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The Impact of Skewness and Fat Tails on the Asset Allocation Decision

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Abstract

The authors modeled the non-normal returns of multiple asset classes by using a multivariate truncated Lévy flight distribution and incorporating non-normal returns into the mean-conditional value at risk (M-CVaR) optimization framework. In a series of controlled optimizations, they found that both skewness and kurtosis affect the M-CVaR optimization and lead to substantially different allocations than do the traditional mean–variance optimizations. They also found that the M-CVaR optimization would have been beneficial during the 2008 financial crisis.

Although practitioners are well aware that asset returns are not normally distributed and that investor preferences often go beyond mean and variance, the implications for portfolio choice are not well known.

In a series of controlled traditional mean–variance optimizations (MVOs) and mean-conditional value at risk (M-CVaR) optimizations, we gained insights into the

ramifications of skewness and kurtosis for optimal asset allocations. In our first four scenarios, prior to running the optimizations, we used the multivariate TLF distribution model to simulate a large number of returns with appropriate variance, skewness, and kurtosis, which, in turn, enabled us to more accurately measure the downside risk of a portfolio by using the CVaR.

In our first example, in which returns are symmetrically distributed and have uniform tails, the MVO and the M-CVaR lead to the same results. When there are varying levels of skewness and kurtosis in the opportunity set of assets, the MVO and the M-CVaR lead to significantly different asset allocations. In particular, the combination of a negative skewness and a fat tail has the greatest impact on the optimal asset allocation weights. Intuitively, the M-CVaR prefers assets with higher positive skewness, lower kurtosis, and lower variance.

Over the last 20 years, global high yield, U.S. REITs, U.S. TIPS, and value stocks have had significant negative skewness, whereas non-U.S. government bonds have had positive skewness. The kurtosis for global high yield, U.S. REITs, and U.S. TIPS is higher than it is for other asset classes. In a 14-asset-class bootstrapping analysis, the M-CVaR, relative to the MVO, leads to significantly higher allocations to non-U.S. government bonds and U.S. nominal bonds and lower allocations to global high yield, U.S. REITs, and commodities.

An out-of-sample test showed that the M-CVaR outperformed the MVO in the financial crisis of 2008, with excess gains ranging from 0.84 percentage point to 1.44 percentage points across the efficient frontier. This outperformance suggests that higher-moment information embedded in historical returns had some predictive power in the crisis.

Although we are just beginning to understand the impact of higher moments on asset allocation policy and further study is needed, these optimizations drive home a critical implication of modern portfolio theory: What matters is the overall impact on the portfolio’s characteristics.

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