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# Why Mean-Variance Optimization Isn't Useful for Investment Management

by

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## Abstract

The logic of mean variance optimization is seductive, but the seduction unravels in the investment period.

Classical mean-variance (MV) optimization is a quantitative tool used by asset managers, consultants, and investment advisors to construct portfolios. The goal of MV optimization is to find portfolios that optimally diversify risk without reducing expected return and to facilitate portfolio construction. The procedure is based on the pioneering work of Harry Markowitz, the Nobel Prize-winning economist, widely recognized as the father of modern portfolio theory. While the aim is admirable, the results in practice are disappointing.

Anyone who spends time working with most commercially available optimizers usually reaches the conclusion that classical MV optimization fails to live up to its promise. Optimizers are unstable; without ad hoc constraints even small changes in estimates of risk or return result in totally divergent portfolios. Because you are never perfectly certain of your information, which of these optimized portfolios should you recommend to your client?

MV optimizers overuse information and produce biased portfolios. Optimized portfolio return is, on average, an overestimate and the portfolios which are based on this biased information are "error maximized" and typically do not perform well. Despite the sophistication of the underlying mathematics and ideas, advisors quickly conclude that the process is somehow critically flawed.

**Constrain the Optimizer, get the result**

The conventional way of dealing with bias, instability, and poor performance in MV optimized portfolios is to constrain the optimization and to manage the inputs so that the portfolio is "appropriate". But this doesn't solve the problem. In this case optimizers produce essentially predefined portfolios and provide little more than a scientific veneer for an ad hoc process. In contrast, non-optimized portfolios have, at least, the virtue of no pretensions to scientific rigor.

It is natural for investors to blame the problems of MV optimization on flawed inputs. For this reason, investment institutions typically focus the bulk of their human and capital resources on improving the reliability of estimates of asset risks and returns. In doing this, however, they often ignore the optimization technology used to transform that information into an investment portfolio. At the end of the day, good inputs are no better than bad if the portfolios that represent the information have little real investment value.

Our research shows that the focus on developing inputs and ignoring the optimizer is counter productive. MV optimization typically creates portfolios reflecting biased estimates of return and risk whatever the quality of the information. This bias seriously limits the investment value of MV optimization for asset management and financial planning.

The simplest way to understand the limitations of classical optimizers is that they assume all input information is 100% certain. While investors know there is uncertainty in risk and

return estimates, MV optimizers are insensitive to this uncertainty. This is why what an experienced investor expects to see in an optimized portfolio and what actually is computed is typically very different.

The necessary solution is to incorporate forecast uncertainty in portfolio optimization. Such a process would see the investment world as it really is – in shades of gray rather than black or white. New Frontier Advisors uses Monte Carlo simulation to generate hundreds of plausible scenarios from estimate inputs to define MV optimized portfolios that reflect forecast uncertainty. The result is Resampled Efficient Frontier™ portfolio optimization, a patented generalization of MV optimization that is sensitive to the uncertainty level in your risk and return estimates. This new definition of portfolio optimality, stability, intuitiveness, and performance on average. Resampling works because it uses investment information in an appropriate way.

**An illusion of certainty**

The logic of MV optimization is seductive, but this is mostly an illusion that is all too apparent in the investment period. As used currently, MV optimization has largely a marketing, rather than investment, function. The demonstrable biases in MV optimization indicate that even the most sophisticated institutions and investors rely mostly on their intuition when developing recommended portfolios for investment. This may give rise to a significant fiduciary concern, since technology is now available to improve investment performance and to avoid the unreliability of the ad hoc process underlying optimized and non-optimized recommended portfolios.

MV optimization is an important idea with many potential investment benefits for investment managers. But the nearly fifty-year-old promise of better-diversified portfolios, improved investment performance, and nearly automatable asset management is likely to be achieved only when uncertainty is properly integrated into portfolio optimization.