Low Volatility vs. Low Beta Portfolios

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Over the past several years, numerous quantitative asset managers have launched versions of "low volatility" portfolios. The approaches to constructing these portfolios and the explanations as to why they should work can sometimes differ greatly.

INTECH's Approach

INTECH launched its suite of absolute volatility strategies in October 2011, with the goal of generating long-term returns in excess of either the Russell 1000 or MSCI World indices at lower levels of absolute volatility and higher Sharpe Ratios.[1] Unlike many managers which utilize fundamental or quantitative approaches, INTECH does not attempt to exploit any behavioral "anomalies." The only "anomaly" INTECH exploits is the inefficient manner in which cap-weighted indices are constructed. Cap-weighted indices are not mean-variance efficient, meaning that they do not maximize return at a given level of risk and they do not minimize risk for a given level of return. As such, it should be possible for a skilled active manager to (i) beat the cap-weighted index with volatility that matches the index, or (ii) match the return of the cap-weighted index with lower volatility than the index, or (iii) beat the cap-weighted index with lower volatility than the index.

INTECH applies the mathematical principles of Stochastic Portfolio Theory[2] to attempt to identify portfolio weights that provide an improved risk/reward tradeoff through efficient relative volatility capture. Utilizing proprietary estimates of stocks' variances and covariances for both alpha generation and risk controls, INTECH employs a mean-variance optimization process which targets a certain level of excess return above the cap-weighted index while minimizing the risk (either relative risk or absolute risk) for that level of excess return.

INTECH's traditional actively managed products focus on beating their underlying cap-weighted indices at low tracking errors. As a result, the level of absolute risk (as measured by the standard deviation of portfolio returns) for those products is similar to that of their respective underlying cap-weighted indices. In contrast, instead of attempting to minimize the tracking error of the strategies, INTECH's Absolute Volatility strategies are engineered to reduce the absolute standard deviation of the portfolio for a given target excess return. In addition, just like INTECH's traditional actively managed strategies, the absolute volatility strategies rely on estimates of volatilities and correlations for both alpha generation and risk control. The alpha source, volatility capture, is the same for all of INTECH's products.

As previously mentioned, INTECH believes that a skilled manager with a robust investment process can likely generate positive alpha over time regardless of whether that manager focuses on reducing tracking error or standard deviation. It is up to investors to decide which approach best suits their needs.

The Low Beta Approach

A different approach to reducing the absolute volatility of portfolios is to invest in a low Beta factor, which generally involves overweighting low Beta stocks and underweighting high Beta stocks. This approach is supported by academic literature which suggests that portfolios of low Beta stocks outperform portfolios of high Beta stocks[3] and that, consequently, a low Beta factor portfolio may be able to outperform a cap-weighted index over time at lower volatility levels.

There are several possible explanations raised in academic literature as to why portfolios of low Beta stocks outperform portfolios of high Beta stocks. For example, Baker, Bradley and Wurgler (2010) hypothesize that investors have a preference for high volatility stocks due to their "lottery-like" payoffs, causing those stocks to be overpriced. They also suggest that this "anomaly" has not yet been fully exploited because the typical investment management mandate is focused on relative risk and information ratios. This benchmark-centricity makes institutional investment managers less likely to exploit the "low volatility anomaly." In a separate study, Frazzini and Pedersen (2011) develop a model with leverage and margin constraints which predicts that high Beta stocks will be overpriced. They find empirical results consistent with their predictions.

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1 INTECH's Low Volatility strategies target market-like long-term returns, net of fees, at lower volatility levels and higher Sharpe Ratios than the underlying cap-weighted indices over the long term. INTECH's Managed Volatility strategies seek long-term excess returns of 3%-4% per year at lower levels of volatility and significantly higher Sharpe Ratios than the underlying cap-weighted indices over the long term.

2 See Fernholz (2002).

The Pitfalls of the Low Beta Approach

Without delving into the merits of the aforementioned behavioral explanations or empirical studies, it is imperative to recall that INTECH does not follow the low Beta approach described above. Moreover, investors must be mindful of several pitfalls that are associated with the low Beta approach.

Low Beta ≠ Low Risk – A brief refresher on Beta is useful in understanding this particular pitfall. Consider a simple market model where a stock's return (R_i) is proportional to its Beta relative to the market's return (R_m). We notate this model as

$$R_i = \alpha_i + \beta_i R_m + \varepsilon_i \quad \text{where} \quad E(\varepsilon_i) = 0 \text{ and } E(\varepsilon_i R_m) = 0.$$

The Beta of the stock with the market can be estimated by regressing the stock's returns on the market's returns, where the returns of a stock index such as the S&P 500 or Russell 3000 can serve as a proxy for the market returns.

The Beta from the above regression equals the covariance of the stock's returns with the market's returns divided by the variance of the market returns. We can also denote the estimated Beta as the correlation of the stock's returns with the market's returns times the standard deviation of the stock's returns divided by the standard deviation of the market's returns. Or, in equation form:

$$\beta_i = \frac{cov(R_i, R_m)}{var(R_m)} = \frac{correl(R_i, R_m) * stdev(R_m) * stdev(R_i)}{stdev(R_m)^2} = \frac{correl(R_i, R_m) * stdev(R_i)}{stdev(R_m)}$$

This leads to an interesting observation. In the cross section, a stock can have a low Beta if (i) it has low volatility of returns (i.e., low *stdev*(R_i)) or (ii)) it has a low correlation with the market's returns (i.e, low *correl*(R_i,R_m)). In fact, in the latter case, **an asset can have a low Beta with the market and still be extremely risky.** A typical example of such an asset is gold and gold-related stocks, which typically have low or even negative Betas, but can be extremely volatile.

Low Beta ≠ Downside Protection – As noted above, low Beta stocks can still be highly volatile. Moreover, a portfolio that overweights (or is long) low Beta stocks and underweights (or is short) high Beta stocks may not take into account the correlations among stocks and various hedging opportunities. Holding large weights in volatile stocks will increase the portfolio risk and ignoring stock correlations in the portfolio construction process may also increase portfolio risk. For example, due to the benefits of diversification, a portfolio of two uncorrelated high Beta stocks can be less volatile than a portfolio of two correlated low Beta stocks.

There is some evidence in academic literature that portfolios favoring low Beta stocks outperform over time. However, examining the nature and the periods when those portfolios outperform is crucial in fully understanding the low Beta "anomaly." For example, Frazzini and Pedersen (2011) show that Beta neutral portfolios of U.S and International equities generate abnormal returns over time. However, **those portfolios underperformed significantly in 2008**. If one considers using a similar low Beta strategy as an alpha overlay for a cap-weighted index, then a significant loss on top of a 40% loss in the market in 2008 completely defeats one of the main purposes of low-volatility investing, which is to achieve greater downside protection.

While the absence of risk controls is likely a primary contributor to the lack of downside protection exhibited by some low Beta portfolios, one additional contributing factor may be that a Beta neutral portfolio may be constructed in a manner which involves leverage (e.g. Frazzini and Pedersen (2011)). To obtain a "Beta neutral" portfolio, it is necessary to overweight approximately $2 of low Beta stocks for each $1 of high Beta stocks that are underweight. Since such a portfolio is net overweight (long), its performance may be extremely impacted in times of extreme market movements and market crises. This is especially true if stocks' Betas in up-markets differ from their Betas in down-markets,[4] which would not be captured in these levered portfolios constructed based on unconditional Betas.

[3] See for example Frazzini and Pedersen (2011), and Baker, Bradley, and Wurgler (2010).

In sum, there are various different strategies an investor could employ to lower portfolio volatility. There is also evidence which shows that some of these methods also have the ability to generate market-like (or greater) returns over time. Generating market-like returns at lower levels of volatility should be appealing to all investors and can have important implications in investors' asset allocations. Low volatility strategies will also tend to have low Betas, but it is important to keep in mind that not all low Beta portfolios have low volatility or perform like a low volatility strategy. Choosing the methodology for achieving lower portfolio volatility is vitally important. Does the strategy (i) avoid reliance on anomalies that can be arbitraged away, (ii) use a mean-variance optimization process to control risk, (iii) employ any proprietary methodologies, or (iv) have return characteristics which are consistent with low volatility strategies i.e., attractive downside capture ratios? After asking these essential questions and evaluating the various alternatives available to investors, it seems that a "low volatility" strategy based on overweighting low Beta stocks and underweighting high Beta stocks is probably one of the least appealing options.

[4] There is some evidence that Betas in up-markets differ from Betas in down-markets; see Post, Van Vliet, and Lansdorp (2009).

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Baker, Malcolm P., Bradley, Brendan and Wurgler, Jeffrey A., *"Benchmarks as Limits to Arbitrage: Understanding the Low Volatility Anomaly,"* NYU Working Paper No. FIN-10-002 2010.

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