well supported by both behavioral finance and structural characteristics of the marketplace that appear very likely to persist.

The simple conclusion is that investors should consider an allocation to lower risk stocks. Such portfolios may offer equity-like returns at lower

risk, and as such can be used to lower plan risk, increase equity allocations while maintaining risk, diversify, or simply enjoy the benefits of equity returns compounding at a higher rate.

References

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Notes

- 1 Sander van Ouwerkerk works for Acadian Asset Management (UK) Limited.
- 2 Baker, Malcolm, Brendan Bradley, and Jeffrey Wurgler, 2011, "Benchmarks as limits to arbitrage: understanding the low-volatility anomaly," *Financial Analysts Journal* 67 (1) pp. 40-54. Available at: <http://www.acadian-asset.com/documents/FAJArticleJanFeb2011.pdf>.
- 3 For example, for the period 1999-2010, hypothetical minimum variance portfolios formed for European, EAFE, and Japanese stock markets achieved risk reductions of at least a third of cap-weighted benchmark risk, while realizing an increase in average returns of at least 300 basis points. Source: Acadian Asset Management LLC research.
- 4 Minimum variance portfolio methodology: at each monthly rebalance, a five-factor principal components model was estimated for the top 1,000 (by market capitalization) U.S. stocks using the prior sixty months of returns, and the variance-covariance matrix implied by the principal components model was used to form a portfolio that had the lowest possible (i.e., minimum) variance. This simulated portfolio was formed without adjustments for transaction costs or management fees. Source of data: CRSP.