November, 2011

Risk Reduction: The Case for a Low Volatility Equity Portfolio

By Yuriy Bodjov, Vice-President & Director, TD Asset Management
and Jean Masson, Managing Director, TD Asset Management

Introduction

As investors struggle to adjust to exceptional volatility in the post-financial crisis markets, it is increasingly evident that traditional equity market benchmarks do not fully reflect the complexity of risk. In the search for stable and less risky returns, alternative models are gaining traction. One of these, low volatility equity strategies, is particularly suited to these uncertain times.

Low volatility equity portfolios are long-only equity portfolios engineered to have as little volatility as possible. The ultimate goal is risk reduction with similar returns to traditional indices over time. Unlike traditional indices that are structured based on market capitalization, low volatility portfolios are structured based on historical volatility, with volatility and other risk measures determining the inclusion and weighting of individual equities in the portfolio. Surprisingly, research shows that low volatility portfolios not only deliver lower volatility as designed, but also tend to generate better risk-adjusted returns over the long term. Such performance turns the conventional view of the risk/reward relationship on its head. Nonetheless, the fact that low volatility portfolios perform better over the long term is confirmed by extensive research.[1]

This paper will examine the research that validates this strategy and will describe how the strategy works. Referring specifically to TD Asset Management's low volatility funds, we will review our simulated and live performance and outline how we construct our portfolios. Lastly, we will look briefly at the possible future for low volatility strategies.

[1] See for example Haugen and Baker (1991) which analyses US equity returns from 1972 through 1989.

Re-examining the relationship between risk and return

Modern Portfolio Theory and the Capital Asset Pricing Model (CAPM) suggest that investors who wish to increase their expected returns should assume additional risk; that is, they should hold a portfolio that lies on the efficient frontier where expected return rises with the level of risk taken.

This link between expected returns and risk has been accepted conventional wisdom for decades. While it may indeed hold true when comparing alternative asset classes, an analysis of historical performance data reveals that it does not hold true for common equities – in fact, the opposite appears to be the case.

Most empirical tests of the CAPM, starting with Black, Jensen & Scholes (1972), conclude that riskier equities have not yielded statistically significantly higher returns than less risky equities. More recently, a considerable body of academic and professional research suggests that the returns on more volatile equities have, in fact, been lower than the returns on less volatile equities in the long term. This has been documented for US and other developed market equities over a considerable period of time.[2]

As will be shown in the charts below, the historical evidence demonstrates that, outside of extreme bull markets, more volatile stocks do not provide better returns over time – low volatility stocks do. This is described as “the low volatility anomaly”.

The historical evidence

The following graphs illustrate the pattern observed in most equity markets. In both down and normal markets, the lowest volatility stocks have the best returns (Figures 3 and 4). The highest volatility stocks are outperforming only when the markets are extremely strong (Figure 2).

To create the following charts we constructed five equally-weighted portfolios of global equities sorted on the basis of the standard deviations of the trailing 60 monthly returns. In each chart:

- Q1 is the portfolio of the least volatile equities, while Q5 is the portfolio of the most volatile equities.
- The quintile portfolios are rebalanced each month and are equally-weighted.
- All four graphs in figures 1, 2, 3, and 4 below track the stocks that are members of the MSCI World index from August 1995 through August 2011.
- Risk is measured as the standard deviation of monthly portfolio returns.
- Return is the average monthly portfolio return.

---

[2] See for example Ang, Hodrick, Xing, and Zhang (2006) which analyses US equity returns from 1963 through 2000.

Figure 1 illustrates the pattern of quintile portfolio returns over all months from August 1995 through August 2011. Over that period, the third quintile portfolio returned 0.79% per month on average, which corresponds to almost 10% per year. However, the portfolio made up of the least volatile equities delivered 0.81% per month on average with considerably less return volatility, while the portfolio of the most volatile equities returned 0.74% per month with considerably more volatility.

Fig 1: Risk/Return by Volatility Quintile
(August 1995 - August 2011)

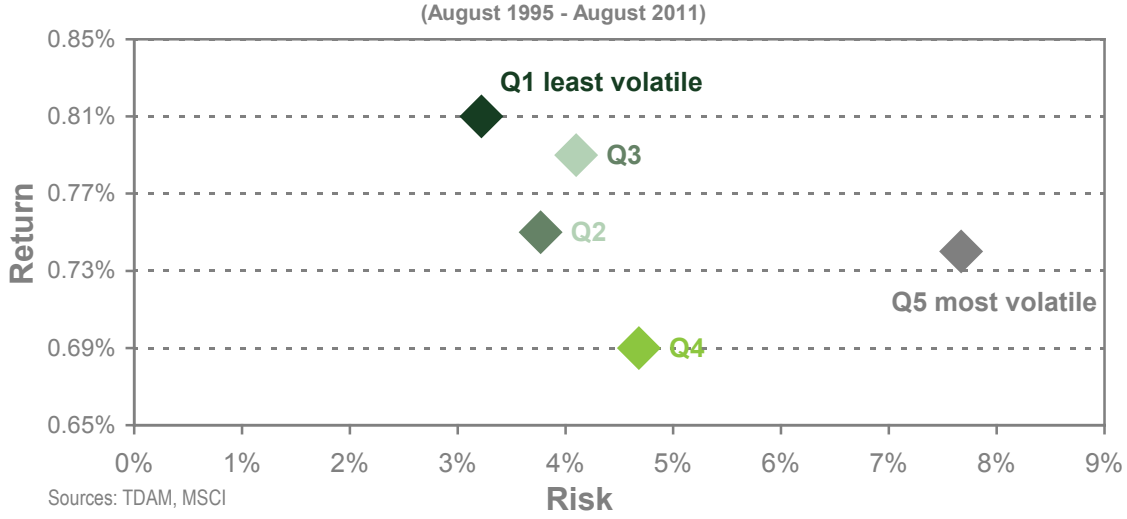


Figure 2 illustrates the risk-return pattern in strongly rising markets (in which the average stock returns more than 4% per month). In such markets, we observe the pattern predicted by CAPM in which the most volatile equities out-perform less volatile equities.

Fig 2: Strong Up Markets (Average Stock Return > 4%)
(August 1995 - August 2011)

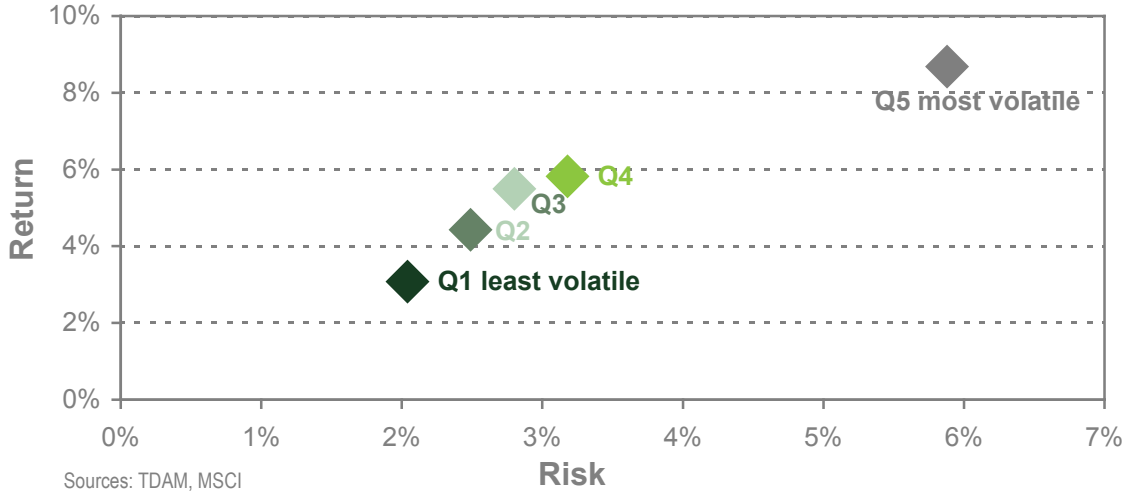


Figure 3 illustrates the risk-return pattern in strongly falling markets. Here the pattern predicted by the CAPM holds true in its negative form: The most volatile equities lead the market down.

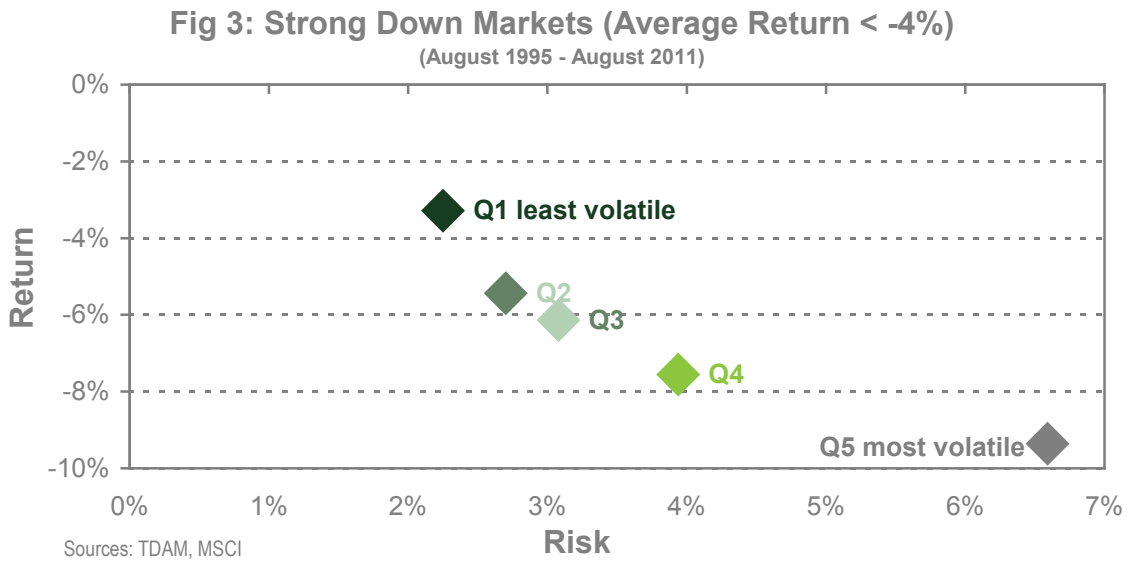
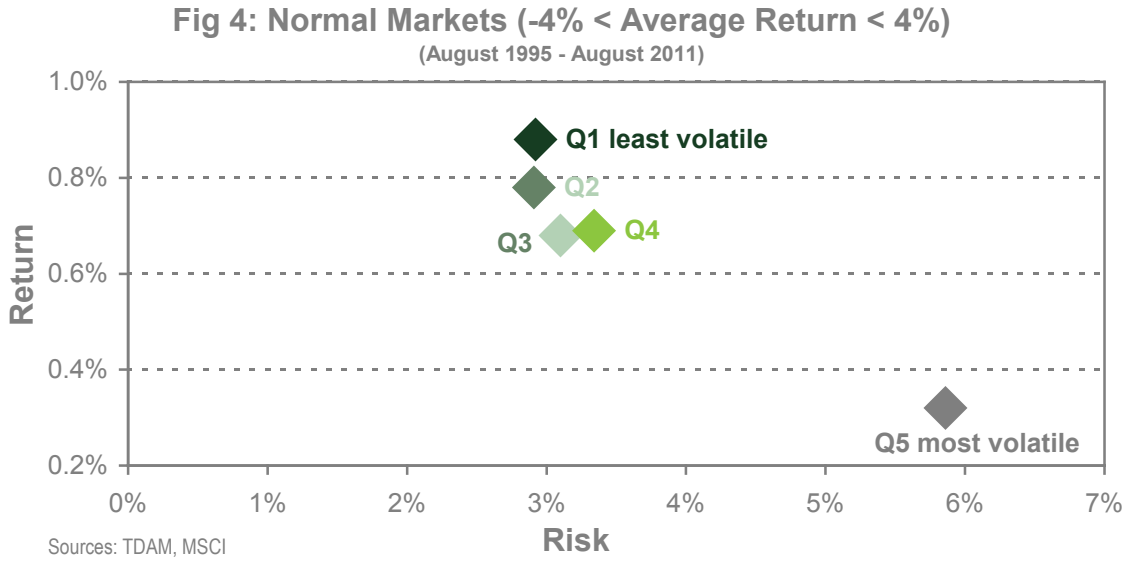


Figure 4 focuses on months in which the average stock return falls between -4% and +4%. In these neither too cold, nor too hot markets, the most volatile stocks under-perform on average the least volatile equities.

Thus, in markets with modest positive returns, the portfolio of the most volatile equities yields lower returns than the portfolio of the least volatile equities.



Looking at these charts in concert, the conclusion is undeniable: The conventional risk/reward relationship holds true only in exceptionally strong markets. Instead, 70% of the time, low volatility equities will be the best choice.

Lower volatility stocks provide one further benefit: the better returns in down markets ensure that the effect of compounding is enhanced. An asset that loses 10% of its value needs to rise by 11.1% to get back to its initial value. On the other hand, an asset that suffers a loss of 15% will require a subsequent return of +17.6% to get back to par.

This evidence is inconsistent with the predictions of the CAPM. It is however consistent with the great majority of empirical research results published in academic journals.

Making the case for low volatility equities

If the expected returns on stocks are approximately equal, then an investor who wants to build an efficient portfolio should simply minimize expected portfolio return volatility. The portfolio with minimum return volatility would under this scenario maximize the Sharpe ratio (the measure of return per unit of risk).

The conclusion would be the same if the investor cannot effectively forecast future stock returns but can forecast return volatility. Many studies have indeed concluded that it is materially easier to forecast return volatility than to forecast future stock returns.[3] This is important as the ability to forecast return volatility is the key to the construction of low volatility portfolios.

How we construct low volatility portfolios

TD Asset Management launched the *TD Emerald Low Volatility Canadian Equity PFT* on September 11, 2009. Two years after its launch (and the subsequent launch of two other low volatility equity funds) the strategy has garnered substantial attention and delivered excellent risk-adjusted returns in line with expectations based on our research team's historical simulations.

Our portfolios begin with a particular universe of stocks, such as the S&P/TSX Index or the MSCI Index. These indices can be considered the parent index from which the portfolio is created. Unlike the parent index, however, our low volatility model uses risk, not market capitalization, to determine the inclusion, exclusion, and optimal weighting of the stocks in the portfolio.

The risk that each security contributes to the portfolio is determined using standard deviation and covariance analysis. While our model predicts risks, it does not predict returns – this is one way that TDAM's model differs from several competitors.

---

[3] Chopra and Ziemba (1993) find that errors in estimating expected returns are over ten times larger than when estimating variances, and over twenty times larger than errors in estimating covariances.

We use state-of-the-art factor-based risk models to estimate the various correlations among the large numbers of equities involved. We assume that return correlations originate from exposures to common risk factors. For example, increases in energy prices will systematically and positively impact oil and gas firms.

The same increases will also negatively impact important energy users such as transportation and chemical firms. Changes in interest rates will impact firms in the financial sectors as well as firms that carry heavy debts. Common risk factors such as these must be included in the model to determine the optimal risk weightings.

Differences can also be found in the constraints that we employ. Each portfolio has specific guidelines that determine the minimum number of positions and the maximum sector, country and individual security weights permitted. These common sense constraints are factored into the model to determine the final weightings and are unrelated to the corresponding capitalization-weighted indices.

Interestingly, despite the large number of factors that determine the inclusion and weighting of individual stocks, the portfolio turnover is typically lower than the turnover of active strategies based on individual stock analyses because risk assessments do not change as rapidly as valuation assessments.

Low volatility portfolio characteristics

Because of our portfolio construction process, the end portfolio will look quite different than the capitalization-weighted index from which the assets are selected. Since the optimal low volatility portfolio stock weights are determined by the pattern of estimated stock volatilities and correlations, the portfolio weightings will be different than the parent index and not all securities will be included. Stocks with lower return volatilities and lower correlations with other stocks will tend to have larger weights. Stocks with higher return volatilities or with higher correlations will have either zero or smaller weights.

In practice, stocks from the Utilities or Consumer Staples sectors tend to be well represented in low volatility portfolios. These stocks are typically issued by firms with relatively stable technologies and markets. The stocks of fast growing firms are less well represented. Their stock prices are heavily influenced by faster changing expectations of future cash flows.

Similarly, the stocks of firms with low degrees of accounting or economic leverage have higher weights than the stocks of firms that are heavily indebted or have mostly fixed costs that cannot easily be altered according to the state of the economy.

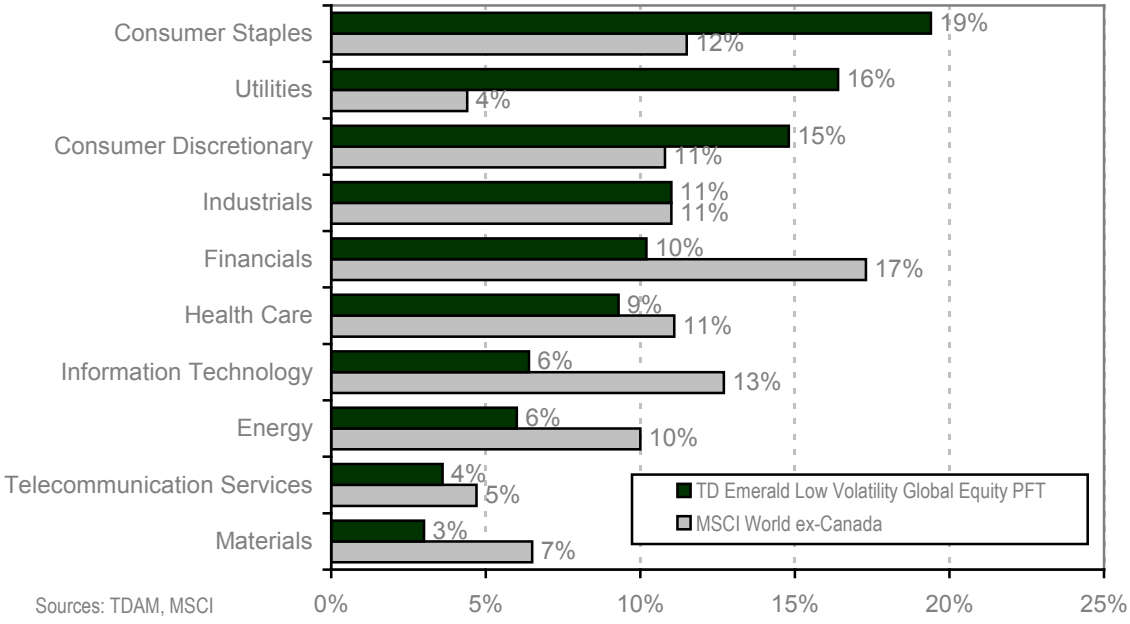
Finally, stocks that pay high dividend yields have higher weights within the low volatility portfolio as these stocks tend to deliver more stable returns.

Table 1: Global Low Volatility Portfolio as of September 30, 2011

Characteristics	TD *Emerald* Low Volatility Global Equity PFT	MSCI World ex-Canada
Beta *	0.69	1.00
Annualized Std. Deviation of Return *	10.66%	14.16%
Sharpe Ratio	0.69	-0.17
Number of stocks	236	1,531
Market Capitalization (average, CAD)	$40.7 billion	$67.7 billion
Dividend Yield (average)	3.13%	3.08%

** Calculated using daily returns since inception*

Fig 5: Sector Weights as of September 30, 2011



Our low volatility portfolios have fewer mega cap stocks and are more exposed to the segment of companies with mid and small market capitalization. Although it is a known fact that the small caps are on average more volatile than larger caps, this is not a universal truth. There are some very large cap companies such as Apple, which are very volatile and some small caps from the consumers sector with very stable returns.

Our stock selection process helps us identify the least volatile and least correlated stocks in all market segments. Moreover, the smallest cap stocks held by our fund have a market capitalization exceeding two billion dollars.

Low volatility portfolio returns

Our empirical simulations suggest that investors can expect higher risk-adjusted returns from low volatility equities over the long run. However, lower volatility equities do not out-perform higher volatility equities under all scenarios. As demonstrated earlier (Figure 2) individual low volatility equities will under-perform higher volatility equities during strong bull markets.

Similarly, low volatility equity portfolios will under-perform capitalization-weighted indices in strong bull markets. In such markets, characterized by general optimism and falling risk aversion, the stocks of faster growing and volatile equities tend to rise faster than the stocks of more stable firms.

The opposite will tend to be observed in falling markets, with low volatility equity portfolios losing considerably less than capitalization-weighted indices.

Table 2: Simulated Market Capture Statistics (Aug 1998 – Nov 2009)

Monthly return on MSCI World ex-Canada Index in Canadian dollars (Market)	Months	% of Occurrences		Average Monthly Outperformance
		Out-performance	Under-performance	
Market > +4%	26	26.9%	73.1%	-2.02%
-4% < Market < +4%	89	61.8%	38.2%	0.30%
Market < -4%	22	100.0%	0.0%	3.41%
Overall Percentage	137	61.3%	38.7%	0.37%

The simulated returns summarized in Table 2 suggest that low volatility portfolios tend to deliver less positive returns in strong bull markets (defined as a monthly return on the capitalization-weighted index in excess of 4%). For our global low volatility equities the average relative under-performance in the back tests is around -2%. Low volatility equities under-perform in most such strong market months. The live performance corresponds to the back tests: In strong bull markets, low volatility equities underperformed by 1.83%.[4]

On the other hand, simulated low volatility equity fund returns exceeded cap-weighted index returns in 100% of months in which market returns were lower than 4% in both the simulated and the live history.

For global low volatility equities, the average out-performance in the back tests was 3.41%. Our out-performance in down markets since the December 2009 launch of the Fund is in-line with prior simulations at 3.34%.

The frequency of out-performance in neither too hot nor too cold markets was 61.8% in the back tests and 70.6% for the live history. In markets with monthly index returns ranging from -4% to +4%, low volatility equities tended to out-perform. The average monthly out-performance ranged from 0.30% per month in the back tests to 0.79% per month since we launched the fund.

Table 3: Live Market Capture Statistics (Jan 2010 – Sep 2011)

Monthly return on MSCI World ex-Canada Index in Canadian dollars (Market)	Months	% of Occurrences		Average Monthly Outperformance
		Out-performance	Under-performance	
Market > +4%	2	0.0%	100.0%	-1.83%
-4% < Market < +4%	17	70.6%	29.4%	0.79%
Market < -4%	2	100.0%	0.0%	3.34%
Overall Percentage	21	66.7%	33.3%	0.79%

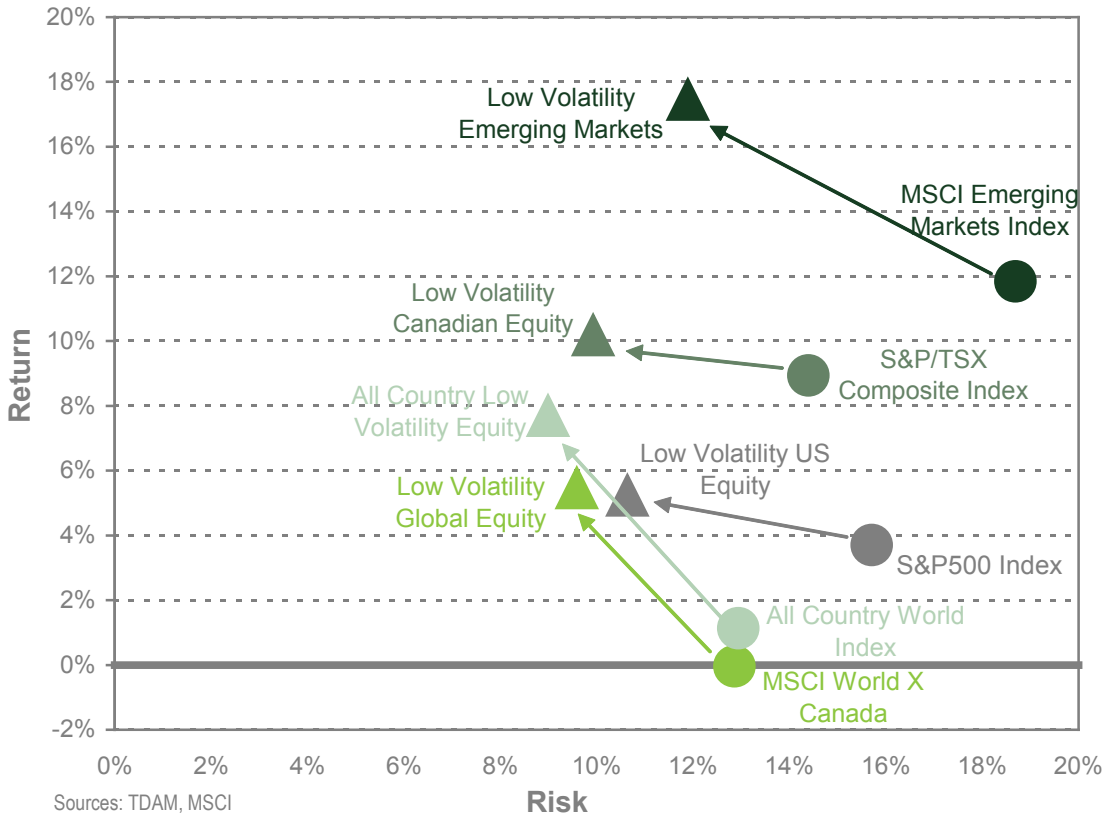
[4] All simulated returns referenced in this document are expressed in Canadian dollars. Simulated returns are shown for illustrative purposes. Past performance is not indicative of future returns. Simulated Global Low Volatility returns assume trading costs (commissions and market impact) of 0.35%. They were realized with a custom global statistical risk model created by TDAM.

We performed longer back tests with Canadian equities (where we have a longer history of accurate equity returns). The simulated and live returns are very much consistent with the results summarized in Table 2 and are available upon request. The live performance of our *TD Emerald Low Volatility Canadian Equity PFT* has also been in line with our simulated performance.

Figure 6 summarizes simulations performed in different universes. All simulations start in January 2002 and end in December 2009. They were performed with proprietary risk models created by TDAM. In all cases, simulated low volatility returns have higher annualized returns and lower volatility.

The results shown in Figure 6 hint at another empirical regularity: Low volatility portfolios will out-perform or under-perform their respective cap-weighted parent indices in the same periods across the world. Thus, there is little diversification of the "low-volatility effect".

Fig 6: Low Volatility vs Cap-Weighted Indices



The future of low volatility strategies

Our empirical back-tests demonstrate historical out-performance. What can be said about future performance? We don't expect future returns to be identical to past returns. We do not anticipate that the low-volatility effect will be rapidly arbitraged away by sophisticated long-short investors. Short selling volatile stocks can be very costly. Some volatile stocks cannot be shorted at all. A hedge fund that goes long low volatility equities and short high volatility equities would itself have a high expected return volatility. Such a hedge fund would post very negative returns during strong bull markets.

For long-only investors, who are widely evaluated on the basis of their information ratio computed with respect to traditional cap-weighted indices, overweighting low-volatility equities reduces the variability of portfolio returns, but the information ratio falls because the increase in active risk does not coincide with a sufficient increase in returns. Thus, the widespread use of the information ratio metric within the asset management industry prevents most portfolio managers from significantly deviating from their capitalization-weighted benchmarks.

Will the low-volatility advantage disappear? If most investors dislike volatility, they should prefer less volatile assets. This process should bid up their prices, thus lowering their expected returns until, in equilibrium, investors are indifferent between assets with various risk levels. Of course, this has not happened yet, even decades after the advantage was demonstrated in academic and professional journals.

Most explanations of this anomaly originate from behavioural finance. One hypothesis is that investors have been willing to "overpay" for volatile equities. They over-estimate the future growth of glamour stocks. Another hypothesis is that many investors are drawn to the "lottery" aspects of volatile stocks with positively skewed returns. A third explanation is that investors are overconfident about future prospects. Overconfidence is more important for highly uncertain volatile stocks than for more established defensive equities. Even cool-headed fund managers are willing to hold volatile stocks because they believe they can pick winning stocks and need them to beat capitalization-weighted benchmark indices.

But as awareness of risk grows, these behaviours will likely change. The low-volatility effect may thus disappear when enough capital is benchmarked using the Sharpe ratio and when enough investors are willing to deviate significantly from capitalization-weighted benchmarks. Until that paradigm shift occurs, there is a window of opportunity for investors, and the first mover rewards may be significant. ■

References

Ang, Andrew, Robert J. Hodrick, Yuhang Xing, and Xiaoyan Zhang, 2006, "The Cross-Section of Volatility and Expected Returns", *Journal of Finance*, 61, 259-299.

Black, Fisher, Michael C. Jensen and Myron Scholes, 1972, "The Capital Asset Pricing Model: Some Empirical Tests" in M. C. Jensen, ed., *Studies in the Theory of Capital Markets*, Praeger.

Chopra, V. K., and W. T. Ziemba, 1993, "The Effect of Errors in Means, Variances, and Covariances on Optimal Portfolio Choice," *Journal of Portfolio Management*, 19, 6–11.

Haugen, Robert A. and Nardin L. Baker, 1991, "The efficient market inefficiency of capitalization-weighted stock portfolios", *The Journal of Portfolio Management*, 17, 35-40.