The Alpha Risk of Low Volatility Investing

By Quantitative Equity Team at TD Asset Management Inc.

The primary objective of low volatility investing is to reduce risk — and more importantly, to do so without sacrificing long-term returns. Therefore, a more accurate definition of the objective of low volatility investing is to generate alpha through risk reduction. However, this does not guarantee delivering the lowest possible alpha volatility. Even though the alpha delivered by low volatility investing compares extremely favourably to other common factors both in terms of strength and stability, episodes of negative alpha that may last for an entire year, and even possibly longer, cannot be ruled out. The COVID-19 pandemic has demonstrated this.

That said, seeking to reduce the alpha volatility of a low volatility portfolio can be challenging. Naive approaches, which typically rely directly or indirectly on tracking error reduction or on neutralizing certain risk dimensions such as exposure to certain sectors, usually result in sacrificing more alpha than reducing alpha volatility. Even if the objective of reducing alpha volatility is considered to be noble and desirable by most investors, it is not without complexity or without cost.

This paper examines in detail the tricky question of the alpha risk of low volatility investing.

The upside/downside asymmetry of low volatility investing

The low volatility anomaly is one of the most enduring proofs that the widely taught Capital Asset Pricing Model, which links the risk of a security to the return it's expected to produce, is a poor approximation of real-world financial markets. Strictly by reducing risk and by remaining agnostic to expected stock returns, an investor can generate better than market returns over reasonably long investment horizons, with lower than market risk. In doing so, the investor can also expect to reap attractive return characteristics compared to the market, generally in the form of strong downside protection, while maintaining a disproportionate upside capture when the market rallies. In other words, investors can expect some degree of asymmetry in the upside and downside captures of their low volatility portfolio.

This upside/downside asymmetry is one of the key characteristics that makes low volatility investing so attractive to many investors. While investors may feel some pain from their underperformance in strong market rallies, the even stronger downside protection observed when markets drop provides some relief from this pain. As long as a low volatility strategy keeps delivering numbers like the ones in **Figure 1**, investors generally feel confident that they are following the right strategy.

Figure 1: Average monthly return (%) of U.S. low volatility quintile in up and down markets from 1963 to 2021

	Low volatility	Market	Capture
Up months	2.74	3.54	77.40%
Down months	-1.55	-3.44	45.19%

Source: Kenneth R. French. As at June 2021.[1]

One might wonder why this asymmetry exists from a theoretical standpoint, and what makes us think that it should persist over time. It may be tempting to believe that low volatility investing presents an asymmetrical behaviour in up and down markets due to a non-linear relationship between low volatility and market returns. However, the difference in capture ratios does not come from non-linearity as much as from steady beta-adjusted returns, or alpha, being generated over time. And this alpha simply comes from the fact that, given similar long-term positive returns, the portfolio that exhibits the lowest systematic risk will, on average, generate the most alpha.

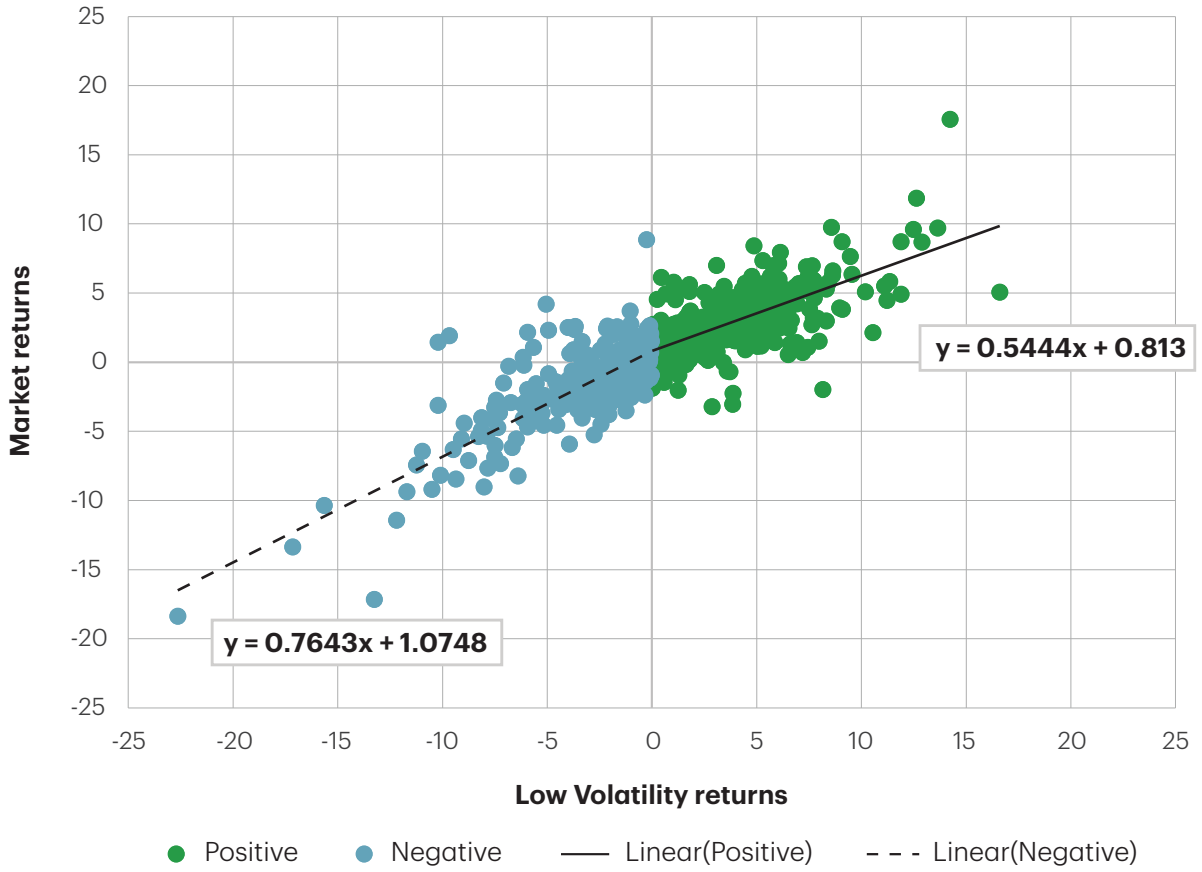
strategy

[1] https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

This phenomenon can be illustrated by estimating conditional betas of a low volatility portfolio in up and down markets (approximated by an equally weighted low volatility quintile portfolio). In **Figure 2**, we can see that in the U.S. equity market since 1963, not only would a low volatility portfolio not have had a higher beta in up markets than in down markets, but the beta of the low volatility portfolio would have been lower in up markets than down markets, on average (as indicated by the first terms of the linear equations in grey: 0.5444 < 0.7643).

This negative convexity phenomenon, however, would have been much more than offset by the strong positive intercept of the regression lines in both up and down markets (0.813 and 1.0748, respectively). This intercept is essentially alpha – average returns generated by the low volatility portfolio that cannot be explained by its beta. And this positive alpha translates in the long run into higher upside than downside capture ratios, as shown in Figure 1.

Figure 2: Upside, downside and alpha



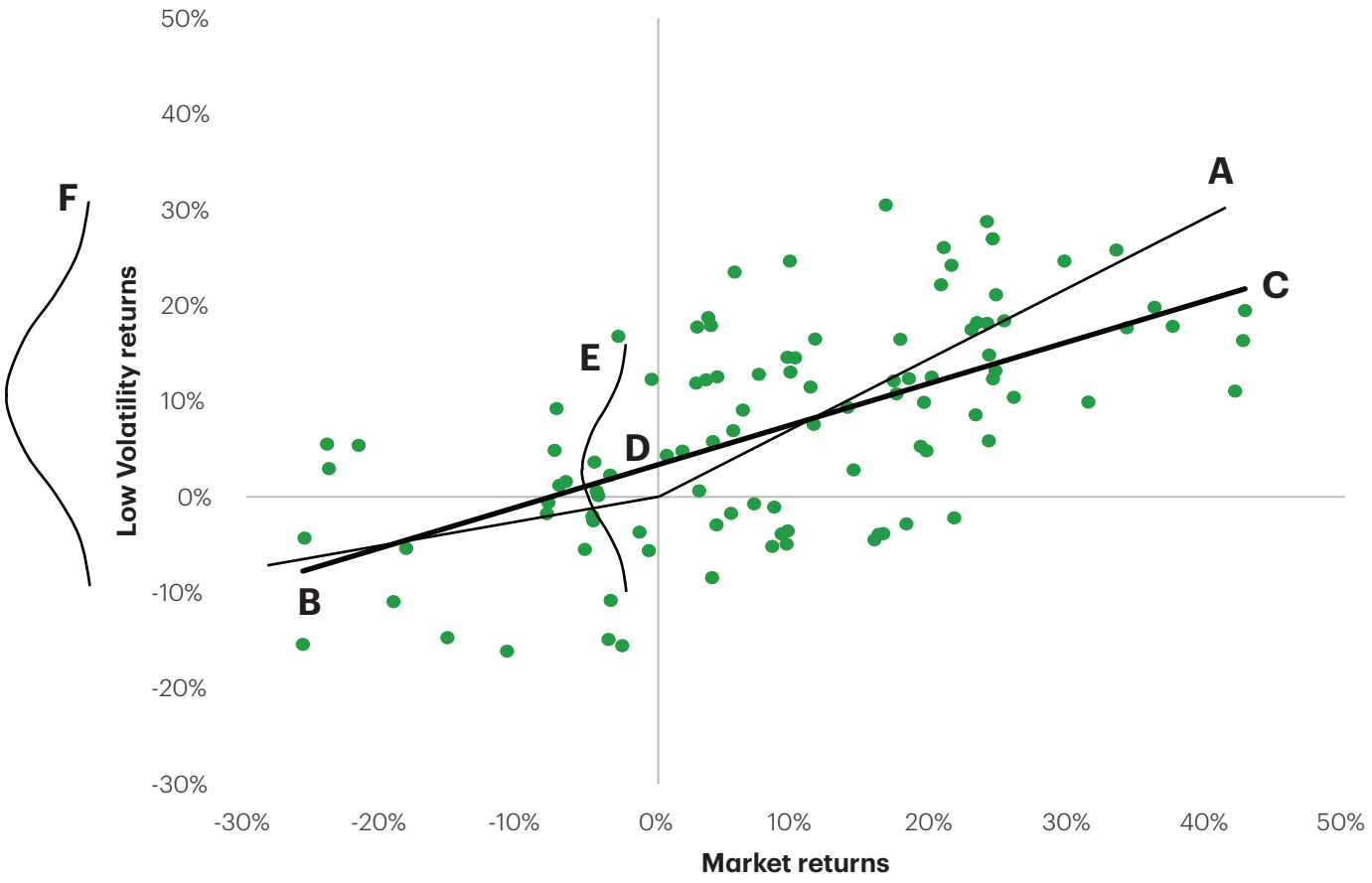
Source: Kenneth R. French. As at June 2021.[2]

Low volatility strategies seek not only to reduce risk, but more importantly to exploit a market anomaly providing long-term returns that compete with those of the market. These strategies implicitly generate alpha through a positive upside/downside capture asymmetry. In other words, low volatility investors largely seek to generate alpha through risk reduction.

[2] https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Figure 3 illustrates those key considerations in a unified form, and how they relate to one another. While the goal of the low volatility strategy is primarily to reduce the variance of the total return distribution F, it also aims to reduce the systematic risk of the portfolio, or the slope of the regression line C. In doing so, however, the expectation is that the long-term returns of the portfolio will not be compromised. Therefore, the residual returns that are unexplained by the slope of line C will have a positive average, resulting in a positive intercept for line C or positive alpha D. Given this positive alpha D, upside capture ratio A and downside capture ratio B will also exhibit the asymmetry that investors seek.

Figure 3: Low Volatility Returns Versus Market Returns



Source: TD Asset Management Inc. For illustrative purposes only.

However, there is still one unaddressed variable. While a low volatility portfolio may seek to minimize the variance of total return distribution F, the variance of alpha, or beta-adjusted return distribution E, may not be fully minimized. In other words, a low volatility portfolio that has the lowest possible volatility will not simultaneously have the lowest possible alpha volatility.

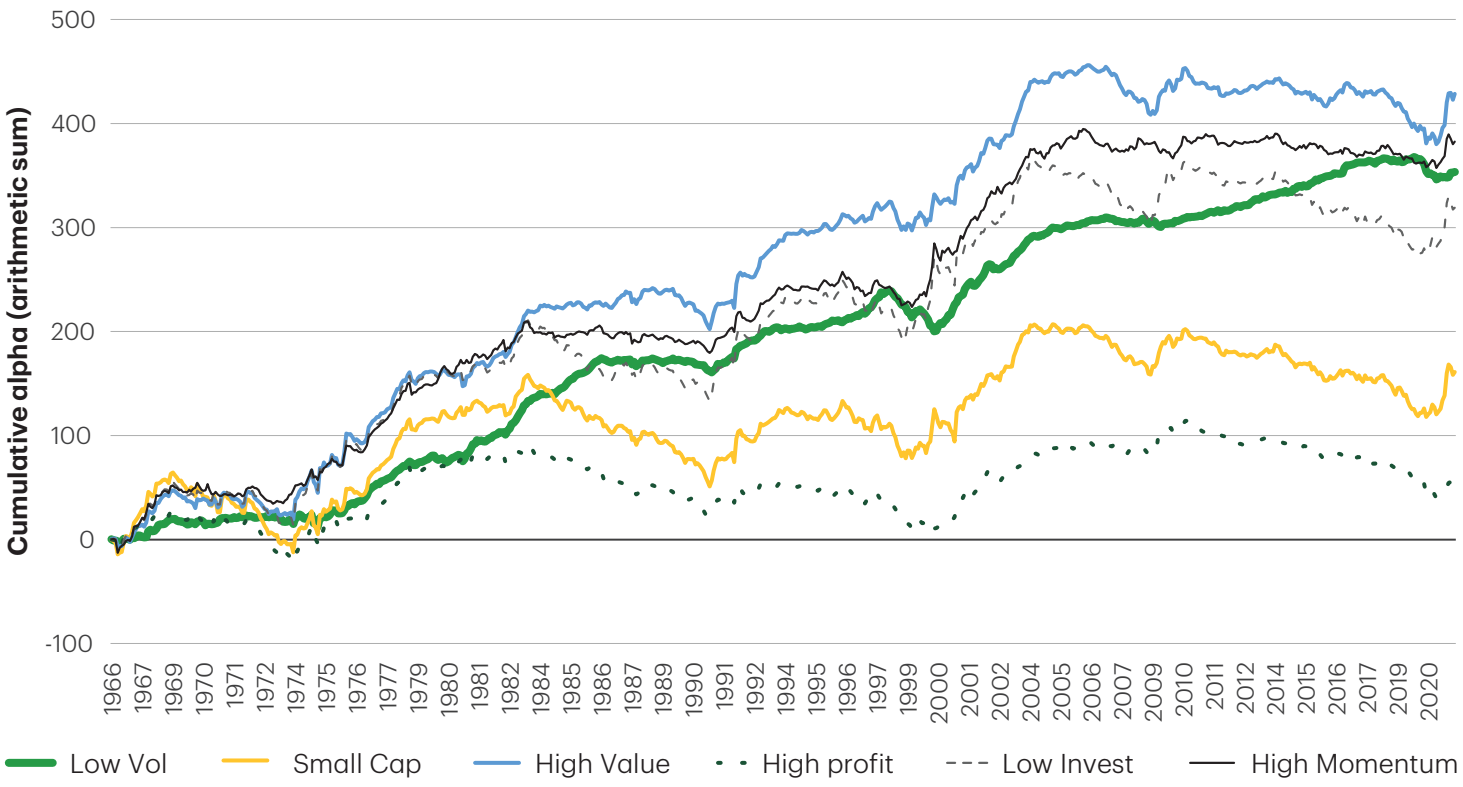
This leads to the unfortunate consequence of not necessarily having the most stable upside/downside capture asymmetry over time. This is a phenomenon that most low volatility investors experienced intensely in 2020, due to the COVID-19 pandemic, and previously in the late 1990s, due to the technology bubble slowly taking form. As we will see later, solving this problem is not easy, and taking a naïve approach to it may lead investors to leave much more alpha on the table than they might have hoped for in the long run.

How low volatility alpha compares to the alpha of other factors

Before we dig further into the alpha volatility of a low volatility portfolio, let's first do a quick comparative analysis. How does low volatility fare in terms of alpha generation - and in terms of risk-adjusted alpha - compared to other well-known alpha-generating factors?

As we can observe in **Figure 4**, since 1966, low volatility has been not only one of the strongest alpha generators, but also by far one of the most consistent and sustained ones over time. This is largely attributable to the fact that low volatility investing generates alpha by pushing down beta much more than by generating excess returns, in contrast with other traditional factors. Therefore, the persistence of the low volatility anomaly cannot be easily arbitraged away like other well documented anomalies which don't tend to exist much longer than the time it takes to identify and document them.

Figure 4: Cumulative alpha from various factor quintiles

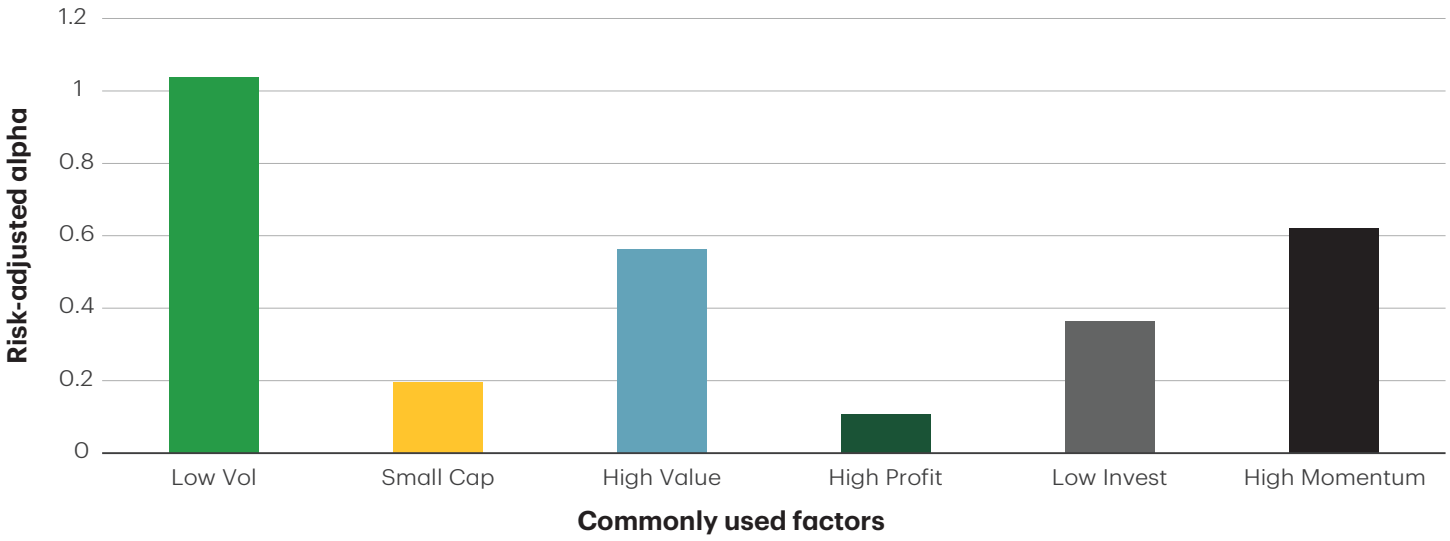


Source: Kenneth R. French. As at June 2021.[3]

[3] https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

But it's really when it comes to the stability of alpha generation that low volatility strongly outperforms the other factors. Given the strength and consistency of the alpha which low volatility investing produces over time, it's no surprise that the risk-adjusted alpha, or the alpha divided by its volatility, generated by low volatility dwarfs the alpha generated by any other investment style. This phenomenon likely won't disappear anytime soon.

Figure 5: Risk-adjusted alpha of various factor quintiles



Source: Kenneth R. French. As at June 2021.[4]

Therefore, compared to other investment styles and factors, low volatility may turn out to be extremely difficult to beat when it comes to generating steady alpha. Yet, after difficult years such as 2020, low volatility investors may find themselves questioning how long periods of negative alpha, and the resulting inverted upside/downside asymmetry, can possibly persist. Is there a simple way to reduce the alpha risk of a low volatility portfolio to further limit the likelihood of negative alpha episodes like 2020? And if so, at what cost?

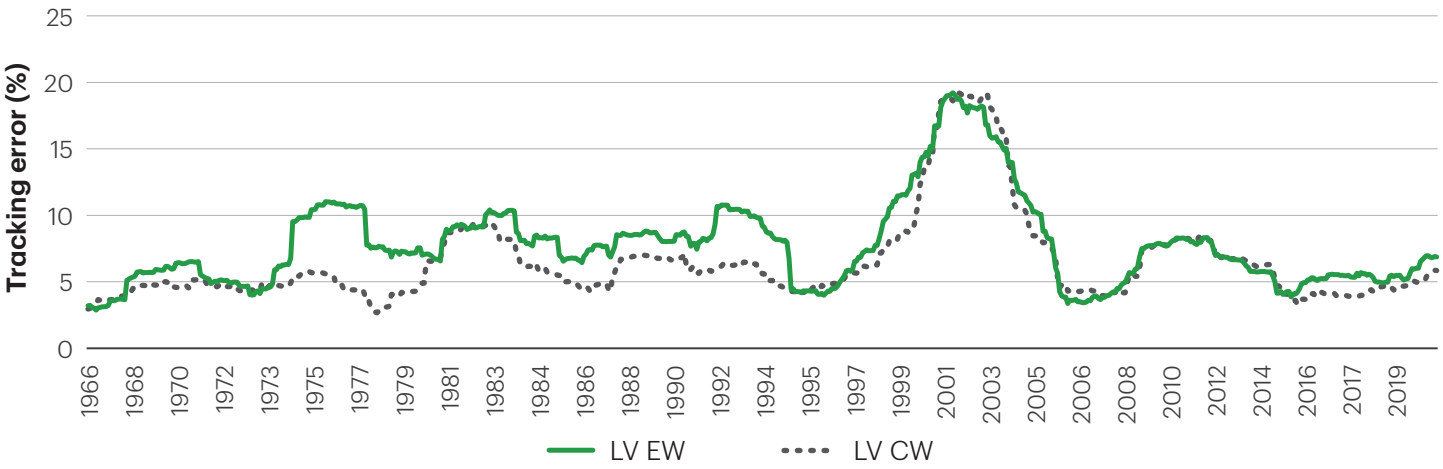
[4] https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Low volatility alpha risk and portfolio weighting schemes

Our examples so far were based on equally weighted low volatility portfolios. One way to reduce the alpha risk is to use a different weighting approach. For instance, when weighting the stocks by capitalization, one can hope to maintain some degree of exposure to the low volatility anomaly while also reducing their tracking error and, hopefully, their alpha risk as well.

As we can see in **Figure 6**, this intuition proves to be correct when it comes to tracking error. Simply by reweighting the same low volatility stocks to match a capitalization-weighted benchmark more closely, one can reduce the tracking error of the portfolio quite meaningfully over time.

Figure 6: Tracking error

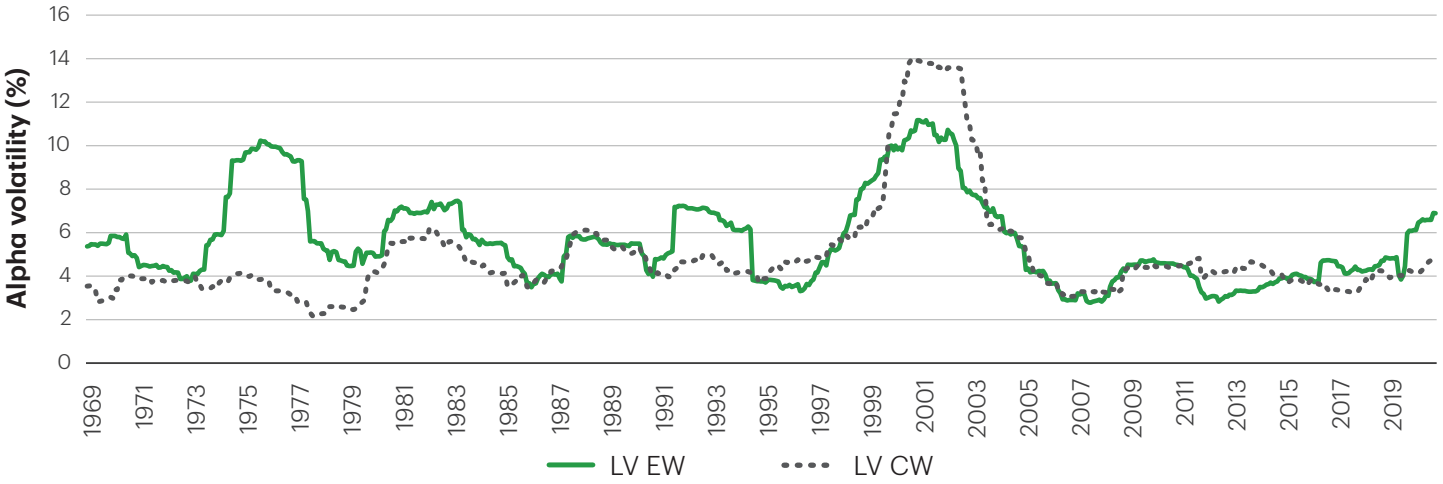


Source: Kenneth R. French. As at June 2021.[5]

Not surprisingly, reducing tracking error can also have the ultimate consequence of reducing alpha risk as well. After all, alpha risk can literally be rewritten as a function of absolute risk and tracking error, and their covariance.

As a result, the alpha volatility of the cap-weighted low volatility portfolio will generally be lower than the alpha volatility of the equally-weighted low volatility portfolio.

Figure 7: Alpha volatility

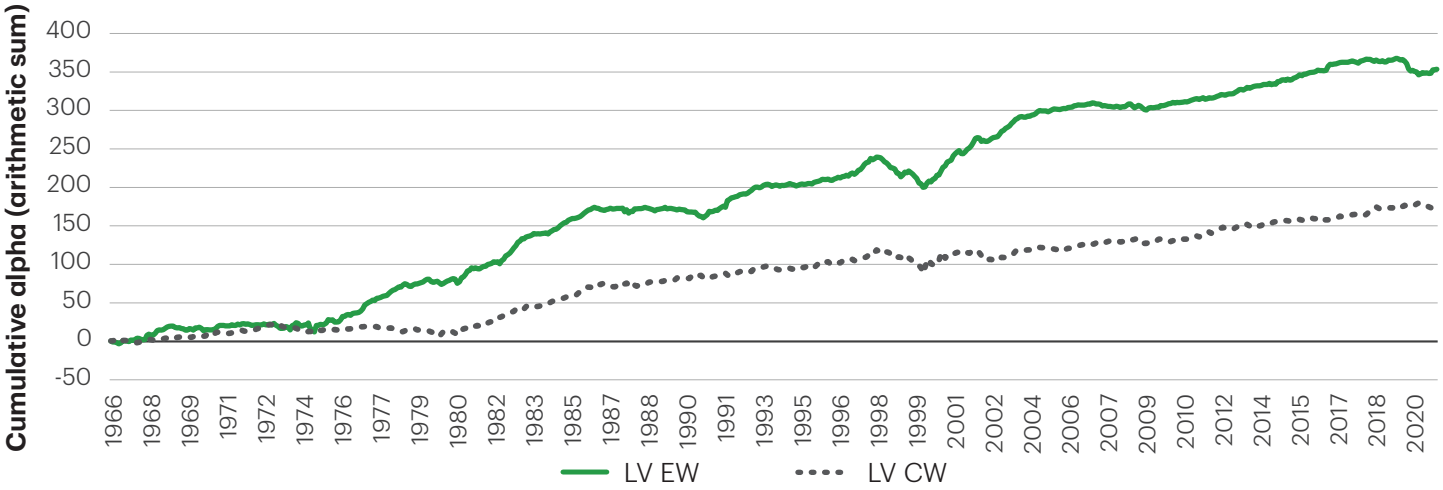


Source: Kenneth R. French. As at June 2021.[6]

[5,6] https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Reducing alpha volatility can therefore be done through a weighting scheme that reduces tracking error. However, by doing so, we should also expect to limit our risk reduction capability, and consequently reduce our ability to extract alpha from the low volatility anomaly through systematic risk reduction. This can be observed quite distinctively through the cumulative alpha generated by both the cap- weighted and the equally-weighted low volatility quintile portfolios over time.

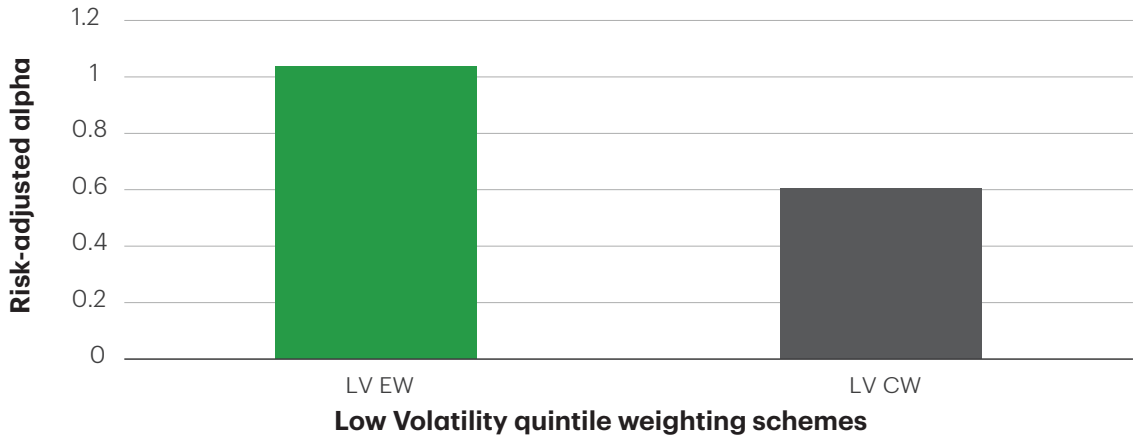
Figure 8: Cumulative alpha on low volatility quintiles



Source: Kenneth R. French. As at June 2021.[7]

Since 1966, the equally-weighted low volatility portfolio generated nearly twice as much alpha as did the cap-weighted low volatility portfolio. Given the slight reduction in alpha risk obtained by the cap-weighted scheme and by the tracking error reduction, one can notice that the alpha is being reduced much more than proportionally to the reduction in alpha risk. So, if reducing tracking error in such a way increases the stability of the alpha, it may not be worth the sacrifice in alpha over the long run. On a risk-adjusted alpha basis, the equally-weighted low volatility portfolio dominates the cap-weighted one by a large margin.

Figure 9: Risk-adjusted alpha of low volatility quintiles



Source: Kenneth R. French. As at June 2021.[8]

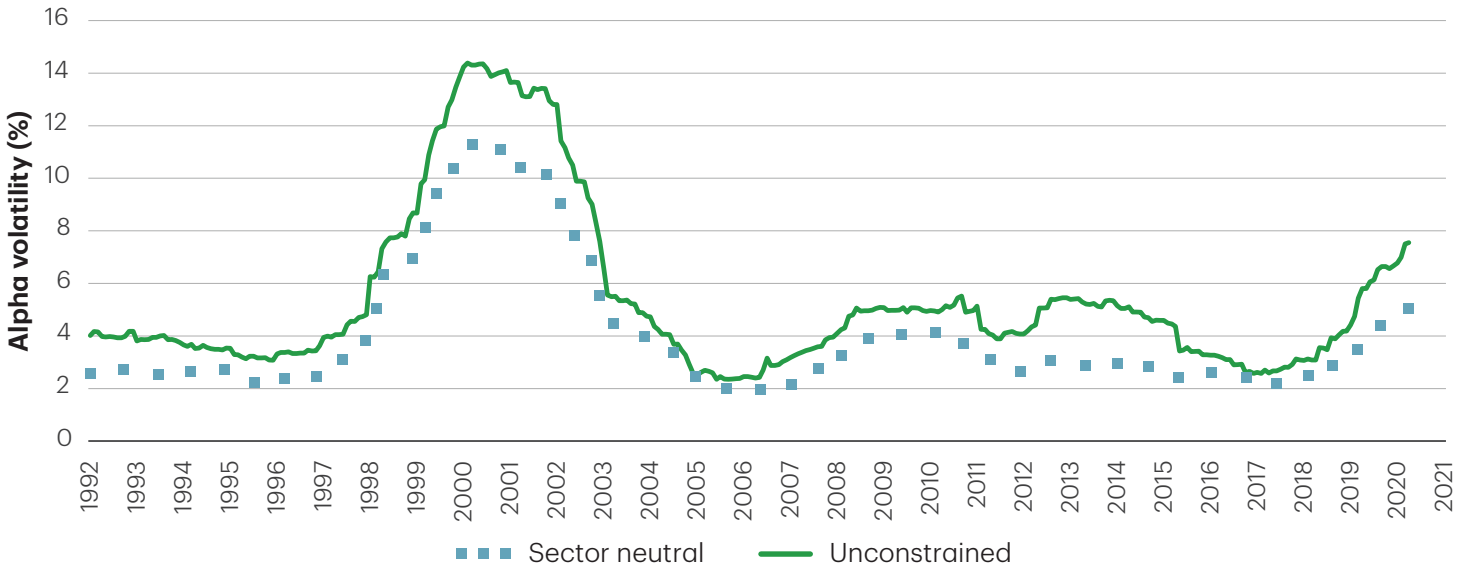
[7,8] https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Low volatility alpha risk and sector exposures

We can explore how various dimensions of tracking error contribute to alpha risk and to alpha generation. In the previous exercise we naively reduced tracking error and alpha risk by adopting a portfolio weighting scheme that was closer to the cap-weighted benchmark than would be an equally-weighted portfolio. However, one could also adopt a neutralization approach, where the volatility measurements are orthogonalized for specific exposures before building our quintile portfolio to possibly reduce alpha risk without proportionally reducing the low volatility alpha generated over time.

In contrast to the previous experiment, which relied on the entire U.S. stock market since 1963, here we built a U.S. low volatility quintile portfolio using volatility measurements orthogonalized for sectors, since 1992. About a quarter of the alpha risk resulting from the low volatility anomaly is the result of sector deviations, which greatly reduce alpha risk once neutralized.

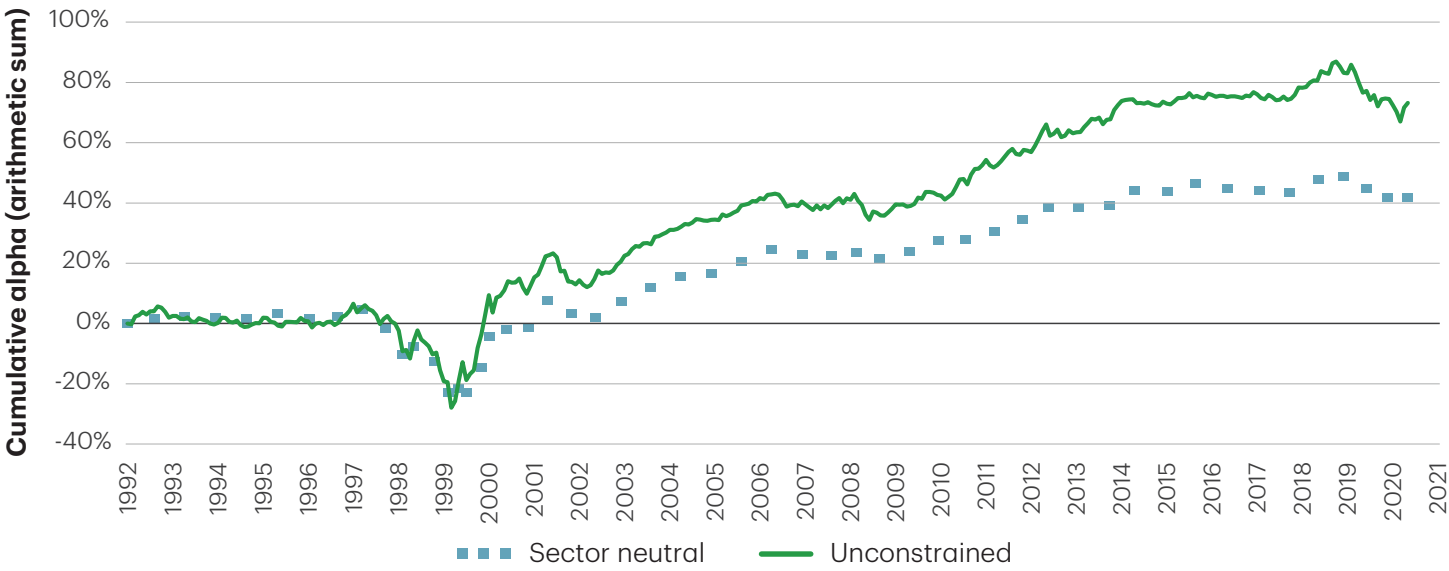
Figure 10: Alpha volatility of sector-neutral low volatility quantile



Source: TD Asset Management, S&P 500. As at April 2021.

However, once again the reduction in alpha risk obtained by neutralizing sectors is not without cost in terms of alpha generated over time. While about a quarter of the volatility of the alpha can be reduced by neutralizing sectors, a bit more than 40% of the alpha generated by the low volatility anomaly also evaporates by doing so.

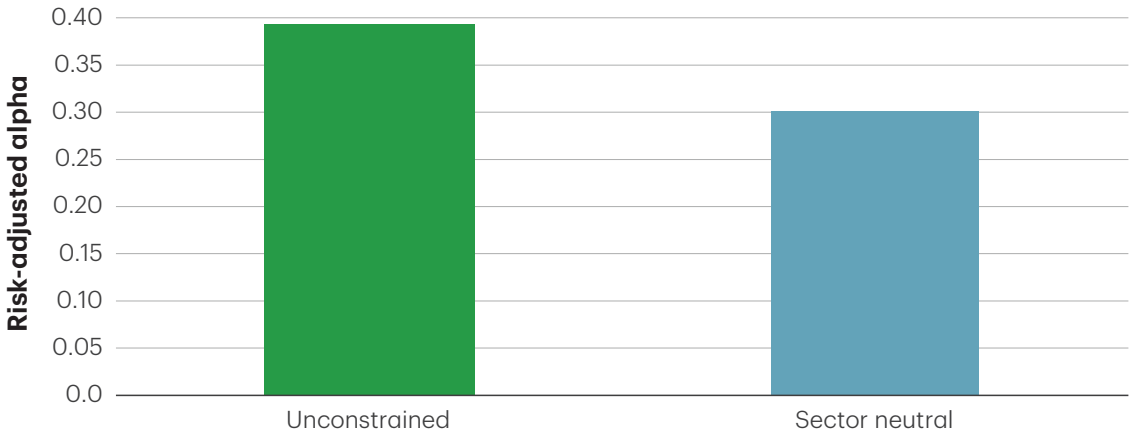
Figure 11: Cumulative alpha on sector-neutral low volatility quantile



Source: TD Asset Management, S&P 500. As at April 2021.

As a result, the alpha risk reduction obtained by sector neutralization is not worth the loss in total alpha generated over time and leads to a meaningful reduction in the risk-adjusted alpha produced by the low volatility anomaly.

Figure 12: Risk-adjusted alpha of sector-neutral low volatility quantile



Source: TD Asset Management, S&P 500. As at April 2021.

Here again, a low volatility investor concerned with alpha risk should be careful about which dimensions of risk to neutralize. Reducing sector deviations may end up stabilizing the alpha and the upside/downside capture asymmetry to some extent, but it will also disproportionately hurt its alpha and its attractive asymmetric upside/downside capture profile.

While the desire to reduce alpha volatility is understandable, investors should keep in mind that this undertaking can be complex and costly. Reducing alpha volatility through the introduction of naïve benchmark-relative constraints, or by unconditionally limiting tracking error, for example, may very well end up costing an investor more alpha than reducing their alpha risk, in the long run.

Most investors out there who hope for a secret recipe that delivers sustained alpha in every imaginable market scenario probably need to readjust their expectations. While some portfolio construction methodologies can help achieve better risk-adjusted alpha, there is no such a thing as risk-free alpha and there never will be. ■

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