A Critique of Statistically Based Asset Allocation
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to the classical theory</td>
<td>3</td>
</tr>
<tr>
<td>Drawbacks and limitations to MVO</td>
<td>5</td>
</tr>
<tr>
<td>Final thoughts</td>
<td>7</td>
</tr>
</tbody>
</table>
Summary

This report discusses the merits and demerits of statistical-based methods of asset allocation, with specific reference to the mean-variance optimisation (MVO) model. Whilst we recognise that the development of MVO was a significant breakthrough in statistical theory, to our mind the methodology is hampered by significant deficiencies that render it inadequate as a serious tool for making asset allocation decisions. Indeed, we believe that a better approach is to take a valuation-based view of investing.

Introduction to the classical theory

According to classical theory, the purpose of asset allocation is to create an optimised portfolio for which one can maximise the return for any given/known level of risk tolerance. The central idea is that through diversification one can improve the risk-return trade-off of an investment portfolio by taking an array of asset classes with divergent performances and avoid losses caused by over-concentration.

Each asset class contributes to a portfolio in different ways, so identifying their behavioural patterns and correlations with other asset classes under different market conditions enables one to understand how they will react in these situations, and whether incorporating them in a portfolio will mitigate risk. This can be achieved through using a family of representative long-term market indices to act as proxies for each asset class, which are then formalised into a single strategic policy asset allocation benchmark index, simulating the performance of a desired portfolio.

When discussing quantitative approaches to asset allocation and active portfolio management, the mean-variance optimisation model is typically one of the first things that come to mind. It’s the core idea underpinning Modern Portfolio Theory (MPT) and was first introduced by the economist Harry Markowitz in 1952. This innovative development brought quantitative discipline and rigour to an often qualitative and subjectivity-prone undertaking. The main input values needed for computation are the expected returns, standard deviation, and correlation of the asset classes, all of which are calculated from historical returns data series of representative indexes.

Figure 1: Flowchart of Mean-Variance Optimisation Methodology

- Select Asset Classes for Consideration
- Choose suitable benchmark indexes to represent each asset class

- Estimate Inputs for Each Asset Class for:
  - Returns
  - Standard Deviation of Return
  - Cross-Correlation with other Asset Classes

- Set Appropriate Constraints on Inputs and/or Outputs:
  - Maximum/Minimum Percentages of Total Portfolio
  - Specified Target Percentages of Total Portfolio
  - Target Weighting of Each Asset Class

- Review Output and Perform Sensitivity Analysis by Adjusting:
  - Risk & Return Assumptions
  - Portfolio Constraints Assumptions
  - Correlation Assumptions
The MVO algorithm identifies efficient portfolios through the simulation of an “efficient frontier”. This is a parabolic curve displaying the risk/return trade-off on a graph - as shown in figure 2 - , mapping the highest rate of return given any risk level for the portfolio. In addition, it displays the weighting of an assorted portfolio of asset classes associated with each pair.

![Figure 2: Example Efficient Frontier computed using Morningstar Encorr Software for years 2000-2010](image)

Each plot represents actual asset class returns, whilst the ‘efficient frontier’ depicts the theoretical return from optimised combinations.

Expected returns data is the most powerful determinant of results, and there are several ways of obtaining this data. The classical approach uses only historical time series, which computes the mean and variance values without considering any forward-looking properties. More recent developments in this field include the Black-Litterman, CAPM and the Building Blocks models which all are more forward-looking approaches. These consider the expected return as the sum of a risk-free rate and market risk premium.
Drawbacks and limitations to MVO

MVO is elegant in theory but does not realistically model the markets as it invokes many assumptions that are counter-intuitive. Despite its popularity in earlier years, the classical mean-variance optimisation has attracted a lot of criticism, especially from adherents of behavioural finance. These criticisms either object to:

(i) the implementation of the model; &/or
(ii) the fundamental theory behind it.

Implementation problems

The optimisation model has exhibited many limitations during implementation, as its reliance on historical data can often result in misleading outcomes. It applies a static treatment to the data in an essentially continuous-time universe. This discrete-time approach unavoidably lacks the ability to track the probabilistic dynamics of financial markets. Furthermore, it relies entirely on risk and return, but fails to consider other asset class characteristics such as liquidity and marketability, which are equally important factors affecting an investor’s decision making process.

The model also postulates an efficient market, a concept which can never be realised due to disproportionate distribution of information across different institutions. It does not take into account tax and transaction costs which can have a detrimental effect on returns. Further complications arise from futures hedging, currency exposures and fees. The model will become unwieldy in trying to take account of all these factors.

Moreover, running optimisations with long investment periods proves impractical, as the limited number of independent historical data points provides insufficient support for developing sensible capital markets assumptions, particularly for non traditional assets that have only recently been introduced.

As mentioned above, the most influential determinant upon results is the expected return. However, expected returns are notoriously difficult to predict and so this is also the factor that is subject to the greatest amount of estimation (error). The variance/covariance on the other hand is far simpler to estimate from historical data, giving much more convincing results. Expected returns are extremely sensitive to inputs but insensitive to the uncertainty of the data fed into the model and, consequently, this can lead to compounded estimation errors over a long time horizon resulting in a misleading portfolio. It ignores the fact that many assets and portfolios display return distributions with significantly non-normal skewness and kurtosis (high volatility due to infrequent extreme deviations as opposed to frequent modestly high deviations), with hedge funds being one such example. Therefore, it often misallocates assets for investors who are sensitive to these features.

The production of over-concentrated portfolios that are clearly not feasible in practice are another problem. The expected returns computed by the optimiser tend to have a positive bias compared to the realised returns, but the mathematical nature of MVO model would then significantly overweigh these asset classes with large estimated returns, negative correlations and small variances to form a highly concentrated portfolio, when these asset classes are the ones most likely to contribute large estimation errors. This obvious bias can be rectified to an extent by adding ad hoc constraint measures such as setting a minimum and maximum percentage allocation to an asset class, and/or adopting a Monte Carlo simulation resampling technique.

Flaws in the theory

As mentioned before, the mean-variance optimiser does not realistically model the markets. It
simplifies historical returns patterns into a normal distribution which is a flawed assumption.

Historical evidence suggests that the distribution of returns is almost always skewed to some extent i.e. there are more outliers created by extreme market fluctuations than would be consistent with a symmetrical distribution.

An experienced investor would find that their proprietary optimised asset allocation differs vastly from the modelled version of MVO. A model like this with less than impressive results beggars the question of investment sense if it is simply a pretension to scientific rigor with little or no investment value.

In his paper “I Want to Break Free, or, Strategic Asset Allocation Is Not Static Allocation” James Montier of GMO debunks the classical theory of MVO and calls for a more holistic, value-based approach to investing.

His most powerful point is his simplest when he challenges the accepted convention that volatility (i.e. standard deviation) is equivalent to risk. We discover that this is in fact not entirely true if we examine how the movements of the volatility index coincide with historical lucrative investment opportunities. Times of high volatility, frequently after a major financial crisis, presents an excellent opportunity to earn a high return, whereby times of low volatility, which often seem to be positioned prior to an imminent financial meltdown, is a precarious moment to invest. Therefore many risk-averse investors may forego great opportunities during high times and fail to realise impending danger before the market crashes completely in low times.

Figure 3  Volatility against Investment Opportunity

Thus risk is not merely a number but rather a multi-factor problem including business risk, valuation risk, financing risk, modelling risk, timing risk and so forth. According to Montier (and, importantly, to all of us at Cerno Capital), one should focus on the probability of what Ben Graham would describe as the “permanent loss of capital” as a sensible measure of risk. Investors should be properly concerned about downside volatility only and an unrepresentative risk calculation can have the effect of altering upside volatility and penalising overall returns. The Sortino ratio, which only utilises the downside semi-variance, and Value at Risk (VaR), which measures the maximum percentage loss within specified confidence regions for a given time period, are two such means of assessment.
Final thoughts

The diversification advanced by MVO is often return-chasing and in name only. What is often ignored is that diversification does not change the fact that a risky asset class is still risky. Further, the belief that correlation remains static over time is unrealistic. There is statistical evidence to show that correlations between all asset classes are rising, not only under distressed market conditions, but during normal conditions too, thus mitigating the effect of diversification.

Therefore what mean-variance optimisation represents is an example of modelling risk where the assumptions are fundamentally flawed, which will fail to provide constructive solutions to asset allocation decisions. It lacks the ability to value the potential and future prospects of an asset at the fundamental level. Market timing is difficult (if not impossible); estimating the fair value of asset classes should still be achievable.

Another important feature to asset allocation is flexibility. A policy portfolio induced by asset allocation will need to be subjected to shifts in weighting (where possible in the case of illiquid assets) over the investment horizon depending on current market conditions and those in the foreseeable future. The investment outlook will not remain static over time. Excessive deliberation to maintain a policy benchmark portfolio can very easily let investors fall into a benchmark-hugging behaviour that focuses on relative performance and not the absolute value of the underlying asset class. This behaviour would also drive investors to be fully invested at all times, buying into the market without appreciation for its absolute underlying worth. This move undermines the role of cash, which weakens the ability to leverage and build up wealth for a truly promising buying opportunity.

In summary, real world investors should not overly rely on asset allocation models. They can be recognised as powerful computational tools, useful as contextual guides, but should not be seen as an investment panacea. Rather, we should consider them in the context of many possible economic and financial scenarios, and remain opportunistic. We should place the greatest emphasis on valuation at the core of risk assessment, taking a value-oriented asset allocation strategy, basing the exposures upon valuation.

Bibliography and References

“I Want to Break Free, or, Strategic Asset Allocation Is Not Static Allocation” James Montier – GMO, 25/5/2010

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