ROY KWON, University of Toronto

Generalized risk parity portfolio optimization: An ADMM approach

The risk parity solution to the asset allocation problem yields portfolios where the risk contribution from each asset is made equal. We consider a generalized approach to this problem. First, we set an objective that seeks to maximize the portfolio expected return while minimizing portfolio risk. Second, we relax the risk parity condition and instead bound the risk dispersion of the constituents within a predefined limit. This allows an investor to prescribe a desired risk dispersion range, yielding a portfolio with an optimal risk–return profile that is still well-diversified from a risk-based standpoint. We add robustness to our framework by introducing an ellipsoidal uncertainty structure around our estimated asset expected returns to mitigate estimation error. Our proposed framework does not impose any restrictions on short selling. A limitation of risk parity is that allowing of short sales leads to a non-convex problem. However, we propose an approach that relaxes our generalized risk parity model into a convex semidefinite program. We proceed to tighten this relaxation sequentially through the alternating direction method of multipliers. This procedure iterates between the convex optimization problem and the non-convex problem with a rank constraint. In addition, we can exploit this structure to solve the non-convex problem analytically and efficiently during every iteration. Numerical results show that this algorithm converges to a higher quality optimal solution when compared to the competing non-convex problem.