Abstract

In the portfolio selection model some parameters such as expected return, risk, proportion of investment, liquidity, etc., are uncertain. These parameters are generally estimated using probability theory or fuzzy set theory or possibility theory etc., for which the distribution function or membership function or possibility distribution, respectively, are to be known in advance. In reality, it is very difficult to identify such functions. However, an investor can state these parameters in the form of intervals, whose lower and upper bound can be found either from historical data or based on the expert's knowledge. As a result, a portfolio selection problem becomes an interval optimization problem and can be dealt using interval analysis. This thesis aims at investigating the impact of these facets on the optimization problems and application to portfolio selection.

In this thesis single and multi-objective linear programming problems are considered in which all the parameters of the objective function(s) and constraints as well as decision variables are expressed in terms of intervals. Methodologies based on partial order relation between intervals are proposed to find the efficient feasible solution of these problems. These theoretical developments are applied to portfolio selection models with data from Bombay Stocks Exchange/National Stocks Exchange, India, wherein expected return, risk, liquidity and proportion of investment on assets are taken as intervals. In each case an efficient portfolio is obtained which gives the total expected return and proportion of total investment on assets in the form of intervals.

In one chapter, a portfolio model, in which an investor revises his portfolio periodically to adapt the changing conditions of the market, including the transaction cost, known as a portfolio rebalancing model, is proposed. The expected return on each asset, variance and covariance of returns of the assets, and fixed or/and variable transaction costs are assumed to be in the form of intervals. A solution methodology is developed to obtain an efficient portfolio in terms of number of units as well as proportion of investment of assets. In another chapter, a portfolio selection model with interval parameters is proposed by taking into consideration of minimax risk measure, in which liquidity of the stocks is allied with the selection of the portfolio. In this chapter, a new concept is introduced, which has established relation between interval and random variable according to the 3σ-rule of Normal distribution. The model is solved using Chance Constrained technique. Finally, a portfolio selection model which maximizes the Sharpe ratio has been proposed.

Keywords: Interval analysis, Linear programming, Multi-objective programming, Fractional programming, Portfolio selection, Risk, Partial ordering.