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Portfolio Optimization with Reward-Risk Ratio Measure Based on the Mean Absolute Deviation

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Abstract : In problems of portfolio selection, the reward-risk ratio criterion is optimized to search for a risky portfolio with the maximum increase of the mean return in proportion to the risk measure increase when compared to the risk-free investments. In the classical model, following Markowitz, the risk is measured by the variance thus representing the Sharpe ratio optimization and leading to the quadratic optimization problems. Several Linear Programming (LP) computable risk measures have been introduced and applied in portfolio optimization. In particular, the Mean Absolute Deviation (MAD) measure has been widely recognized. The reward-risk ratio optimization with the MAD measure can be transformed into the LP formulation with the number of constraints proportional to the number of scenarios and the number of variables proportional to the total of the number of scenarios and the number of instruments. This may lead to the LP models with huge number of variables and constraints in the case of real-life financial decisions based on several thousands scenarios, thus decreasing their computational efficiency and making them hardly solvable by general LP tools. We show that the computational efficiency can be then dramatically improved by an alternative model based on the inverse risk-reward ratio minimization and by taking advantages of the LP duality. In the introduced LP model the number of structural constraints is proportional to the number of instruments thus not affecting seriously the simplex method efficiency by the number of scenarios and therefore guaranteeing easy solvability. Moreover, we show that under natural restriction on the target value the MAD risk-reward ratio optimization is consistent with the second order stochastic dominance rules.

Keywords : portfolio optimization, reward-risk ratio, mean absolute deviation, linear programming
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