



A Review of the Historical Return-Volatility Relationship

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Introduction

Over the past few years, low volatility investment strategies have emerged as an alternative to traditional active and passive strategies. With the goal of providing market-type returns with lower risk, they seek to capitalize on the so-called low volatility anomaly whereby stocks with lower volatility historically have realized higher returns than predicted by theoretical models such as the Capital Asset Pricing Model (CAPM). Unlike traditional investment strategies that focus on generating excess returns through stock selection, investment style or risk factors (e.g. value, size or momentum), low volatility investing seeks to capitalize on a fundamental underpricing of risk in equity markets. Given the surge in popularity of such strategies in recent years, it's logical to ask if this is just a recent phenomenon. While the low volatility effect is supported by a growing body of academic literature, some suggest that it is due primarily to the falling interest rate environment, which favours specific sectors and will fade out as soon as interest rates start to rise. Others suggest that low volatility is just another value strategy. Which hypothesis is confirmed by the historical evidence? To determine this, we must go back in time as far as possible.

Literature Review

The first empirical evidence of the low volatility anomaly came from early tests of the CAPM. Black, Jensen and Scholes (1972) found that CAPM does not provide an accurate description of the cross section of security returns. Specifically, they noted that high-beta assets tended to compensate investors less than predicted by the theory. Further work by Fama and McBeth (1973) and Haugen and Heins (1975) also found that beta did not explain returns, and these studies paved the way for the seminal Fama and French (1992) paper that found the relationship between risk and return was flat or slightly negative over the 1963-1990 period. While recent work by finance scholars, including Haugen and Baker (1991, 1996), Blitz and Van Vliet (2007) and Baker et al. (2011), had some methodology driven differences in findings, the almost-unanimous conclusion was that there is a real disconnect between risk and return in the U.S. stock market and the relation between historical volatility and expected return is either flat or inverted.

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Our Analysis

Our goal was to document whether the low volatility anomaly is only a recent, transitory phenomenon or whether it permeates most of recorded equity return history. What were the times and circumstances when low volatility equities underperformed? To do so, we extended our analysis to include the 86 years from 1927 to 2013.

Similar to previous studies of the low volatility anomaly, our methodology consisted of forming equity portfolios based on historical volatility and comparing the performance ex-post. We focused on the U.S. stock market for which we were able to find the longest historical equity returns and pricing data with an acceptable quality. We used the Center for Research in Security Prices (CRSP) data starting in December 1925 and limited our analysis to the stocks of the biggest 500 companies by market capitalization for which we had the best coverage. Companies with dual or multiple class shares were represented by the stock issue with the largest market capitalization. Substantial efforts were made to clean up the data and take into account various factors that might have had a significant impact on the results. For example, the total returns of the stocks were computed by taking into account all corporate actions, stock splits and regular and special dividends, and to avoid having returns influenced by the bid-ask bounce, we eliminated all penny stocks from the analysis. To maintain consistency with previous studies we used a one month data frequency. The analysis was conducted using the following procedure:

At the beginning of each month, we divided the 500 stocks from our universe into five portfolios (Q1 to Q5) based on their historical return volatility. The first portfolio (Q1) contains the stocks with the lowest volatility and the fifth (Q5) is composed of the stocks with the highest volatility. Each of the 100 stocks in the portfolio was given equal weight. At month-end we computed the total return of each of the quintile portfolios. We repeated the procedure for the entire period of the analysis. The impact of "survivorship bias" was mitigated by taking into account the accumulated daily returns of the stocks that dropped from the universe without having completed the month.

Findings

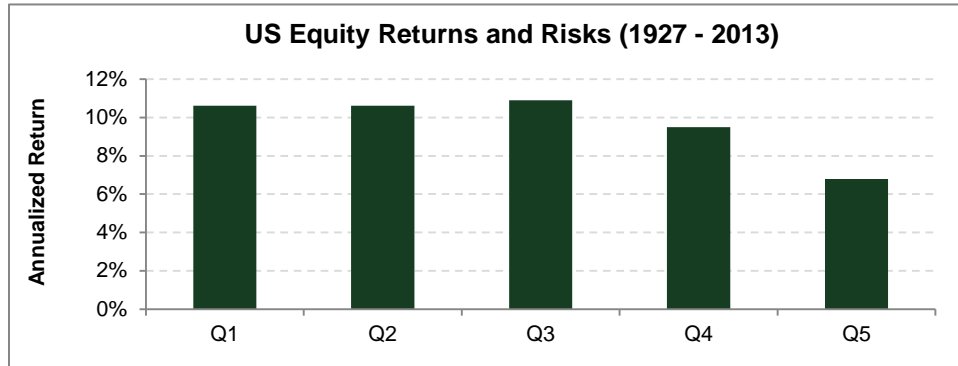
Performance Analysis

Our analysis shows that, on average, over the last 86 years there was not a clear relationship between risk and return within the U.S. equity market. Although the average arithmetic return seems to increase with volatility for the lowest quintiles, it drops for the riskiest stocks. Moreover, the analysis confirms that for any volatility bucket, the return difference compared to the average overall return is not statistically significant.

(Aug. 31, 1927 – Dec. 31, 2013)	Q1	Q2	Q3	Q4	Q5	Overall
Average Return (monthly)	0.93%	0.99%	1.08%	1.04%	0.96%	1.00%
Standard Deviation	4.12%	5.46%	6.62%	7.57%	9.23%	6.37%
t-Stat	-0.552	-0.055	0.379	0.160	-0.123	

Source: TD Asset Management Inc. (TDAM) and CRSP

From an economic standpoint, investing in higher volatility stocks makes little sense. The penalty for taking more risk is amplified by the compounding effect of the returns experienced by multi-period investors. The highest geometric returns are observed over the lower part of the volatility spectrum:



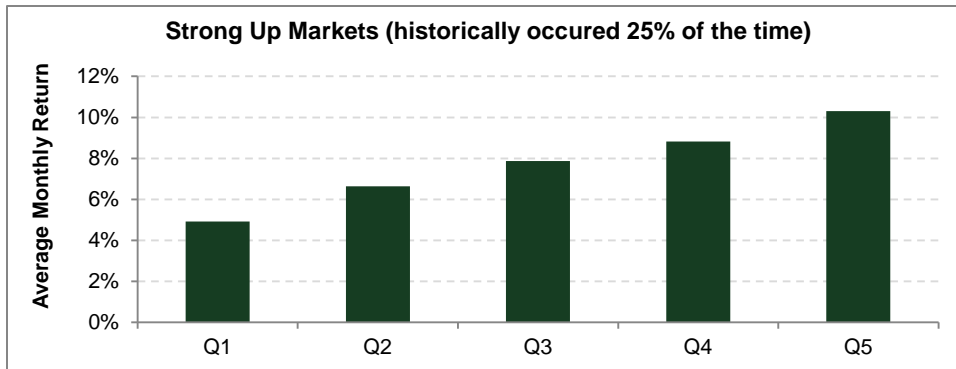
Source: TDAM and CRSP

The Sharpe ratio, which is a common measure of risk adjusted returns, shows that the lowest volatility stocks are the clear winners in that aspect. This finding is not surprising and confirms previous studies made over shorter historical periods.

(Aug. 31, 1927 – Dec. 31, 2013)	Q1	Q2	Q3	Q4	Q5	Overall
Annualized Return	10.6%	10.6%	10.9%	9.5%	6.8%	10.1%
Sharpe Ratio	0.48	0.36	0.31	0.22	0.10	0.29

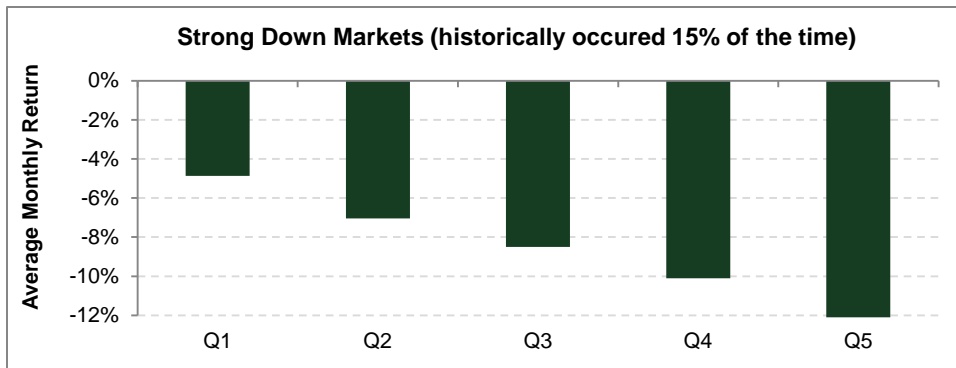
Source: TDAM and CRSP

Of course we cannot expect the anomaly to persist during every single time period. A defensive strategy composed of low volatility stocks will suffer in an environment of strong equity markets. If we limit the analysis to only months when the average stock return exceeds 4%, we observe the following: investors in high volatility equities typically receive most of their compensation for bearing risk during strong bull markets.



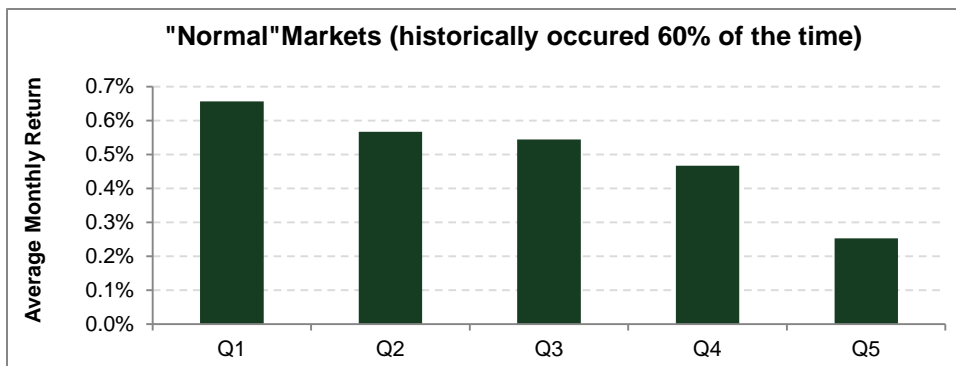
Source: TDAM and CRSP

If, on the other hand, we examine the months during which the average equity return is below -4%, we see an almost mirror image:



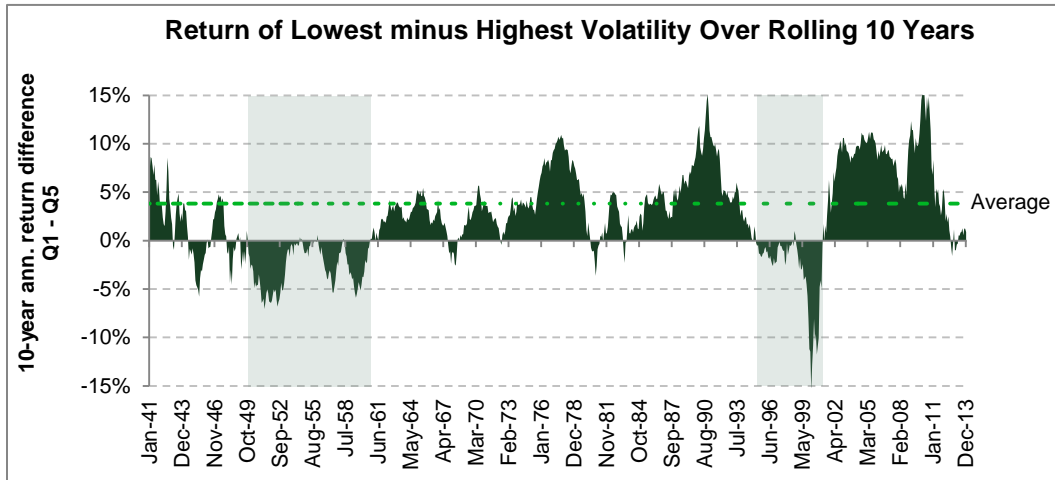
Source: TDAM and CRSP

It is no surprise that defensive low volatility stocks outperformed during bear markets. However, these bull-bear market months with quite predictable outcomes occurred historically only 40% of the time. What happened during the rest of the time? The answer is shown on the following chart:



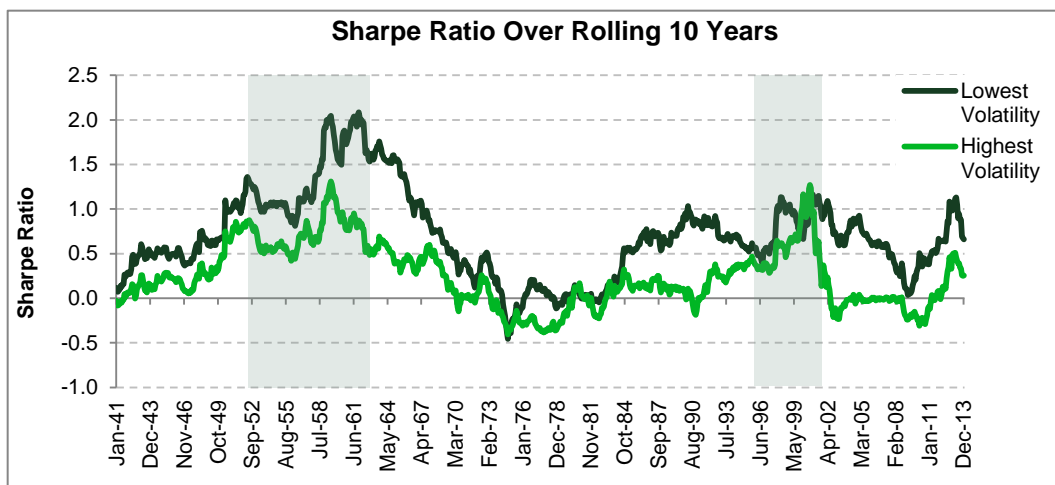
Source: TDAM and CRSP

Most of the time, betting on riskier stocks was a losing strategy. In fact, if we study 10-year rolling periods over the last 86 years, we observe only two significant episodes of low volatility stock underperformance:



Source: TDAM and CRSP

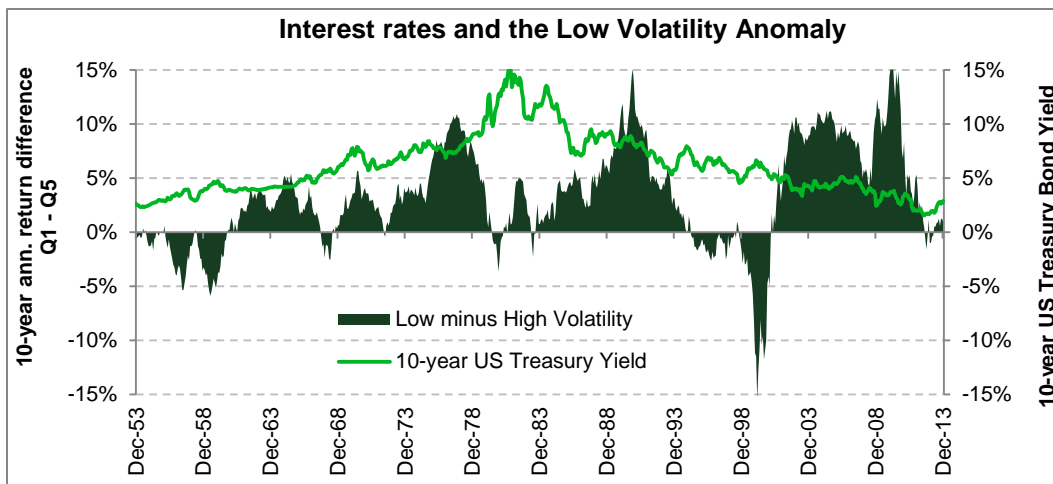
The first period includes the Second World War and post-war reconstruction, and the second period includes the dot-com boom of the nineties. Each of these periods was characterized by very strong equity markets during which riskier stocks posted very high returns. However, even if their absolute returns were less spectacular, on a risk adjusted basis the stocks in the lowest volatility quintile still outperformed during these years. In the fifties, their Sharpe ratio was almost twice as high as that of the stocks the riskiest quintile!



Source: TDAM, Federal Reserve Board and CRSP

The Impact of Interest Rates

Our analysis has shown that low volatility stocks have a long and persistent history of outperformance, but we also wanted to examine whether or not interest rates had a long-lasting impact on this pattern. This is a reasonable supposition given that most of the low volatility stocks come from interest-rate-sensitive sectors such as Utilities, Financials, Consumer Staples and Telecoms. To test this, we used the 10-year U.S. Treasury bond yield as a proxy of the general level of interest rates and compared it with the difference in the rolling 10-year annualized returns of the lowest and the highest volatility quintile portfolios. During most of the forties, interest rates were regulated because of the war, so we started the analysis in 1953, when rates were allowed to float again.



Source: TDAM, Federal Reserve Board and CRSP

On average, interest rates rose from 1953 until 1981, but they have been falling ever since. There were short periods in the late seventies and nineties when sharp increases in interest rates coincided with low volatility stock underperformance. However, there were also periods when low volatility stocks outperformed in rising interest rate environments. Overall, there seems to be no clear long-term relationship between interest rates and the outperformance of low volatility stocks. One possible explanation is that the identities of low volatility stocks change over time — the stocks most affected by changing interest rates become more volatile while stocks that are less sensitive to interest rates become the lowest volatility stocks.

The Impact of Investment Style

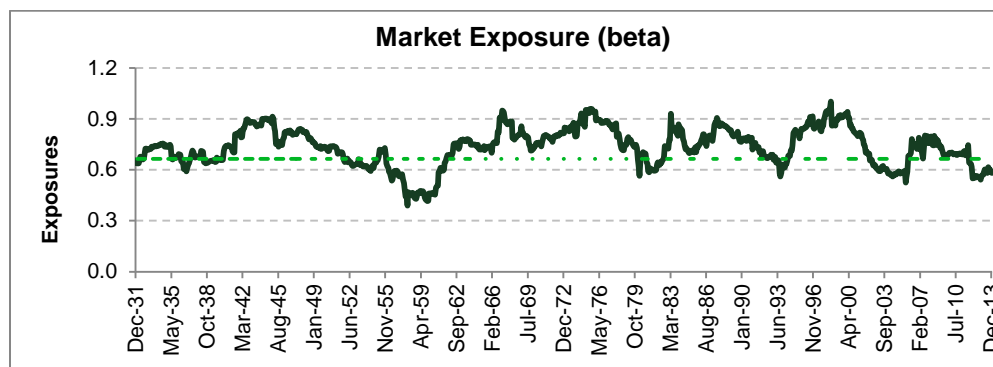
Some researchers associate low volatility strategies with particular investment styles such as value and size. Is there a stable relationship between investment style and low volatility stocks? To answer that question, we performed a detailed analysis over the entire 86 year period. We estimated a regression of the monthly returns of the lowest volatility quintile portfolio against the returns of the three Fama/French factors taken from Kenneth French's data library. The explanatory variables are the Market factor, the Value factor (high book to market minus low book to market) and the Size factor (small cap minus large cap). The results from the regression are given in the table below:

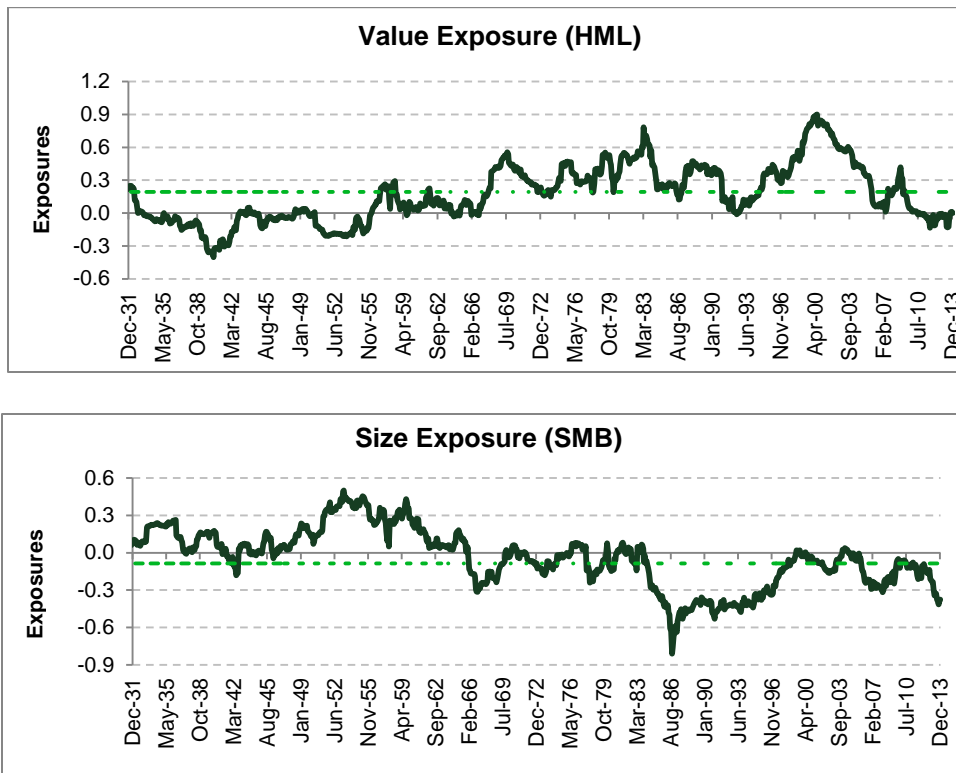
(Aug. 31, 1927 – Dec. 31, 2013)	Intercept	Market	Value (HML)	Size (SMB)
Coefficients	0.0026	0.6645	0.1922	-0.0867
t-Stat	4.6875	60.8782	12.0223	-4.8508

Source: TDAM, Kenneth R. French and CRSP

Together, these three factors explain 82% of the total variation of the low volatility returns. The regression coefficients are highly significant. The coefficient of the Market factor (beta) is in-line with our expectations: low volatility stocks have also low beta. The other two coefficients also confirm the previous studies: there seems to be a value and a large-cap bias.

Can we say then that low volatility investing is simply a value strategy in disguise? To answer that question we need to test the stability of these coefficients. We repeated the regression analysis, but this time over rolling 3-year periods. The following graphs show the historical regression coefficients (exposures) to the three Fama/French factors:





Source: TDAM, Kenneth R. French and CRSP

The exposure to the Market factor or beta is the only coefficient showing relative stability, the Value and Size coefficients were not consistent. Even if low volatility stocks are, on average, positively exposed to the Value factor, there have been some very long periods when the safest stocks were also more expensive, for example from July 1933 to January 1956 and more recently from June 2010 to September 2013. Similarly, the Size factor was not constant. Before 1965, there was a small-cap bias and after 1984 low volatility stocks seem to be mostly larger cap. All these findings suggest that low volatility and value strategies cannot be considered as substitutes. They pursue different objectives, they are constructed differently and, as a result, their returns will be different.

Conclusion

In conclusion, our study shows that the low volatility anomaly is not a short-lived recent phenomenon, but it has persisted for a very long time. Moreover, it is a profitable long-term investment alternative regardless of the prevailing interest rate environment, and low volatility equities differ substantially from value strategies by their construction rules and investment objectives. Overall, low volatility equities provide competitive rates of return with a downside protection resulting in superior risk-adjusted returns.

Yuriy Bodjov is a Vice President & Director, Quantitative Research, TD Asset Management. The co-author, Issac Lemprière, was a co-op student with TD Asset Management in 2013 and 2014 during his studies at Concordia University. As a John Molson School of Business student, Isaac had access to the CRSP database which was used for this research with permission.

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Disclosures

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