MATHEMATICAL MODELS OF OPTIMIZATION OF THE PORTFOLIO OF STOCK INDICES

Gomozov Y. P., Omelaienko O. O., Iglin S. P.
National Technical University «Kharkiv polytechnic institute», Kharkiv

Over the past 20 years, an economic practice has developed in which financial markets determine the movement of real sectors of the economy. Therefore, the task of constructing optimization mathematical models of the behavior of various financial instruments seems to be very relevant. Modern economic practice is also characterized by the presence of structurally unstable markets included as nodes in the real-time global network of the world economy. Almost any process with a real-time changing value of assets is a K-system and has an unremovable region of chaos. Therefore, the risks of a market collapse have increased significantly [1].

From this point of view, there is an interest in financial instruments that have practically no non-systematic risk, but only systematic risk. Stock indices are such financial instruments. Nowadays, econophysics methods are often used in finance [2], [3].

However, previously, in this work, the issue of compiling an optimal stock index portfolio was considered as a problem of linear multi-criteria programming. After analyzing the advantages and disadvantages of different methods, the branch-and-bounds method was chosen because of its simple implementation and complete selection of solutions [4], [5].

To solve the problem and test the given methods, the Python programming language was chosen, with the use of the NumPy and SciPy libraries.

Thus, with the help of a software application, you can make an optimal portfolio according to one of the methods to maximize profit or minimize risk. First, the program calculates the optimization problem according to a certain method. Then he solves the given problem by the method of branches and limits. And, based on these data, makes the optimal stock indices portfolio.

References (translated):

1. Didier Sornette, Why stock markets crash, Princeton University Press, 2022, 241 p. ISBN: 0-691-09630-9.
2. Vishakha Agarval, Cellular automata based financial market, International Journal of Research in Circuits, Devices and Systems, 2022; 3(1); 41-49 p.
3. Gudrun Ehrenstein, Frank Westerhoff, The working of circuit breakers within percolation models for financial markets, International Journal of Modern Physics C Vol 17, No 2, (2006), 299-304 p.
4. Kostin V.P. Evaluation and optimization of the portfolio of financial assets. Balance Business Books – Dnipro, 2013.
5. Nefyodov Y.M., Balytska T.Y. Optimization methods in examples and problems. Condor Publishing House – Kyiv, 2015.