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Using Quality and Value Factors to Enhance a Low-Volatility Portfolio

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Since the global financial crisis of 2008, low-volatility equity investing has become an increasingly popular investment strategy. A low-volatility portfolio seeks to capture an equity exposure with lower total risk than the market capitalization portfolio by investing in stocks that are uncorrelated with one another and in stocks that have low beta and are defensive in nature. The portfolio doesn't participate fully in down markets so it experiences smaller drawdowns. On the flip side, the portfolio usually doesn't participate fully in up markets, either.

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Over the long run, researchers have found that low-volatility portfolios have historically outperformed the market. Clarke, et al. [2006] found that in the U.S. equity market minimum-variance portfolios delivered comparable or higher average returns than the market. Blitz and van Vliet [2007] formed decile portfolios of global stocks based on historical volatility and found that low volatility decile portfolios outperformed high volatility decile portfolios. The outperformance of low-volatility portfolios contradicts one of the basic principles of finance—that risk and return are positively related. This is often referred to as the low-volatility anomaly.

Investors are drawn to low-volatility strategies because they can limit their downside risk and boost performance thanks to the low-volatility anomaly. However, investing in low-volatility strategies comes with its own set of risks. Low-volatility strategies have high tracking error against the market and can suffer from underperformance over extended periods. This highlights the timing risk associated with such strategies and is important given the popularity of this strategy and the amount of assets that it has attracted in recent years. These risks have led Arnott, et. al. [2016] to question whether low-volatility strategies have become a crowded trade that is overvalued.

To manage these risks, we propose two portfolio construction techniques:

1. Explicitly constraining unintended factor exposures—such as high valuations—during the portfolio construction process using optimization and a factor-based risk model.

2. Combining multiple uncorrelated factors together in a blended portfolio.

Parametric's low-volatility strategy, along with other single-factor strategies in its suite, already incorporates the first suggestion. The strategy is constructed such that unintended factor exposures and sector bets are constrained.[1] Combining multiple single-factor strategies should lower tracking error risk as the excess returns associated with the selected strategies are uncorrelated with each other.

We simulated two combination portfolios, based on Parametric's single-factor strategies, to examine whether they can achieve the objective of managing the risks associated with low-volatility investing. The first combination portfolio (LVQ) is invested 50% in a low-volatility strategy and 50% in a quality strategy. The second combination portfolio (LVQV) is invested 50% in a low-volatility strategy, 25% in a quality strategy, and 25% in a value strategy. We found that both combination portfolios have lower total risk and smaller drawdowns than the U.S. equity market and they give exposure to the more defensive segments of the market. Both combination portfolios also have lower tracking error than a low-volatility strategy. And they have a higher probability of outperforming the market over a rolling 3-year period, which suggests that they are less likely to suffer from timing risk. As such, holding a combination of factor portfolios represents a powerful way to get desired exposures while reducing active risk and timing risk.

Combination Portfolios

Parametric uses a minimum-variance approach to construct the low-volatility portfolio, with constraints on unintended exposures. As we shall see later, this simulated portfolio has a 6.7% tracking error against the market, and it outperforms the Russell 1000 Index 66% of the time on a rolling 3-year basis. So, one out of every three times, an investor could experience regret in that the low-volatility portfolio would underperform the market over the preceding three years. As mentioned earlier, to alleviate such timing risk concerns, we propose that investors combine low-volatility portfolios with quality and value portfolios.[2]

[1] Parametric's low-volatility strategy is constructed using an optimizer and Barra's risk model. The portfolio is constructed to minimize forecasted portfolio volatility subject to the following constraints: active exposure to non-targeted risk factors is capped at +/-0.2 standard deviations, active sector bets are capped at +/-5%, and stock weights are capped at 4 times their cap-weight. Other single-factor strategies (such as value, and quality) are constructed to maximize exposure to the targeted factor subject to similar constraints on non-targeted factor exposures, sector bets, and stock weights (see Santodomingo, et al. [2016]). For more discussion of optimizing low-volatility portfolios, see Alighanbari et. al. [2016].

[2] Nemtchinov and Pritamani [2016] show that investing in a linear combination of factor portfolios helps diversify the sources of alpha and results in more stable excess return outcomes.

Figure 1 provides a brief description of the Parametric U.S. single-factor strategies that we used in this paper.

Figure 1. Single-Factor Strategies in U.S. Large Cap Equity

Factor	Description	Key Objectives	Constraints
Low-Volatility	A minimum variance portfolio for equity exposure at lower levels of volatility	Low portfolio variance	Stocks 4x cap weight Sectors +/-5% cap weight, Unintended factors +/- 0.2 standard deviation
Quality	Exposure to profitable companies with stable earnings and low leverage	High gross profitability Low earnings variability Low leverage	Stocks 4x cap weight Sectors +/-5% cap weight, Unintended factors +/- 0.2 standard deviation
Value	Exposure to companies with low price-multiple ratios	Low price-to-book Low price-to-earnings	Stocks 4x cap weight Sectors +/-5% cap weight, Unintended factors +/- 0.2 standard deviation

Low-volatility and quality factors typically go well together. Low-volatility portfolios are defensive in nature and invest in stocks with low beta. High quality stocks represent profitable firms with stable earnings and low bankruptcy risk. During periods of heightened market fear and distress, both low-volatility and high quality stocks are expected to experience smaller drawdowns due to investors' "flight to safety" and "flight to quality" desires. In fact, index providers such as Russell and asset managers such as AQR, use both low beta and high quality to define defensive stocks.[3] Stocks with these two sets of characteristics are expected to be less volatile than the market and are expected to produce better risk-adjusted returns than the market over a full market cycle. In addition, these two strategies have low excess returns correlations, which should help bring down tracking error.

The first combination portfolio is defined as follows.

> Combination Portfolio 1 (LVQ) = 50% Low-Volatility + 50% Quality

The LVQ combination portfolio is rebalanced monthly to maintain equal weightings to low-volatility and quality portfolios[4].

The second combination portfolio (LVQV) invests in the value strategy as well.

> Combination Portfolio 2 (LVQV) = 50% Low-Volatility + 25% Quality + 25% Value

We assigned a smaller weight to the quality and value portfolios to preserve the defensive characteristics of the LVQV combination portfolio.

Why include value in the blend? First, value has low-to-negative excess return correlations with low-volatility and quality, which should help further diversify the sources of excess returns and reduce timing-risk concerns. Second, the LVQV combination portfolio should be of interest to a larger set of investors because the underlying three factors (low-volatility, quality, and value) explain a large proportion of Berkshire Hathaway's returns (see Frazzini et al. [2012]). A philosophy that includes value, quality, and lower risk stocks has a broad following in the investment industry.[5] The LVQV combination portfolio is also rebalanced monthly to maintain the weightings to the underlying factor strategies.

[3] Novy-Marx [2016] shows that low volatility stocks tilt toward high profitability, where the latter is an important component of quality strategies.

[4] Russell Defensive indexes are also constructed by assigning equal weights to low volatility and quality.

[5] Bender et al. [2016] use Buffet's style of investing as one of the reasons to motivate examining how a combination portfolio that invests in these three factors performs.

To understand the benefits of investing in combination portfolios, we look at the low-volatility and quality combination portfolio. We see that the low-volatility and quality portfolios had a 31.6% overlap as of October 2016. So, the combination portfolio is invested 31.6% in stocks that are both low-volatility and high quality, and is 34.2% invested in stocks that are either low-volatility stocks or high quality stocks, but not both. This differs from investing in a portfolio that focuses on investing solely in stocks that display both low-volatility and high quality characteristics.

The advantage of investing using the combination portfolio approach is that one gets the benefit of diversification by investing in stocks that display one but not both sets of characteristics. The smaller the overlap between the factor portfolios, the more likely it is that the correlation in excess returns between the factor portfolios is lower. Note, that the 34.2% investment in low-volatility stocks that are not high quality along with the 34.2% investment in high quality stocks that are not low-volatility help move the overall combination portfolio toward a more robust defensive posture by capturing distinct defensive characteristics. We next examine the performance of the combination portfolios to see whether they achieve their objective of addressing concerns investors may have related to low-volatility investing.

Performance-Based Analysis

We start by looking at the back-tested performance of the combination portfolios over a twenty-year period from 1997 to 2016. Figure 2 presents gross and net returns after deducting a 0.40% annual management fee. Dividends are reinvested and returns are stated gross of transaction costs. For sake of comparison, we present the results for the single-factor portfolios as well. Starting with the low-volatility strategy, we see that it offers equity exposure at a much lower volatility of 11.6% compared to 15.5% for the benchmark. Like earlier studies, we see that it does so without sacrificing performance and it has positive excess returns of 0.3% net of fees. As expected, the low-volatility portfolio has smaller drawdowns than the benchmark. However, tracking error for the portfolio is high at 6.7%.[6]

To capture timing risk, we calculated the rolling three-year returns on a monthly basis from Jan 1997 to Sep 2016. Based on the monthly time series of these rolling three-year returns, we calculated the percentage of times that the portfolio outperformed its benchmark. We see that the low-volatility portfolio outperformed the benchmark 66% of the time. It underperformed the benchmark over a three-year period 34% of the time. This reflects the timing risk associated with the strategy.

[6] Even though the tracking error is high at 6.7%, it is lower than what it would have been had we not constrained unintended factor exposures and sector bets. Our research indicates that if we remove such constraints, then the unconstrained low-volatility portfolio would have around 2% higher tracking error.

Figure 2. Return, Risk, and Correlations, 1997 to 2016 (Hypothetical)

|	Single-Factor Portfolios			Combination Portfolios		Benchmark
	Low-Volatility	Quality	Value	Low-Volatility and Quality (LVQ)	Low-Volatility, Quality, and Value (LVQV)	Russell 1000® Index
Gross Return	8.6%	10.2%	9.7%	9.5%	9.4%	7.9%
Net of Fees Return	8.1%	9.8%	9.3%	9.0%	8.9%	
Volatility	11.6%	15.1%	16.2%	13.0%	13.2%	15.5%
Return/Risk	0.70	0.65	0.57	0.70	0.68	0.51
Net Excess Return	0.3%	1.9%	1.4%	1.2%	1.1%	
Tracking Error	6.7%	3.6%	4.2%	4.0%	3.6%	
Information Ratio	0.04	0.54	0.34	0.29	0.29	
Max Drawdown	39.2%	43.2%	53.6%	41.2%	43.4%	51.1%
Percentage of Times of Outperformance Over Rolling 3-year Periods	65.9%	77.1%	53.7%	74.1%	78.0%	
	Net Excess Return Correlations					
Low-Volatility	1.00					
Quality	0.11	1.00				
Value	-0.01	-0.20	1.00			

Sources: PPA and Russell, as of 12/31/2016. Hypothetical performance is provided for illustration purposes. It does not represent the experience of any investor and should not be used to make investment decisions. Actual investor results will vary. Performance reflects the reinvestment of dividends. Performance does not reflect brokerage commissions, which would reduce the returns presented. Index performance is provided for comparison purposes. It is not possible to invest directly in an index. Indexes are unmanaged and do not reflect the deduction of fees and expenses. All investments are subject to the risk of loss.

Looking at the quality and value single-factor portfolios, we observe that both portfolios outperformed the benchmark and had low excess return correlations with the low-volatility strategy. This justifies including these strategies to reduce tracking error. Similar to the low-volatility strategy, the quality portfolio had lower risk and smaller drawdowns than the benchmark. It is easy to see that it is a natural candidate to include in a combination portfolio aimed at delivering defensive exposure at lower levels of active risk. On the other hand, the value strategy is not defensive in nature and was included in the combination portfolio at a smaller weight primarily to reduce active risk as well as timing risk given its low correlation with the other factors.

Turning to the combination portfolios, we see that both combination portfolios outperformed the benchmark by more than 1% net of fees. Both the combination portfolios displayed defensive characteristics—they have lower volatility than the benchmark and have smaller drawdowns. Also, the diversification benefits associated with combination portfolios are evident from Figure 2. Adding quality to low-volatility helped reduce tracking error to 4%, while adding both quality and value helped reduce tracking further to 3.6%. Similarly, timing risk was also reduced for the combination portfolios. The probability of outperformance over a 3-year period increases from 66% for the low-volatility strategy, to 74% when quality is added to the mix; and it further increases to 78% when value is also added to the mix. Clearly, the combination portfolios

alleviate the tracking error and timing risk concerns associated with low-volatility strategies while continuing to display defensive characteristics.

Holdings-Based Analysis

While the combination portfolios display defensive characteristics from a performance standpoint, we examine whether a holdings-based analysis of the portfolios shows the same. Figure 3 shows the active exposure to the Barra risk factors for the combination portfolios relative to the benchmark. For sake of brevity, we only show exposure to the risk factors of interest—namely those that are related to defensive or value characteristics.

Figure 3. Active Exposure to Risk Factors (as of Oct-2016)
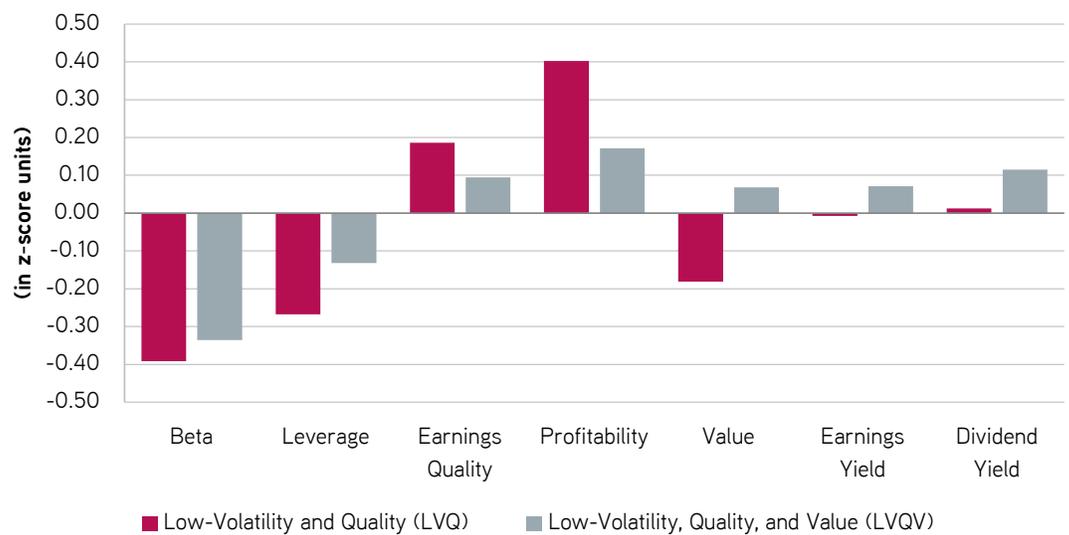
Sources: PPA, Barra, and Russell, as of 10/31/2016. Hypothetical performance is provided for illustration purposes only. It does not reflect the experience of any investor. Actual results will vary. The z-scores represent the difference between the portfolio value and the average value across all stocks, divided by the standard deviation of the observations.

We see that the LVQ combination portfolio has exposure to low beta stocks relative to the benchmark. It also has exposure to high quality stocks in that it is invested in profitable firms with better earnings quality and lower leverage relative to the market. The portfolio has, as expected, the relevant risk factor exposures associated with defensive investing. The LVQV combination portfolio also has similar defensive exposures, though the magnitude is slightly muted as the portfolio must give up some of its defensive exposure to gain the value exposure.

Figure 4 shows the active sector bets of the combination portfolios relative the benchmark. Again, we see that both combination portfolios are overweight to the more defensive sectors, such as utilities, consumer staples, and health care, and are underweight to the more volatile sectors, such as energy. Adding value to the combination portfolio results in slightly muted active exposures to the defensive sectors because the portfolio tilts slightly toward financials and against information technology to gain the value exposure. Overall, the holdings-based analysis of the portfolios in Figures 3 and 4 reveal a defensive exposure that is consistent with the defensive attributes as per the performance-based analysis in Figure 2.

Figure 4. Active Sector Bets (as of Oct-2016)

- ■ Low-Volatility and Quality (LVQ)
- ■ Low-Volatility, Quality, and Value (LVQV)
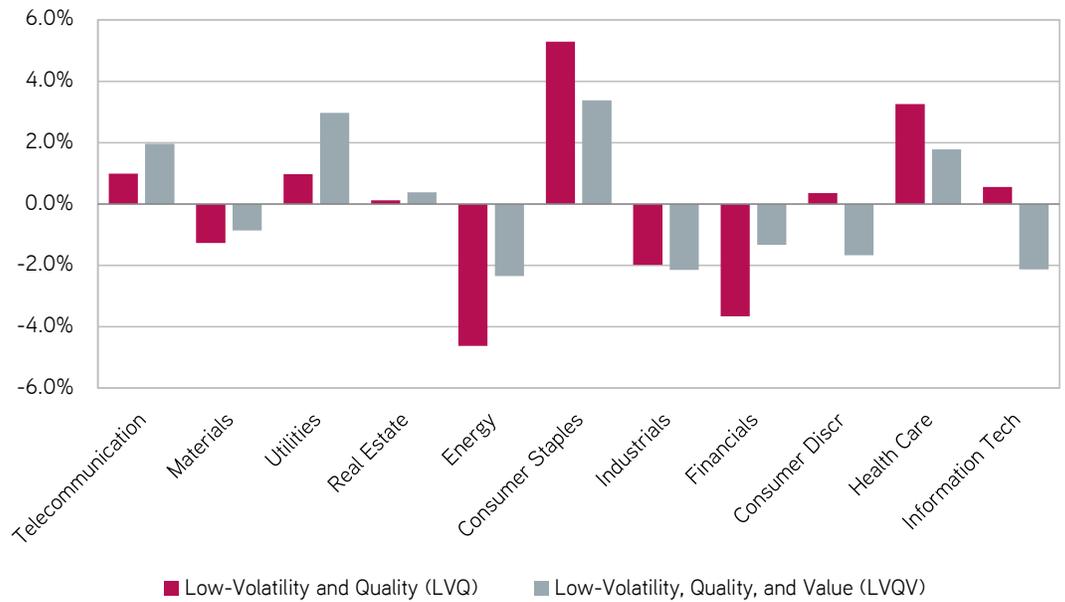
Sources: PPA, Barra, and Russell, as of 10/31/2016. Simulated portfolio data is provided for illustration purposes only. It does not reflect the portfolio holdings of any investor. Actual holdings will vary.

Performance in Different Market Environments

We next turn our attention to the performance of the combination portfolios in different market environments. Specifically, we examine their performance in up and down markets and over full market cycles. As the combination portfolios are defensive in nature, they are expected to outperform in down markets. It remains to be seen how their performance holds up against the benchmark in up markets. Also, it remains to be seen whether the combination portfolios produce more stable excess return outcomes over full market cycles.

We define up and down markets based on trough and peak levels in the Russell 1000 Total Return Index. We have three up markets and two down markets over our sample period, which together sum up to the entire sample period.

Figure 5. Back-tested Annualized Performance in Up and Down Markets

	Total Return	Net Excess Return				
	Benchmark	Single-Factor Portfolios			Combination Portfolios	
	Russell® 1000	Low-Volatility	Quality	Value	Low-Volatility and Quality (LVQ)	Low-Volatility, Quality, and Value (LVQV)
Jan97-Oct00 (Up Market)	20.54%	-5.4%	5.2%	1.7%	0.0%	-0.9%
Nov00-Sep02 (Down Market)	-24.52%	7.8%	3.7%	4.5%	5.8%	6.0%
Oct02-May08 (Up Market)	12.68%	-0.6%	-2.0%	3.0%	-1.3%	0.0%
Jun08-Feb09 (Down Market)*	-46.94%	11.6%	7.5%	-1.1%	9.5%	7.2%
Mar09-Dec16 (Up Market)	17.96%	-1.9%	1.1%	-0.5%	-0.4%	-0.7%

*Performance is not annualized for this period as the sample period is less than 12 months.

Sources: Parametric and Russell, as of 12/31/2016. Hypothetical performance is provided for illustration purposes. It does not represent the experience of any investor and should not be used to make investment decisions. Actual investor results will vary. Performance is presented net of fees and reflects the reinvestment of dividends. Performance does not reflect brokerage commissions, which would reduce the returns presented. Index performance is provided for comparison purposes. It is not possible to invest directly in an index. Indexes are unmanaged and do not reflect the deduction of fees and expenses. All investments are subject to the risk of loss.

Figure 5 shows the net excess returns to the combination portfolios in each of these up and down market periods. As earlier, we show the performance of the single-factor portfolios as well to shed light on the drivers of performance for the combination portfolios. We see that, as expected, the low-volatility portfolio outperforms in down markets and underperforms in up markets. The combination portfolios also outperform in down markets because these portfolios are also defensive in nature. In up markets, the combination portfolios usually perform better than the low-volatility portfolio and have similar performance as the benchmark. The benefits of diversification seem to drive this result, as underperformance of one factor in up markets is offset by the outperformance of the other factor.

We next look at the performance of the portfolios over full market cycles; ones that include both a bull and bear market. Leggio and Romick [2015] suggest that investors look at the performance of their portfolios over full market cycles to get a better understanding of how their portfolios perform. We define full market cycles based on peak-to-peak and trough-to-trough levels in the Russell 1000 Total Return Index. There were four full market cycles over our sample period. These four full market cycles overlapped each other.

Figure 6. Back-tested Annualized performance over Full Market Cycles

	Total Return	Net Excess Return				
	Benchmark	Single-Factor Portfolios			Combination Portfolios	
	Russell® 1000	Low-Volatility	Quality	Value	Low-Volatility and Quality (LVQ)	Low-Volatility, Quality, and Value (LVQV)
Jan97-Sep02 (Trough-to-Trough)	3.12%	0.2%	4.6%	3.0%	2.5%	2.2%
Sep00-Oct07 (Peak-to-Peak)	2.25%	3.1%	-0.6%	3.4%	1.3%	2.3%
Oct02-Feb09 (Trough-to-Trough)	0.67%	2.7%	0.5%	2.1%	1.6%	2.0%
Nov07-Dec16 (Peak-to-Present)	6.51%	1.1%	2.6%	-0.4%	1.9%	1.2%

Sources: Parametric and Russell, as of 12/31/2016. Hypothetical performance is provided for illustration purposes. It does not represent the experience of any investor and should not be used to make investment decisions. Actual investor results will vary. Performance is presented net of fees and reflects the reinvestment of dividends. Performance does not reflect brokerage commissions, which would reduce the returns presented. Index performance is provided for comparison purposes. It is not possible to invest directly in an index. Indexes are unmanaged and do not reflect the deduction of fees and expenses. All investments are subject to the risk of loss.

Figure 6 shows the performance of the portfolios in each of the four full market cycles. The low-volatility portfolio earned a net annualized excess return of 0.2% to 3.1% across the four full market cycles. The combination portfolios also outperformed in each of the four full market cycles. However, their outperformance is more stable and in a much narrower range of 1.2% to 2.7%. These results, along with earlier results in Figure 2 showing that the combination portfolios outperformed 74% to 78% of the time over rolling 3-year periods, highlights one of the most attractive features of combination portfolios—that they are less likely to suffer from timing risk because they deliver more stable excess return outcomes.

Conclusion

We propose that investors concerned with the high tracking error and timing risk associated with low-volatility strategies consider combining a low-volatility strategy with other factor strategies to alleviate such concerns. Specifically, we propose combining a low-volatility portfolio with a quality portfolio as well as combining low volatility, quality, and value factor portfolios. Our simulations lead us to believe that such combination portfolios continue to display defensive characteristics associated with low-volatility strategies. They have lower risk than the market, smaller drawdowns, higher exposure to the defensive sectors, and they outperform in down markets. According to our results, combining factor strategies reduces tracking error to 3.6% to 4% compared to 6.7% for a low-volatility strategy. In addition, the combination portfolios outperformed 74% to 78% of the time over rolling 3-year periods compared to 66% for a low-volatility strategy. These results demonstrate that adding quality and value to a low-volatility strategy helps alleviate the tracking error and timing risk concerns associated with low-volatility investing. From a broader perspective, it shows that Parametric's single-factor strategies are important building blocks, which, when combined, can help deliver desired exposures at low levels

of active risk and offer the potential for long-term outperformance.

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