



Risk-Adjusted Momentum: A Momentum and Low-Volatility Barbell?

October 21, 2019

SUMMARY

- After the Great Financial Crisis, the Momentum factor has exhibited positive returns, but those returns have been largely driven by the short side of the portfolio.
- One research note suggests that this is driven by increased risk aversion among investors, using the correlation of high volatility and low momentum baskets as evidence.
- In contradiction to this point, the iShares Momentum ETF (MTUM) has generated positive excess annualized returns against its benchmark since inception. The same note suggests that this is due to the use of risk-adjusted momentum measures.
- We explore whether risk-adjusting momentum scores introduces a meaningful and structural tilt towards low-volatility equities.
- For the examples tested, we find that it does not, and risk-adjusted momentum portfolios behave very similarly to momentum portfolios.

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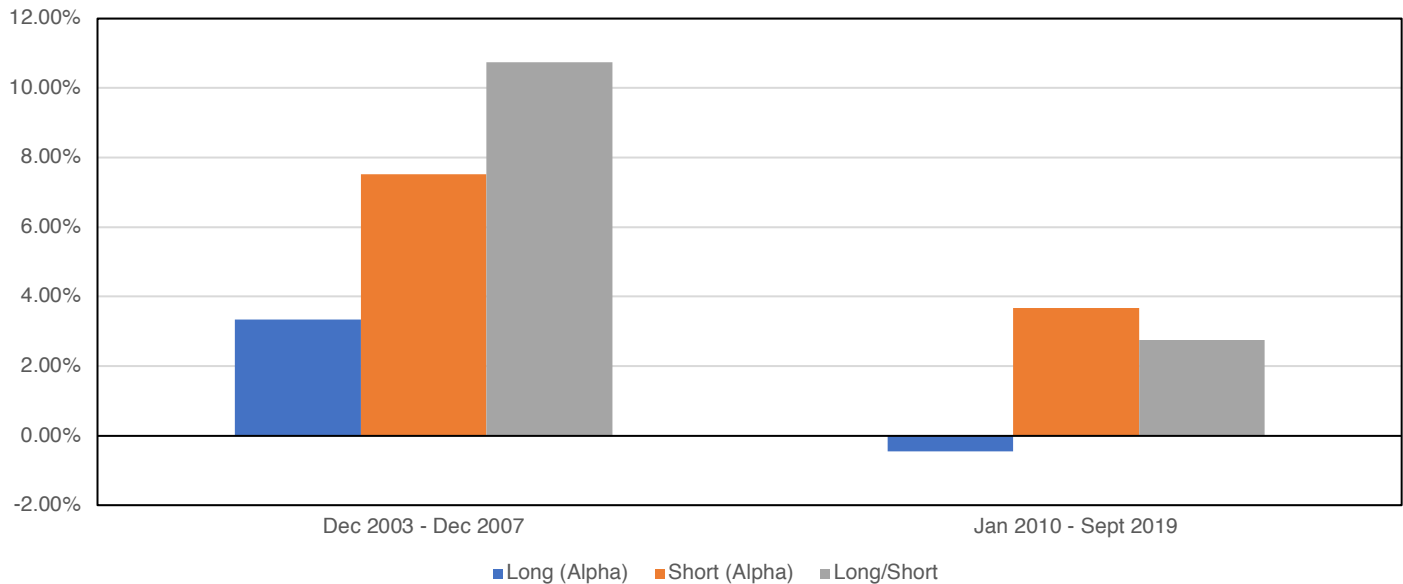
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A research note recently crossed my desk that aimed to undress the post-Global Financial Crisis (GFC) performance of the momentum factor in U.S. equities. Not only have we witnessed a significant reduction in the factor's return, but the majority of the return has been generated by the short side of the strategy, which can be more difficult for long-only investors to access.

Momentum Factor Returns Pre- and Post-GFC

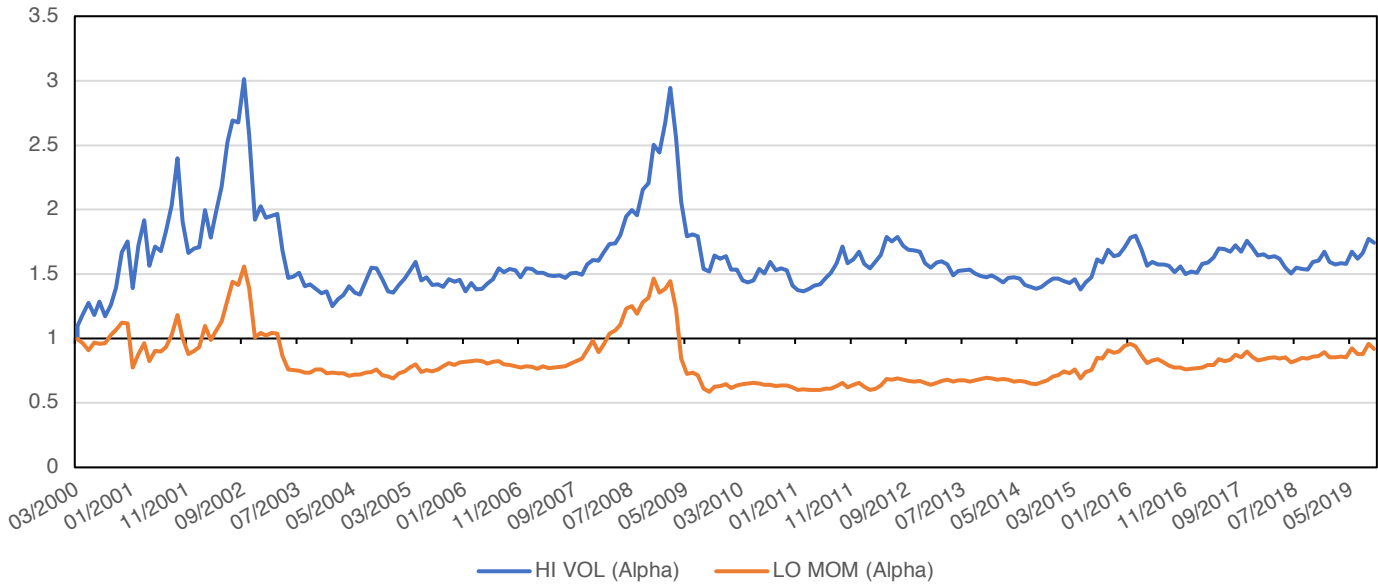


Source: Sharadar. Calculations by Newfound Research. Past performance is not an indicator of future results. Performance is backtested and hypothetical. Performance figures are gross of all fees, including, but not limited to, manager fees, transaction costs, and taxes. Performance assumes the reinvestment of all distributions. The Long (Alpha) strategy is a monthly rebalanced portfolio that goes long, in equal weight, the top 50 securities in the S&P 500 ranked on 12-1 month momentum and shorts an equal-weight S&P 500 portfolio. The Short (Alpha) strategy is a monthly rebalanced portfolio that goes long an equal-weight S&P 500 portfolio and shorts, in equal weight, the bottom 50 securities in the S&P 500 ranked on 12-1 month momentum.

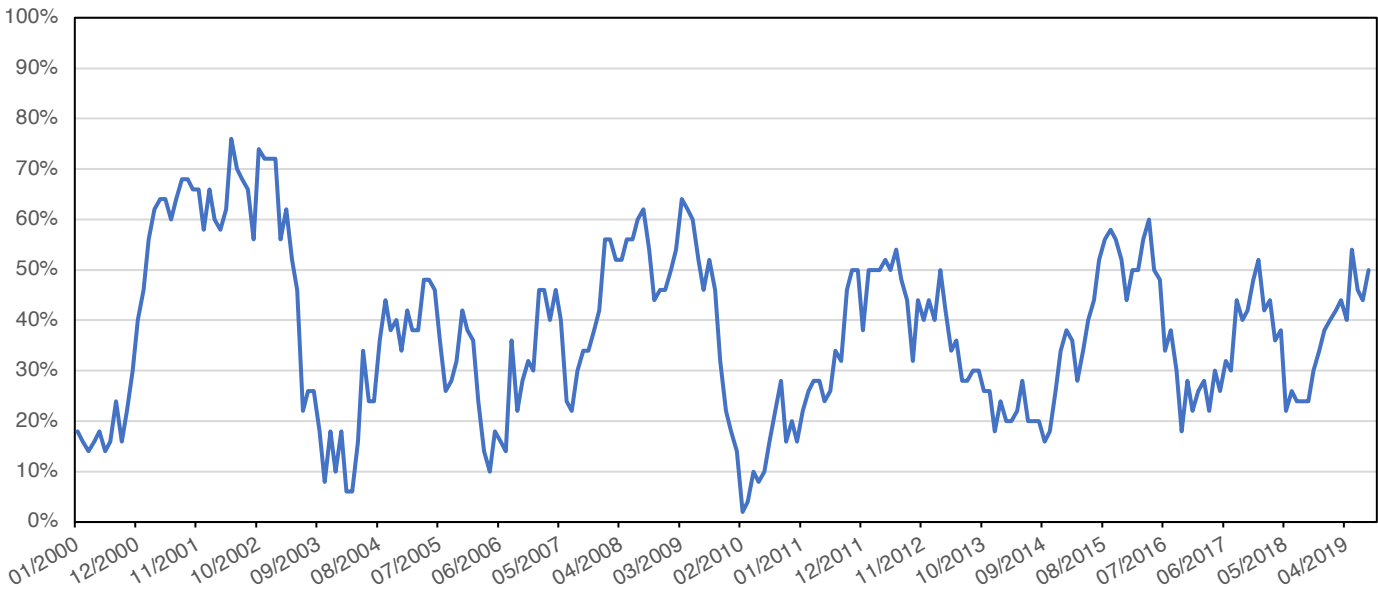
The note makes the narratively-appealing argument that the back-to-back recessions of the dot-com bubble and the Great Financial Crisis amplified investor risk aversion to downside losses. The proposed evidence of this fact is the correlation of the cumulative alpha generated from shorting low momentum stocks and the cumulative alpha generated from shorting high volatility stocks.

While correlation does not imply causation, one argument might be that in a heightened period of risk aversion, investors may consistently punish higher risk stocks, causing them to become persistent losers. Or, conversely, losers may be rapidly sold, creating both persistence and high levels of volatility. We can arguably see this in the convergence of holdings in low momentum and high volatility stocks during “risk off” regimes.

Cumulative Alpha



Percent Holdings Overlap in Low Momentum and High Volatility Decile Portfolios



Source: Sharadar. Calculations by Newfound Research. Past performance is not an indicator of future results. Performance is backtested and hypothetical. Performance figures are gross of all fees, including, but not limited to, manager fees, transaction costs, and taxes. Performance assumes the reinvestment of all distributions. The HI VOL (Alpha) strategy is a monthly rebalanced portfolio that goes long an equal-weight S&P 500 portfolio and shorts, in equal weight, the bottom 50 securities in the S&P 500 ranked on trailing 252-day realized volatility. The LO MOM (Alpha) strategy is a monthly

rebalanced portfolio that goes long an equal-weight S&P 500 portfolio and shorts, in equal weight, the bottom 50 securities in the S&P 500 ranked on 12-1 month momentum.

Given these facts, we would expect long-only momentum investors to have harvested little out-performance in recent years. Yet we find that the popular iShares Momentum ETF (MTUM) has out-performed the S&P 500 by 290 basis points per year since its inception in 2013.

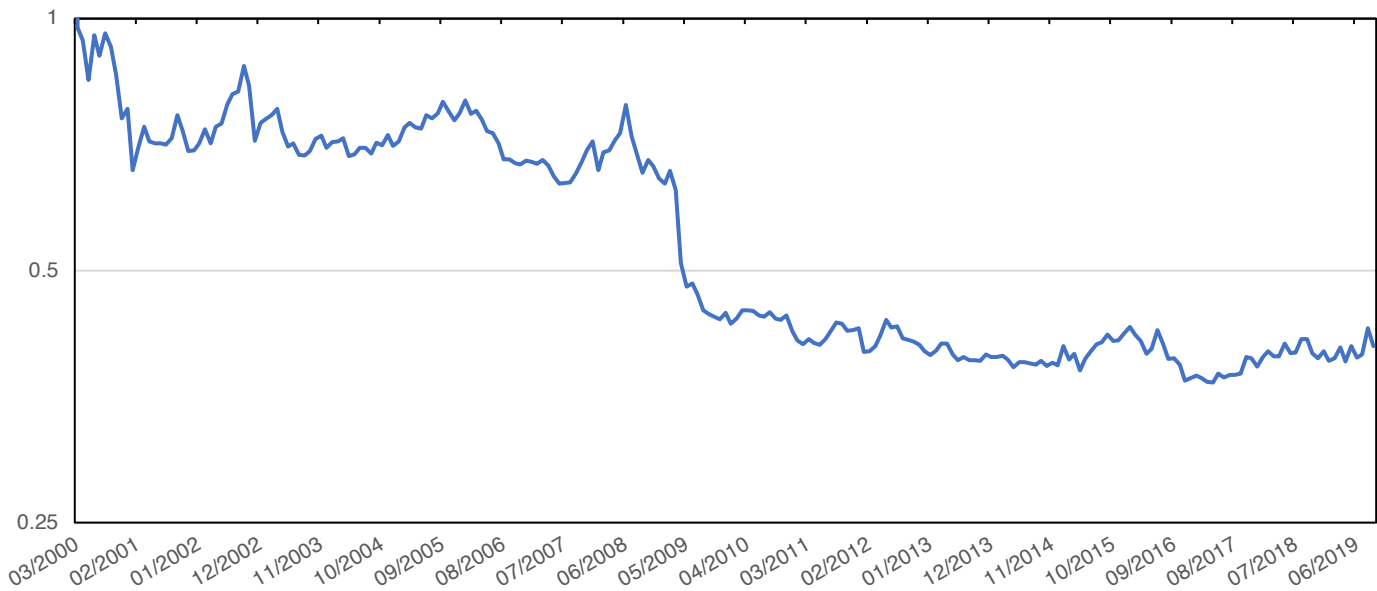
The answer to this conundrum, as proposed by the research note, is that MTUM's use of *risk-adjusted* momentum is the key.

If we think of risk-adjusted momentum as simply momentum dividend by volatility (which is how MTUM defines it), we might interpret it as an integrated signal of both the momentum and low-volatility factors. Therefore, risk-adjusting creates a multi-factor portfolio that tilts away from high volatility stocks.

And hence the out-performance.

Except if we actually create a risk-adjusted momentum portfolio, that does not appear to really be the case at all.

Cumulative Alpha of Risk-Adjusted Momentum Portfolio



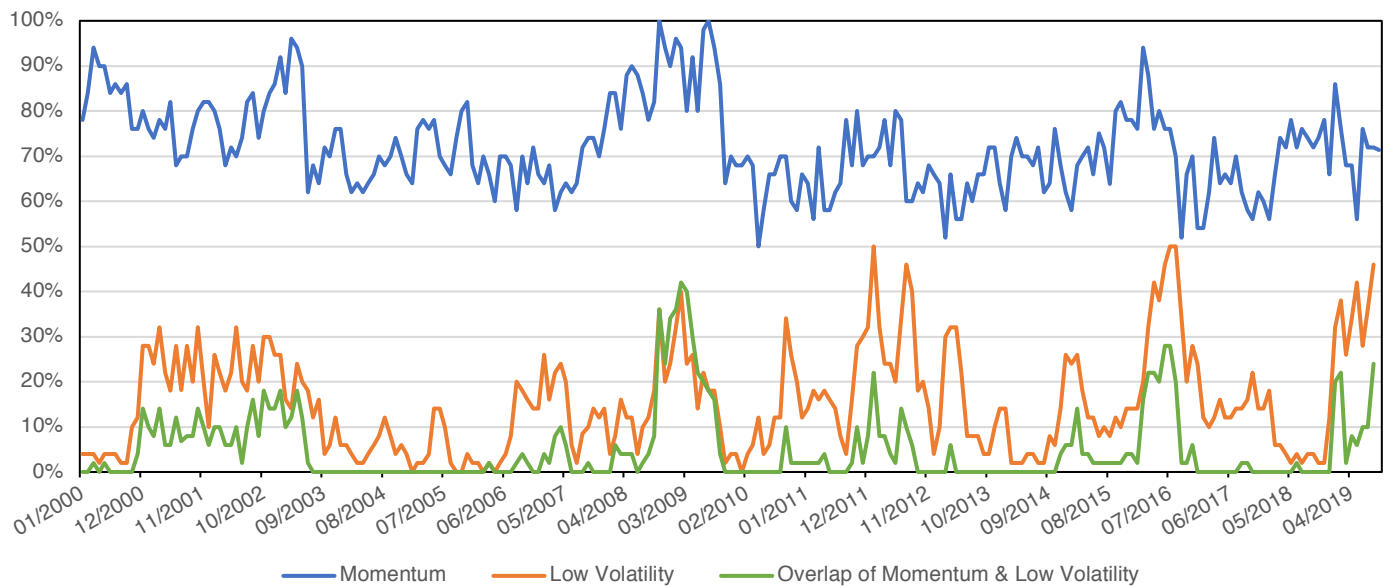
Source: Sharadar. Calculations by Newfound Research. Past performance is not an indicator of future results. Performance is backtested and hypothetical. Performance figures are gross of all fees, including, but not limited to, manager fees, transaction costs, and taxes. Performance assumes the reinvestment of all distributions. The alpha of the risk-adjusted momentum strategy is defined as the return of a monthly rebalanced portfolio that goes long, in equal weight, the top 50 securities in the S&P 500 ranked on risk-adjusted momentum (12-1 month momentum divided by 252-day realized volatility) and shorts an equal-weight S&P 500 portfolio.

To be fair, MTUM's construction methodology differs quite a bit from that employed herein. We are simply equally-weighting the top 50 stocks in the S&P 500 when ranked by risk-adjusted momentum, whereas MTUM uses a blend of 6- and 12-month risk-adjusted momentum scores and then tilts market-capitalization weights based upon those scores.

Nevertheless, if we look at actual holdings overlap over time of our Risk-Adjusted Momentum portfolio versus Momentum and Low Volatility portfolios, not only do we see persistently higher overlap with the Momentum portfolio, but we see fairly low average overlap with the Low Volatility portfolio.

For the latter point, it is worth first anchoring ourselves to the standard overlap between Momentum and Low Volatility (green line below). While we can see that the Risk-Adjusted Momentum portfolio does indeed have a higher average overlap with Low Volatility than does the Momentum portfolio, the excess tilt to Low Volatility due to the use of risk-adjusted momentum (i.e. the orange line minus the green line) appears rather small. In fact, on average, it is just 10%.

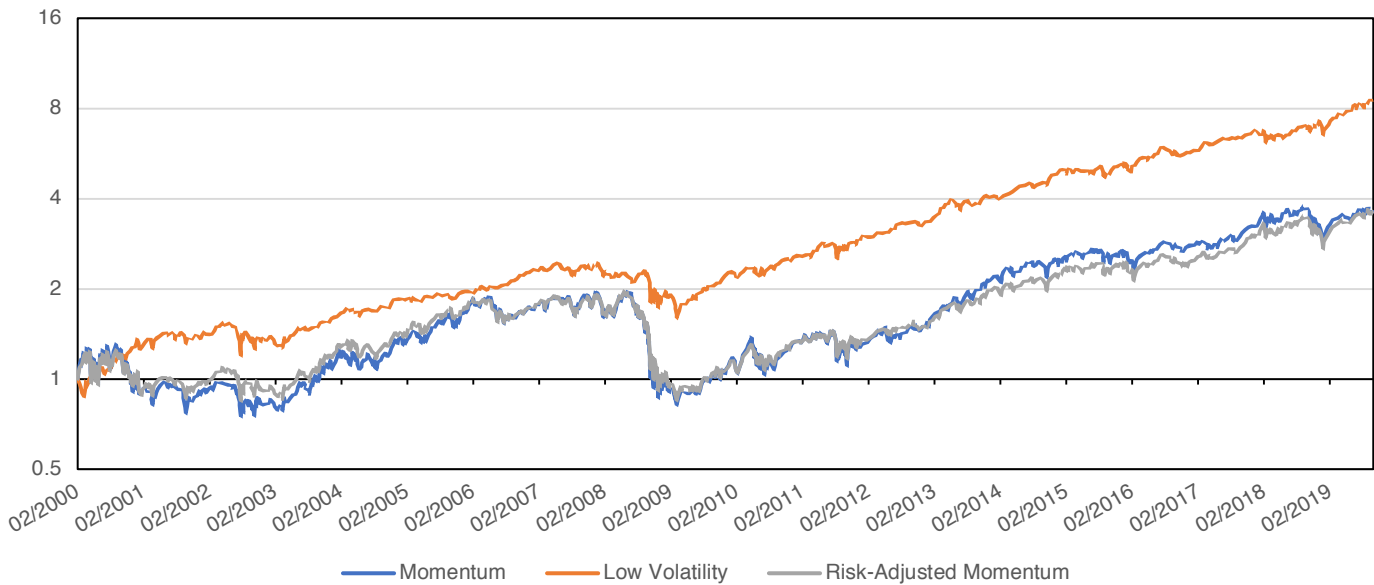
Holdings Overlap of Top 50 Risk-Adjusted Momentum Momentum



Source: Sharadar. Calculations by Newfound Research. Past performance is not an indicator of future results. Performance is backtested and hypothetical. Performance figures are gross of all fees, including, but not limited to, manager fees, transaction costs, and taxes. Performance assumes the reinvestment of all distributions. The risk-adjusted momentum strategy is a monthly rebalanced portfolio that goes long, in equal weight, the top 50 securities in the S&P 500 ranked on risk-adjusted momentum (12-1 month momentum divided by 252-day realized volatility). The momentum strategy is a monthly rebalanced portfolio that goes long, in equal weight, the top 50 securities in the S&P 500 ranked on 12-1 month momentum. The low volatility strategy is a monthly rebalanced portfolio that goes long, in equal weight, the top 50 securities in the S&P 500 ranked on trailing 252-day realized volatility.

This is further evident by looking at the actual returns of the strategies themselves:

Growth of \$1 in Top 50 Portfolios



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The Risk-Adjusted Momentum portfolio performance tracks that of the Momentum portfolio very closely.

As it turns out, the step of adjusting for risk creates far less of a low volatility factor tilt in our top-decile portfolio than one might initially suspect. (Or, at least, I'll speak for myself: it created far less of a tilt than I expected.)

To understand this point, we will first re-write our risk-adjusted momentum signal as:

$$MOM_{RA} = \frac{MOM}{VOL} = MOM * \left(\frac{1}{VOL} \right) = MOM * INVVOL$$

While trivial algebra, re-writing risk-adjusted momentum as the product of momentum and inverse volatility is informative to understanding why risk-adjusted momentum appears to load much more heavily on momentum than low volatility.

At a given point in time, it would appear as if Momentum and Low Volatility should have an equal influence on the rank of a given security. However, we need to dig a level deeper and consider how changes in these variables impact change in risk-adjusted momentum.

Fortunately, the product makes this a trivial exercise: holding INVVOL constant, changes in MOM are scaled by INVVOL and vice versa. This scaling effect can cause large changes in risk-adjusted momentum – and therefore ordinal ranking – particularly as MOM crosses the zero level.

Consider a trivial example where INVVOL is a very large number (e.g. 20) due to a security having a very low volatility profile (e.g. 5%). This would appear, at first glance, to give a security a structural advantage and hence create a low volatility tilt in the portfolio. However, a move from positive prior returns to negative prior returns would shift the security from ranking among the best to ranking among the worst in risk-adjusted momentum.¹

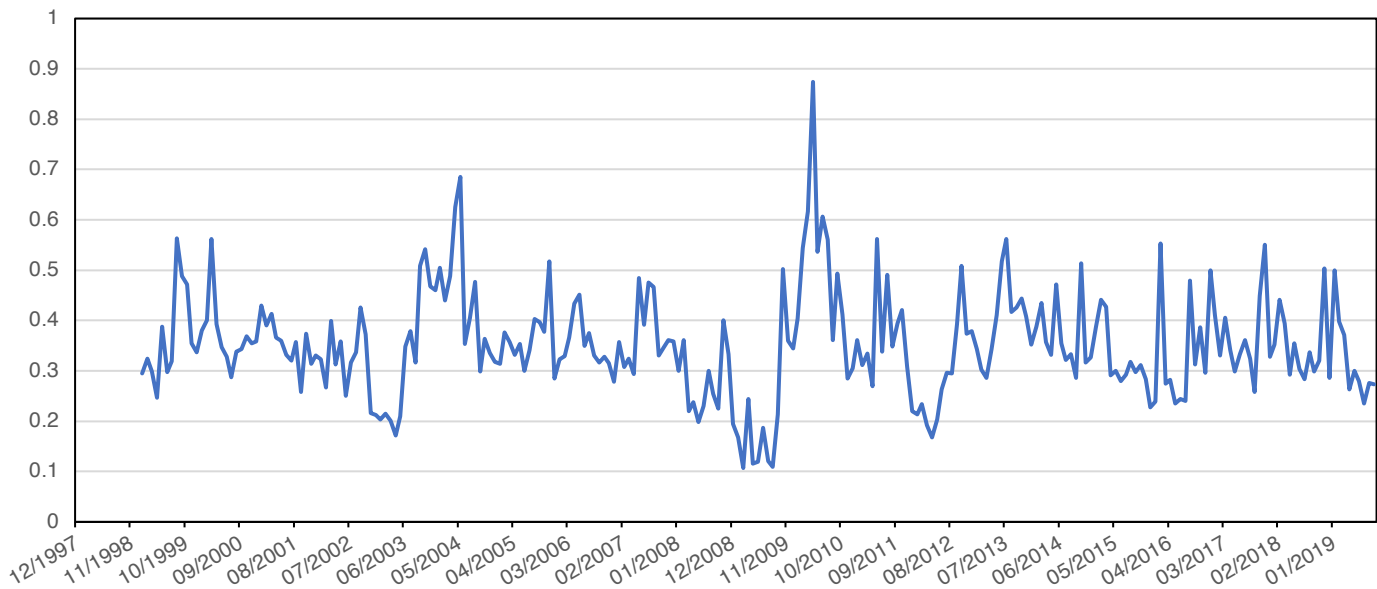
A first order estimate of change in risk-adjusted momentum is:

$$\Delta(MOM * INVVOL) \approx \Delta MOM * INVVOL + MOM * \Delta INVVOL$$

So which term ultimately has more influence on the change in scores over time?

To get a sense of relative scale, we plot the cross-sectional mean absolute difference between the two terms over time. This should, at least partially, capture interaction effects between the two terms.

Mean Absolute Difference of $\Delta MOM * INVVOL$ and $MOM * \Delta INVVOL$



Source: Sharadar. Calculations by Newfound Research.

¹ While it does not make much of a difference for our “top 50” portfolios discussed herein, an appropriate fix for this issue is to divide by volatility when momentum is positive but multiply by volatility when momentum is negative. This fix keeps negative risk-adjusted returns orderable. MSCI does not appear to take this step in their index methodology.

We can see that the term including the change in MOM has a much more significant influence on changes in risk-adjusted momentum than changes in INVVOL do. Thus, we might expect a portfolio driven entirely by changes in momentum to share more in common with our risk-adjusted momentum portfolio than one driven entirely by changes in volatility.

This is somewhat evident when we plot the return of MTUM versus our top 50 style portfolios. The correlation of daily returns between MTUM and our Momentum, Low Volatility, and Risk-Adjusted Momentum portfolios is 0.93, 0.72, and 0.93 respectively, further suggesting that MTUM is driven more by momentum than volatility.

Growth of \$1 in MTUM and Top 50 Style Portfolios

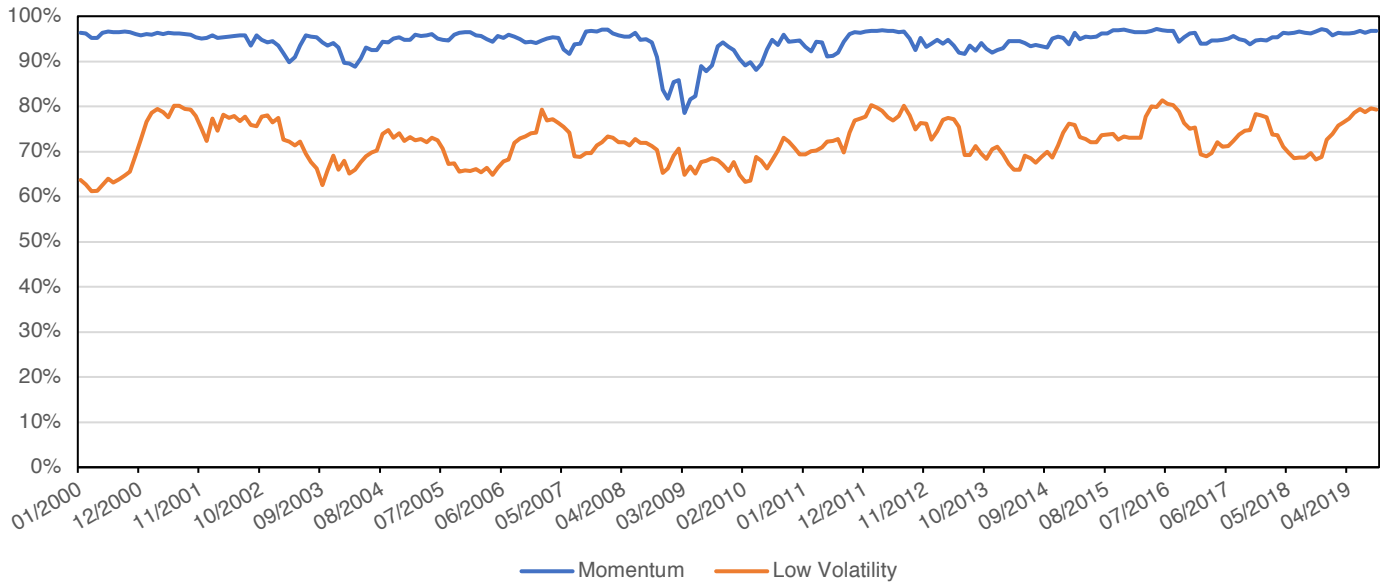


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This is only one part of the equation, however, as it is possible that changes to the risk-adjusted momentum score are so small – despite being largely driven by momentum – that relative rankings never actually change. Or, because we have constructed our portfolios by choosing only the top 50 ranked securities, that momentum does drive the majority of change across the entire universe, but the top 50 are always structurally advantaged by the non-linear scaling of low volatility.

To create a more accurate picture, we can rank-weight the entire S&P 500 and evaluate the holdings overlap over time.

Holdings Overlap of Rank-Weighted Risk-Adjusted Momentum Portfolio



Source: Sharadar. Calculations by Newfound Research.

Note that by now including all securities, and not just selecting the top 50, the overlap with both the Momentum and Low Volatility portfolios naturally appears higher on average. Nonetheless, we can see that the overlap with the Momentum portfolio is consistently higher than that of the Low Volatility portfolio, again suggesting that momentum has a larger influence on the overall portfolio composition than volatility does.

Conclusion

Without much deep thought, it would be easy to assume that a risk-adjusted momentum measure – i.e. prior returns divided by realized volatility – would tilt a portfolio towards both prior winners and low-volatility securities, resulting in a momentum / low-volatility barbell.

Upon deeper consideration, however, the picture complicates quickly. For example, momentum can be both positive and negative; dividing by volatility creates a non-linear impact; and momentum tends to change more rapidly than volatility.

We do not attempt to derive a precise, analytical equation that determines which of the two variables ultimately drives portfolio composition, but we do construct long-only example portfolios for empirical study. We find that a high-concentration risk-adjusted momentum portfolio has significantly more overlap in holdings with a traditional momentum portfolio than a low-volatility portfolio, resulting in a more highly correlated return stream.

The most important takeaway from this note is that intuition can be deceiving: it is important to empirically test our assumptions to ensure we truly understand the impact of our strategy construction choices.

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