

We use modern approach of stochastic dominance in portfolio optimization, where we want the portfolio to dominate a benchmark. Since the distribution of returns is often just estimated from data, we look for the worst distribution that differs from empirical distribution at maximum by a predefined value. First, we define in what sense the distribution is the worst for the first and second order stochastic dominance. For the second order stochastic dominance, we use two different formulations for the worst case. We derive the robust stochastic dominance test for all the mentioned approaches and find the worst case distribution as the optimal solution of a non-linear maximization problem. Then we derive programs to maximize an objective function over the weights of the portfolio with robust stochastic dominance in constraints. We consider robustness either in returns or in probabilities for both the first and the second order stochastic dominance. To the best of our knowledge nobody was able to derive such program before. We apply all the derived optimization programs to real life data, specifically to returns of assets captured by Dow Jones Industrial Average, and we analyze the problems in detail using optimal solutions of the optimization programs with multiple setups. The portfolios calculated using robustness in returns turned out to outperform the classical approach without robustness in an out-of-sample analysis.