Low-Volatility Anomaly: Challenges for CAPM

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Background

There are established literatures in the study of low volatility anomaly (a.k.a. minimum variance anomaly). This anomaly suggests that, holding low-volatility stocks have historically produced higher risk-adjusted returns compared with holding high volatility stocks. This anomaly holds in most market conditions, in both emerging and developed markets.

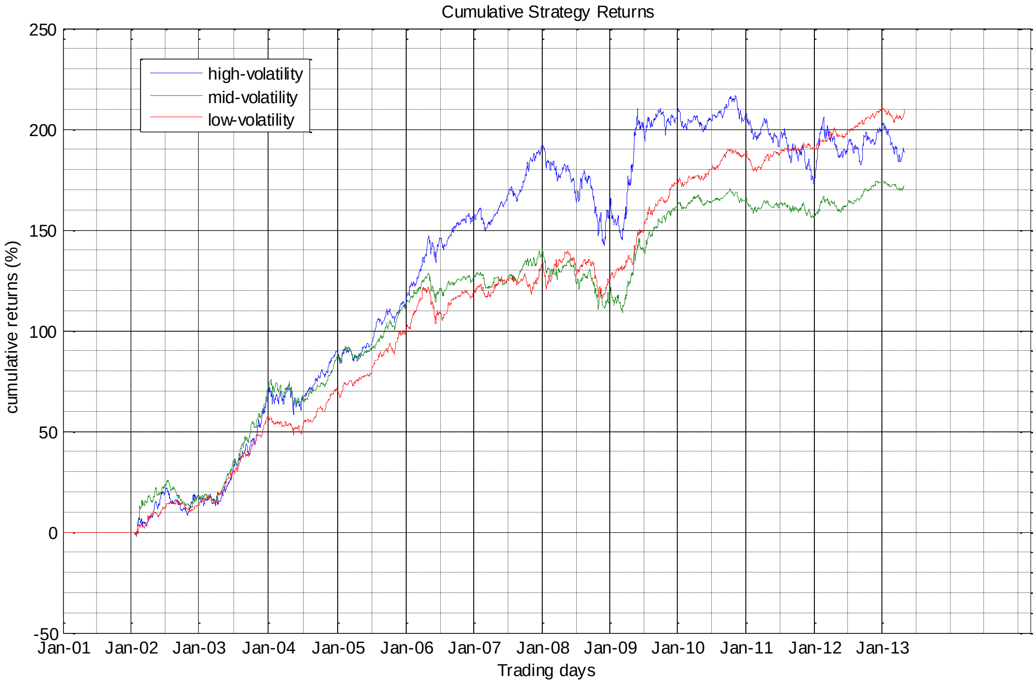
This anomaly is a direct challenge for the CAPM model, which suggests that expected returns should be linear functions, and therefore low beta stocks are expected to result in relatively low returns. However, empirical studies find these assumptions wrong.

Empirical Study

I tested this anomaly using historical data in India market (NIFTY Index) from year 2000 to 2013, as this anomaly has been tested using US data extensively by academics and practitioners, but less covered for emerging markets. In this test, beta is used as the proxy for volatility. To compute the beta, a sliding window of one year is used (252 business days). On each portfolio rebalance period (monthly), we rank all stocks in the universe according to their historical beta and therefore construct 3 portfolios:

1) portfolio of low beta stocks, which can be viewed as a proxy for low-volatility universe;
2) portfolio of high beta stocks, which can be viewed as a proxy for high-volatility universe;
3) portfolio of other stocks in the universe, whose betas are neither too low nor too high;

We run this strategy on each day for all the 13 years, and generate the cumulative returns for each of the three aforementioned portfolios:



It can be seen clearly that low-volatility portfolios deliver consistent superior risk-adjusted returns over the high volatility alternatives. Concretely, the underlying index return during the back-testing period averages 16.09% annually, with an annual volatility of 25.42% and Sharpe ratio of 0.63. During the same period, the volatility ranked portfolios generated the following results. The low volatility portfolio results in the lowest portfolio volatility and maximum Sharpe ratio. Compared with the high volatility portfolio, it also achieves similar returns with substantially lower equity drawdowns (maximum drawdown of 87.74 for high volatility portfolio versus 56.61% for low-volatility portfolio, both observed during the 2008 financial crisis):

Portfolio	Ann. Return	Ann. Volatility	Sharpe
High-volatility	23.74	27.72	0.86
Mid-volatility	22.37	20.65	1.08
Low-volatility	25.43	18.35	1.39

This anomaly can be used as a building block for more sophisticated quantitative trading strategies.

**This article is not yet finished. I will soon add the case study for other markets (such as S&P 500) and provide some theoretical explanation for this anomaly.*