Linköpings tekniska högskola
IEI
Produktionsekonomi

Finansiell optimering
Computer exercise 3
November 14, 2018

Computer exercise 3 - Simulation of an optimally managed portfolio

Aim: You shall use optimization to determine optimal investment decisions in a realistic environment. You shall also study a portfolio management model with historical data.

Background: Before portfolio management models are used to manage real money the model is tested against historical data to evaluate the models performance. Since optimization is an automated method for making decisions it is well suited for testing against historical data. However, these historical back tests have to be carried out with caution in order to avoid overfitting of the parameters to the data.

To help you, you have access to the functions which were introduced in computer exercise 2 and functions for modelling financial investment problems, solving them and simulation of the portfolio management. The files (simulation.zip) can be downloaded from lisam.

The Black-Litterman model will be used to stabilize the estimation of the expected return. We will use the expected from CAPM as the prior estimate and the historical estimation as the views, and hence $P = I$ is used. Here the covariance matrix of the asset returns is used to describe the uncertainty for both expected returns (Σ, Ω), where the uncertainty is assumed to be larger for the estimation from historical data.

Preparation: Write down the expected return for the posterior distribution for the Black-Litterman model.

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Exercise: Implement estExpectedBlackLitterman.m that is used to combine the expected return estimation from CAPM with the estimation from historical data (in optimizePortfolio.m).

Exercise: Use runTradeRegion.m to determine the optimal investment decisions given transaction costs and different initial holdings. Describe the characteristics of the optimal solution.

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Exercise: What happens with the no-trade region when the transaction cost is increased/decreased?

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Exercise: What happens with the no-trade region when the time horizon (t) is increased/decreased?

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Exercise: Study the part that simulates the portfolio performance as well as the primal-dual interior point solver that is used to solve the problem.

Exercise: How can the transaction cost in the Stochastic Programming model (transCostSP) be used to change the amount of trading? How does this influence the no-trade region?

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Exercise: How can the time horizon in the Stochastic Programming model (t) be used to change the amount of trading? How does this influence the no-trade region?

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Exercise: What happens with the amount of trades (transaction costs) when higher emphasis is put on the historical estimation of the expected return in Black-Litterman? What is the interpretation?

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Exercise: How does the number of scenarios in the Stochastic Programming model (nSamples) change the amount of trading? Why does this influence?

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Exercise: How does the risk averion (gamma) change the results?

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Structure of runSimulation.m

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loadExcelFile

... Parameter settings ...

for % Each date in a historical time period
  optimizePortfolio
    estExpected % Calculate yearly historical return
    estVol % Calculate yearly volatility and correlation
    genScenariosLatin % Generate scenario prices with latin hypercube sampling

    buildMatlabModel % Define optimization problem on matrix form
    primalDual2StageSimple % Solves optimization problem

  ... Update portfolio ...

end
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Structure of runSimulation.m