ABSTRACT

The thesis is presented in 70 pages. It contains 2 appendixes and bibliography of 30 references. Nine figures and 5 tables are given in the thesis.

Topic relevance. Over the past decade, the stock market has undergone significant changes: significantly increased the number of companies and corporations, mutual funds, widespreading of pension funds while information technology were developing rapidly that has led to wide availability of financial information, greatly facilitated and speeded up the process of trading. Along with this, the basic theory of classical models and methods of the portfolio selection have been developed in the middle of the last century yet. Therefore they are not suited for practical use. The basis of these methods is the use of one or two criteria to optimize the portfolio that are based on the specific, usually a relatively small set of equities. In today's reality, the investor usually has to generate a portfolio based on two assets: bonds with fixed income and part of capital invested in a certain sector of economy or mutual fund. Therefore, to solving the investment task, is higly appreciated methods that take into account more criterias than the criterias known classical methods of portfolio theory.

Thesis connection to scientific programs, plans, and topics. The thesis was prepared according to the scientific research plan of the Applied Mathematics Department of the National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute.”

Research goal and objectives. The goal of this thesis is to develop a method for multi-objective optimization of financial portfolio using the theory of Markov chains.

To accomplish this goal, the following objectives were reached:

– it has been analyzed current situation in the stock market trends and issues of long-term investment;

– it has been analyzed existing systems, methods and approaches for portfolio optimization, criterias that they have based on;

– it has been developed the method of optimization of financial portfolio using four criterias;

– it has been developed the software for importing financial data from available sources of financial information and has been implemented the method for portfolio optimization;

– it has been done the experimental research and testing of the developed methods and algorithms based on real data.

Object of research is the process of selecting and distribution of investments in order to optimize the investment portfolio for the specified criterias.

Subject of research is the process of determining the optimal proportion of capital invested in financial instruments with fixed income in the investment portfolio consisting of securities of two types.

Methods of research. To solve the task, the following methods were used: methods of probability and mathematical statistics (estimation of parameters for the distribution of asset returns), methods of stochastic processes (for estimation the probability of asset price changes within specified limits), methods of algorithms and data structures theory (for effective software implementation of the developed method), methods of designing and applying changes to the software (for the obtaining modular structure of the software, reducing connectivity of units, ensuring continued support ability and extantion of software).

Scientific contribution consists of the following:

– model for optimazing a portfolio of securities, model is diferent from the existings due to using two new optimization criteria: the probability that the price of the portfolio will not fall below the threshold value and the probability that the portfolio price reaches a specified level within a specified time period;

– algorithm for obtaining the probability that the price of the portfolio will fall below the threshold value and the probability that the portfolio price reaches a specified price level within the specified period;

Practical value of obtained results. Methods are proposed that can be applied during optimization or reallocation of assets in a portfolio consisting of financial instruments are of two types: fixed and random return, especially when investing in mutual

funds or a group of companies, the economy sector. The developed software implements the proposed method and allows to upload, process and visualize financial data.

Approbation of the thesis results. Basic ideas and results of the research were presented at the International Conference SAIT 2017 (System Analysis and Information Technologies) and at the International Scientific Conference "Actual problems of modern science".

Publications. Thesis results are published in 3 scientific works:

- in 1 paper in proceedings of international scientific and technical conference;
- in 2 papers in proceedings of international scientific and practical conference.

Keywords: asset, portfolio, yield, price, probability of lowering the price, distribution sequence, recurrence relations.