

Portfolio Optimization Models with MATLAB®

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Abstract

The modern portfolio theory, starting from the seminal works by Nobel prize Harry Markowitz, involves an optimization problem to identify efficient portfolios. The model requires to maximize the expected return of a portfolio given a proxy level for portfolio risk, subject to some constraints on the weight of each assets in the portfolio.

In the standard approach by Markowitz the proxy for the risk is computed from the historical variance-covariance matrix of the assets return. Other risk measures have been proposed later as the Conditional Value at Risk (CVaR) and the Mean Absolute-Deviation (MAD). A different approach to portfolio optimization has been proposed by Black and Litterman (BL), where the expected return of assets is calculated by the Capital Asset Pricing Model (CAPM) combined with the view of professional portfolio managers.

All these models have been implemented in MATLAB® using an object oriented programming defining the class of `AbstractPortfolio` and the single object for every different portfolio optimization: `Portfolio` for the Markowitz approach, `PortfolioCVaR`, `PortfolioMAD` and `PortfolioBL`, for the CVaR, MAD and BL approach, respectively.

In this plenary session we will introduce the mathematics of portfolio optimization in the different approaches, with some numerical example implemented in MATLAB®.