Russell Investments

Viewpoint

Russell Research

By: Michael Thomas, CFA, Chief Investment Officer, Americas Institutional
Bob Collie, FIA, Chief Research Strategist, Americas Institutional

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Volatility management

Since the global credit crisis, investors have become more attuned to risk in general and to portfolio volatility in particular. The investment industry has responded with a dizzying array of products and strategies designed to help manage volatility. In this paper, we test three of what we believe to be the more promising approaches, exploring the underpinnings of each, and asking whether the recent effectiveness of the strategies – a combined 30% to 40% reduction in portfolio volatility, with no reduction in return – can be expected to persist. We believe that with a clearer understanding of the sources of volatility reduction, investors are better placed to make informed assessments of the attractiveness of these strategies.

Markets have been unusually volatile in recent years and, for many institutional investors, the impact of that volatility has been accentuated by the Pension Protection Act of 2006 (PPA) and the shift toward mark-to-market accounting.[1] In a recent survey of executives at corporate defined benefit pension plans, public pension plans and nonprofit organizations (Russell, P&I [2012]), market volatility topped the list of greatest current concerns for each of the three groups. As a result, thoughts are turning to the question of how to more effectively manage volatility.

The strategies institutional investors have traditionally used to manage volatility are de-risking (i.e., increasing exposure to low-risk or liability-hedging assets) and diversification; specific descriptions and some brief observations on their use are given in the appendix to this note. These are well understood and have been widely adopted by institutions of all types. They remain appropriate tools.

[1] See, for example, Collie and Gannon (2011).

They are not, however, the only tools. In recent months Russell has researched a wide array of alternative approaches to managing volatility – in particular, the volatility associated with equity exposure. We identify them as falling in three groups that can be broadly described as:

1. Changing the "flavor" of the equities we hold.
2. Changing the shape of the return distribution we get from equities.
3. Varying the exposure to equities over time, based on the environment we are in.

THE SUPPLY/DEMAND DYNAMICS OF THE PRICE OF RISK

There are many forms of risk. Each of the strategies we consider in this paper involves transactions in which some form of risk is transferred from one market participant to another. The price at which that transfer takes place is critical. Almost all institutional investors knowingly bear some risk they could avoid, and they do so because they believe that the likely rewards justify doing so. As supply and demand for each form of risk changes, that cost/benefit balance also changes.

So, in each case, the underlying logic for a strategy rests on how the market sets the price of a particular form of risk, and how that might vary over time.

Fama and French (1992) noted that stocks with lower volatility tended to perform better on a risk-adjusted basis than stocks with higher volatility.

Changing the flavor: defensive equity

The capital asset pricing model (CAPM) of Sharpe (1964) suggests that a stock with a volatility that is, say, 80% of the volatility of the broad market should be expected to deliver a return roughly equal to that of a portfolio that is comprised of 80% of the broad equity market and 20% cash. This theory rests on the belief that the only form of risk that affects a stock's price is its beta, or the systematic risk for which the investor can anticipate compensation.[2]

In another of finance's most widely cited papers, however, Fama and French (1992) noted that stocks with lower volatility tended to perform better on a risk-adjusted basis than stocks with higher volatility: "In a nutshell, market β seems to have no role in explaining the average returns on NYSE, AMEX and NASDAQ stocks for 1963–1990." This divergence between empirically-observed market behavior and that predicted by CAPM theory has been noted in markets across the globe over a period that spans several decades. This idea is often expressed as the security market line being flatter than the capital asset pricing model would predict. Collie and Osborn (2011) – drawing on Baker, Bradley and Wurgler (2011), and others – argue that the most likely cause of this pattern has been the focus of institutional and mutual fund managers on benchmark-relative returns. This has meant that managers have had no incentive to pay a premium for low absolute volatility, even though this would benefit the asset owner. For managers, the risk that is more pertinent is tracking error – a quite different thing than absolute volatility. For example, a stock that is materially less volatile than the market could have a high tracking error relative to the market and thus be deemed unattractive by a manager. That can happen even if the stock's expected return is similar to that of a stock with higher absolute risk but lower tracking error.

One possible response to this perhaps surprising result would be to construct a portfolio of stocks that have lower expected volatility. Russell's approach to identifying these stocks in advance – described in detail in Hintz (2011) – is based on a combination of low trailing stock price volatility, low leverage, low earnings variability and high return on assets. Russell describes stocks with these characteristics as defensive.

[2] Idiosyncratic (i.e. non-systematic) risk, according to the CAPM, can be diversified and should not carry any expected reward.

Contrary to most investors' intuition, defensive stocks have historically delivered higher returns than those of the broad market.[3] In light of the explanation above about the incentives and behavior of institutional and mutual fund managers, there are grounds for believing that this effect will persist going forward. In particular, there is a case to be made that risk-adjusted returns may continue to be higher on defensive stocks than on the broad market. However, whether the extent of the advantage will continue at its historical level is unclear, and – because the rationale for this belief rests on a point of supply and demand – it seems likely that the size of the effect will vary over time.[4]

As usual, where there is a gain there is also a price.

As usual, where there is a gain there is also a price. In the case of a defensive portfolio, this price lies primarily in tracking error – most notably, in the sometimes significant underperformance against the broad market which should be expected when the market is performing strongly. The key point is that the very argument on which the case for defensive equity rests is that these stocks are unattractive if judged by the standards of a traditional benchmark-relative investment mandate; the reason that in this case risk may be attractively priced is that the risk in question is more closely related to absolute volatility (to which traditional mandates pay no attention) than to tracking error.

Changing the shape: options-based strategies

Options allow investors to participate in markets, but only within certain limits (for example, purchasing an at-the-money call option provides exposure to market gains, but not to market losses). The price of an options contract is ultimately driven by supply and demand. There can be significant differences in the supply/demand patterns across different types of options – not just across options on different markets, but across options within a given market that have different time horizons or different strike prices.

There are certain types of options contracts for which a natural supply/demand imbalance exists.

In particular, there are certain types of options contracts for which a natural supply/demand imbalance exists. Most notably, options contracts that cut off the tail of the distribution of possible outcomes on the downside have appeal for just about all investors. There is no natural seller of these options, so the premium for an out-of-the-money put option tends to run higher than if supply and demand were in balance.

One way to quantify this supply/demand imbalance is to calculate the difference between implied volatility[5] and realized volatility. For example, Maidel and Sahlin (2012) find that implied volatility has persistently exceeded realized volatility by an average of ~27% since 1990. This is due, to some extent, to the non-normality of the distribution of asset returns,[6] but the extent of the difference seems to be greater than can be attributed to that effect alone. In addition, implied volatility varies for options that have the same time horizon but different strike prices. This is referred to as the "volatility smile" – or volatility skew – and was discussed by Thomas and Collie (2010) and Rae and Maidel (2012). Thomas (2009) described how the pricing of options can vary significantly over time. This means that, even

[3] Documented, for example, in Baker, Bradley and Wurgler, which covers the time period 1968-2008.

[4] We would note that *past* experience documented in Collie and Osborn (2011) and elsewhere has not been merely that the defensive portfolio has outperformed an 80/20 portfolio (i.e., a risk-adjusted portfolio), but that is has even outperformed a 100% broad market stock portfolio. As far as *future* expectations go, a continuation of that pattern would represent an anomaly that appears to be easily exploitable even within the context of traditionally structured investment mandates – and hence, as Collie and Osborn note, "to expect this experience to persist indefinitely in the future may be optimistic." It seems more reasonable to look for an improvement in risk-adjusted returns than for an improvement in absolute returns.

[5] Implied volatility is often used to describe the price of options. Implied volatility is the amount of assumed market volatility that, when plugged in to the Black-Scholes option pricing model, produces a price equal to the market price of a given option. The other required parameters are the strike price of the option, the current price of the security in question, the time to maturity and the return available on cash. These are all observable in the market. Because market volatility is not observable, the most common use of the Black-Scholes model today is to input a market price and derive a volatility, rather than to input a volatility and derive a price (which is the purpose for which it was originally designed). For pricing, most serious market participants today use other approaches, mainly because price changes do not in practice generally follow a normal distribution, as the Black-Scholes model assumes they do. The model is described in Black and Scholes (1973) and Merton (1973).

[6] Fat tails tend to lead to higher implied volatilities for options associated with large price movements.

more than with the other strategies described in this note, the attractiveness of options-based strategies varies with market conditions.

An example of a strategy that seeks to exploit the difference between implied and realized volatility is call overwriting, which is described in Maidel and Sahlin. Following this strategy, the investor foregoes the upside above the specified strike level in exchange for an upfront premium (which can run rich, because of the factors described above) and experiences the downside of the market, offset by this premium received. In short, the written call truncates returns on the upside while the premium dampens returns on the downside.

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We should note that options are more complex instruments than the other strategies discussed in this note. In particular, each option comes with a specific maturity date. Thus, holdings need to be managed and, from time to time, rolled into longer-dated contracts for an investor to maintain a desired exposure. This adds to the dynamic nature of the strategy.

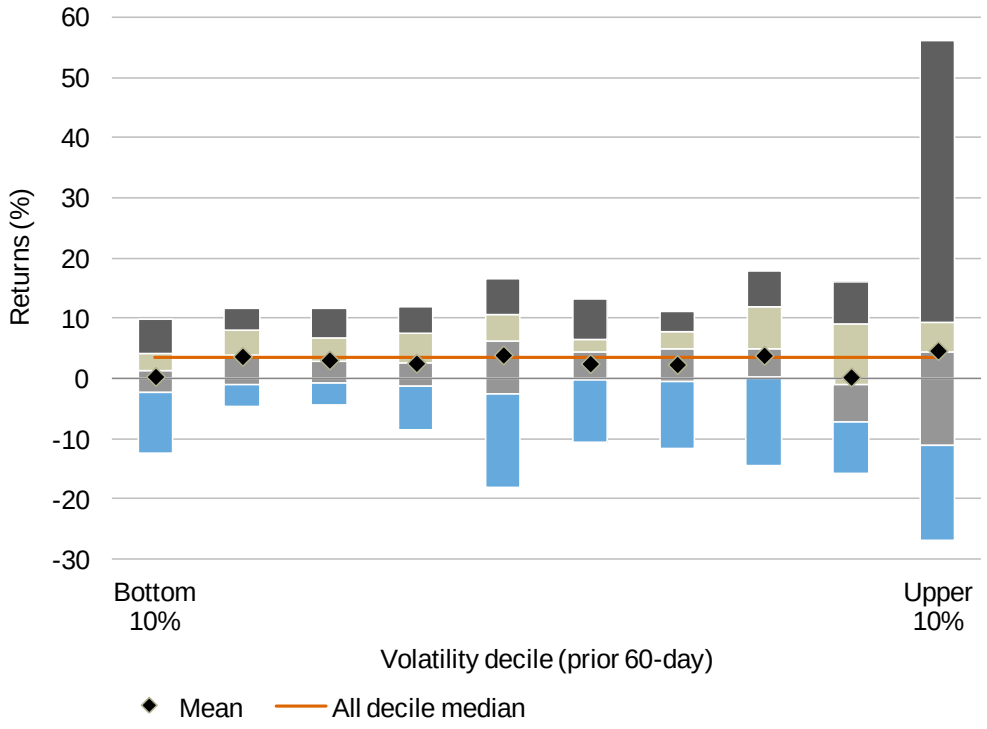
As with defensive equity, the price paid with call overwriting is tracking error. We can, however, be fairly sure as to how this tracking error will manifest itself over time. In most bull markets, writing calls will lead to underperformance against the broad market. In bear markets the premium capture will offset losses, leading to outperformance (i.e., smaller losses). Again, if judged by the standards of a traditional benchmark-relative investment mandate, call overwriting will be unattractive. If instead the objective is more closely related to managing absolute volatility, call overwriting allows an investor to take advantage of the supply/demand imbalance that results from the attractiveness of downside protection to most investors with little natural supply – an imbalance that appears likely to persist in most market conditions.

Varying the exposure: volatility-responsive asset allocation (VRAA)

In itself, the decision to take risk implies a belief that risk will, in time, be rewarded. However, that belief is not necessarily static. Certainly, the level of realized risk associated with the equity market is not constant. As Engle (2001) observed, “Even a cursory look at financial data suggests that some time periods are riskier than others…Moreover, these risky times are not scattered randomly.” Hill (2010) finds that “there is a tendency for increases in short-term index volatility to precede increases in longer-term risk” and notes that the serial correlation between quarterly returns of the S&P 500 is 0.1, while the serial correlation between quarterly volatility of the S&P 500 is 0.6 from 1950 to 2009. In other words, variations in the volatility environment are to some extent persistent and hence predictable.

What is more, Collie, Sylvanus and Thomas (2011) found no evidence that the reward for taking market risk is greater at times of elevated volatility. This is illustrated in Exhibit 1.

Exhibit 1: Average returns on S&P 500 Index 1928-2011 have not differed significantly by trailing volatility decile



The notions that volatility can be forecast with more certainty than returns, and that returns, on average, are not materially different following periods of high or low volatility bring us to the idea of volatility-responsive asset allocation.

We created the exhibit above by grouping the quarterly returns of the S&P 500 Index from 1928 to 2011 by volatility decile. Specifically, we calculated the volatility of daily returns in each of the 332 quarters, sorted the findings into volatility deciles, and plotted subsequent-quarter returns in the distribution shown above. While the dispersion of returns for the highest-volatility decile is wider than for the lowest-volatility decile, the average returns of each decile are not markedly different[7] from one another; there has been no systematic reward for participating in the most volatile markets.

Together, the notions that volatility can be forecast with more certainty than returns, and that returns, on average, are not materially different following periods of high or low volatility bring us to the idea of volatility-responsive asset allocation. VRAA is what Perold (2012) refers to as a stable risk policy, noting that "such an approach would hold lower exposures to equities and other risky assets in more volatile times and higher exposures in calmer environments. A stable risk policy is less prone to fat tails…"

Such a strategy would not have experienced as much variation in volatility as a traditional fixed-weight strategy would have. This is due to increased exposure to equity (at the expense of low-risk and/or liability-hedging assets) in stable times and reduced exposure in unstable times, while holding, on average, the same allocation to equity. As Perold highlighted, this has a particular benefit in terms of downside protection, since the worst

[7] A T-test of the mean of each decile was performed which showed that none of the 10 deciles had a mean that differed from the mean of the entire data set by a statistically significant amount. The tenth decile, for example, shows a notably wider range of outcomes than the others, but the mean (4.64%) of the results in the tenth decile did not differ by a statistically significant amount from that of the full data set (2.72%). While the tenth decile results appear to be heavily skewed, the median (4.40%) is close to the mean.

outcomes tend to occur during volatile periods. Over the past 30 years, there would have been no loss in terms of average return from this strategy.[8]

Just as with the other two strategies discussed above, the cost of VRAA lies in its tracking error to a traditional mandate. Also, while this approach appears to be quite effective in positioning a portfolio for different volatility regimes, it does not offer protection against short-term shocks such as occurred in October 1987 or in the "flash crash" of 2010.

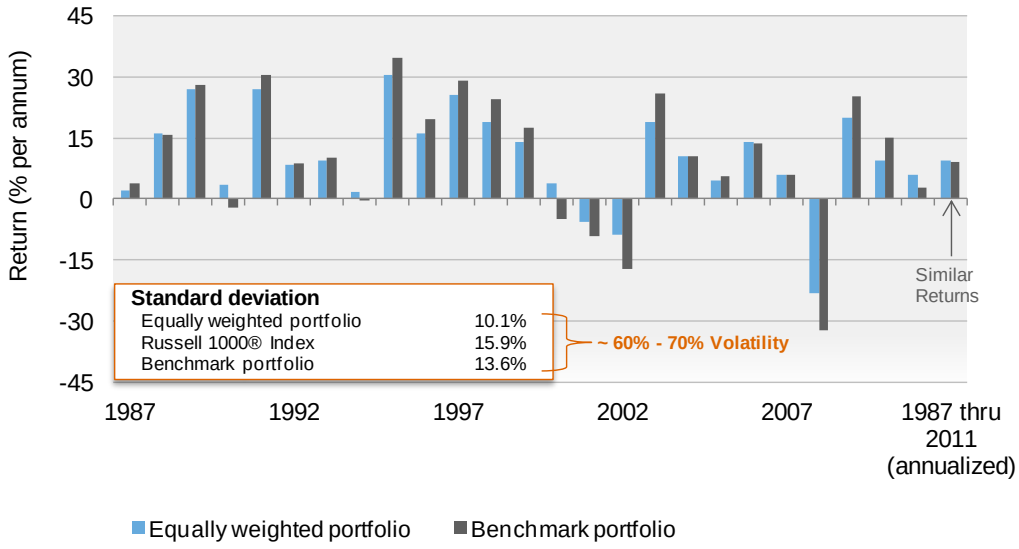
A portfolio of volatility-management strategies

The papers cited above that describe the three strategies provide detailed historical returns for each strategy. What we find particularly appealing is that while all of the strategies seek to reduce volatility, they do so by attempting to exploit different market effects. Consequently, their return patterns are not perfectly correlated and, in combination, they work well as tools to mitigate volatility.

While all of the strategies seek to reduce volatility, they do so by attempting to exploit different market effects.

Below we show the results of an equally weighted portfolio of the three strategies described above for the period 1987 to 2011.[9]

Exhibit 2: A combination of volatility-management strategies would have generated similar 25-year average returns to its benchmark with materially lower volatility



Consistent with the underlying strategies, we see muted returns in the tails (i.e., underperformance relative to the broad market in strong bull markets, and outperformance in bear markets). Over long periods, we see similar returns to an 85% Russell 1000 Index/15% Barclays U.S. Aggregate Bond Index portfolio, with approximately two-thirds the volatility.

[8] See Collie, Sylvanus and Thomas. Note that, by construction, the average exposure to equities was the same between the VRAA portfolio and the benchmark portfolio. Differences in return and volatility are the result of differences in the timing of that exposure.

[9] This analysis is based on the returns of the Russell 1000 Index and the Barclays U.S. Aggregate Bond Index (for the market returns) and (for the strategy returns) the Russell 1000 Defensive Index, the CBOE S&P 500 BuyWrite Index (known as the BXM index), and the VRAA methodology of Collie, Sylvanus and Thomas (2011). The choice of 1987 as the start date for the analysis reflects the data history available for the BXM index. 85% Russell 1000/15% Barclays Aggregate was selected as the total strategy benchmark because the neutral position for VRAA is 50% equity/50% bonds, while the other two strategies would most naturally be benchmarked to a 100% equity position. Assuming an equally weighted portfolio to each gives us 83.5% equity/16.5% bonds, which rounds to the benchmark shown above.

DYNAMIC MANAGEMENT OF THE STRATEGIES

We have assumed a static weight to each strategy over time. In practice, the relative attractiveness of these strategies changes over time, since the pricing of the embedded risk transfer varies with supply/demand. This is most notably true of the options strategies, but also of the others. Therefore, we argue that a strategy such as described here ought to be dynamically managed, with the amount allocated to each of the strategies varying when the prices of the underlying components become more or less attractive.

WHAT TO EXPECT, WHAT TO MEASURE

As with all investment strategies, long-term success requires the investor's ability to hold the course during the inevitable periods when they are out of favor. Investors or trustee boards with a short-term focus on excess returns or peer-relative performance are advised to steer clear of strategies such as those described in this paper.

For those whose primary objective is related to managing absolute risk (including defined benefit liability-focused measures such as surplus volatility, volatility of funded status or volatility of contributions) these strategies have appealing characteristics along with clear rationales. Successful implementation requires that investors align their reporting with these objectives. Failure to do so exposes the investor to the behavioral risk of selling at the bottom.

Conclusion

Much of the analysis in this paper is drawn from previous works, some widely recognized (such as those of the Nobel laureates cited) and some more recent. While the three strategies discussed are each distinct, they share a common feature: the goal of reducing the risk in an investor's equity exposure. Each strategy offers the potential to manage volatility and/or downside risk, and it is important to consider the price that must be paid for that benefit.

Thus, the most important points in this paper relate to our understanding of the source of the opportunity offered by each of the strategies we have described. Although we have presented past performance, that is very much a supplemental consideration, serving as evidence to test the validity of the primary arguments.

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By way of recap, we summarize these arguments below:

- **Defensive equity** – Current manager benchmarking practices lead managers to steer away from lower-volatility stocks, because they introduce tracking error into portfolios.
- **Options-based strategies** – A supply/demand imbalance for protection leads certain options contracts to (tend to) be attractively priced.
- **Volatility-responsive asset allocation** – Volatility can be forecast with more confidence than returns can be; furthermore, on average, returns have not been higher following periods of high volatility.

In recent years, Russell has started managing each of these strategies individually for clients.

To the extent that investors are concerned primarily with benchmark-relative returns, they are unlikely to be willing to take on tracking error in exchange either for absolute risk reduction or for downside protection. However, the focus of many investors has shifted in recent years, and the solutions presented here offer an upside/downside trade-off consistent with evolving investor preferences.

For investors primarily focused on managing absolute volatility, we find that a portfolio of multiple strategies provides an attractive approach that is complementary to the traditional

risk-management approaches of de-risking and diversification. Those interested in digging deeper into any or all of the underlying strategies are encouraged to read the supporting papers referenced throughout this paper.

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Appendix – Traditional strategies

De-risking

A general rule of investment is that in most circumstances, risk ought to carry an expected reward.[10] It is this hope of a higher reward that leads investors to invest in assets other than the lowest-risk portfolio. The most direct route to reducing risk in an investment program is to accept a lower return aspiration and move back toward that lowest-risk portfolio.

This approach to de-risking has been a major feature of corporate pension plan investment in recent years, especially for closed and frozen plans, where the investment time horizon is shorter than that of the typical open plan. Public plans and the nonprofit sector have tended not to follow this strategy to the same extent.

Diversification

Diversification as a risk-management strategy is literally thousands of years old: the principle of spreading one's risks was found in the Babylonian Talmud and in Shakespeare long before Markowitz's optimization and Sharpe's market portfolio.[11] The principle applies across asset classes and within them. A different and increasingly popular perspective on diversification is based on diversifying factor exposures, rather than directly diversifying asset classes.

Since there is no price to be paid beyond the attention and other resources that investing across a broader range of assets demands, diversification has been called a free lunch, offering the prospect of lower risk without the need to sacrifice return expectations. There are limits to how much can be achieved, however – limits that become tighter when asset classes become more closely coupled as described in Collie (2011). We would note, too, that in practice, the most difficult part of diversification is finding worthwhile investments into which to diversify. Repackaging and reshuffling existing assets can create the appearance, but not the reality, of diversification.

Notwithstanding those limitations, diversification is one of the most valuable tools in the institutional investor's toolkit.

[10] Strictly speaking, this is a one-way relationship, in that all expected reward should be associated with some form of risk, although not all forms of risk should necessarily carry an expected reward. We'd also note that not all risks are equal, and that the volatility of markets implies substantial variation in the pricing of risk over time as supply and demand wax and wane.

[11] See Murphy (2009).

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