ATTITUDE

on dissertation work for the acquisition of educational and scientific degree "doctor" in a professional field: 4.6 Informatics and Computer Science

Author of the thesis: **Krassimira Doneva Stoyanova-Chokova**

Thesis title: **Models and Methods for Optimizing and Managing Portfolio using Time Series**

Member of the Scientific Jury: **Assoc. Prof. PhD Desislava Ivanova**

1. Relevance of the problem

The presented dissertation consists of an introduction, an exposition of three chapters, a conclusion, a declaration of originality of the results, a list of publications on the dissertation and a bibliography. The dissertation consists of 130 pages, 17 figures and 22 tables, 253 cited references and 3 appendices. Mathematical modeling in the financial field is an extremely hot topic related to the study of economic systems such as stock exchanges, banks, insurance and investment companies. This is a difficult task with a high degree of complexity and its solution requires the development of novel models and algorithms.

2. Degree of knowledge of the status of the problem and responsibility of the chosen research methodology and set goals and objectives

The first chapter presents the mathematical modeling of the decision maker's actions as conditioned by an adequate description of uncertainty, the need to measure statistical regularities, to account for and to measure a huge volume of dynamically changing information. The second chapter describes the proposed bicriteria optimization model and the proposed hybrid algorithm to solve the problem of portfolio optimization and management under given constraints. A summary methodology for portfolio selection is also presented. For tasks related to mathematical modeling in the financial field and in particular the portfolio optimization, it is necessary to build complex models of optimal investment with different optimization criteria. In the dissertation by means of two optimization approaches Interior Point in the Matlab environment and the proposed new hybrid algorithm for portfolio selection the corresponding optimization problems are solved, and the obtained results are compared by three criteria - number of iterations, number of calculations of the objective function and calculation time. *Conclusion: Krassimira Stoyanova-Chokova Krassimira shows a high level of knowledge in the scientific field, as the goals and tasks set in the dissertation fully correspond to the chosen research methodology.*

3. Contributions

The contributions in the dissertation can be divided into scientific and applied:

Scientific and applied:

➢ A bicriteria optimization model for portfolio selection has been formulated, which is a modification of the Markowitz's mean variance model

➢ A summary methodology for portfolio selection is proposed.

- A Hybrid evolution algorithm is created based on FFA and PS. The advantage of the proposed algorithm is the accuracy in the calculation of the optimal solution and the relatively short time to solve the optimization problems. The polynomial computational complexity of the Hybrid evolutionary algorithm allows it to be successfully used to solve large-scale optimization problems.

- On the basis of the proposed bicriteria optimization model, corresponding tasks are formulated, which are solved by the created Hybrid algorithm and by the standard Matlab's fmincon solver. The obtained results confirm the working capacity of the Hybrid algorithm.

- A set of software modules of Matlab has been developed to implement the Hybrid algorithm to solve the problem of portfolio optimization while minimizing risk, with different diversification and expected rates of return.

4. Dissertation publications

Krassimira Stoyanova has submitted 7 dissertation related publications. One of the publications is in an international journal indexed in the world scientific database "Scopus". In one of the publications, she is the sole author. All publications are presented at international scientific forums. In this way the dissertation satisfies the minimum requirements of the law, as well as the specific requirements of BAS for acquiring the educational and scientific degree "Doctor".

5. Opinion and recommendations

The dissertation is written at a high level. The proposed modifications and novelties in the dissertation are clearly and in detail explained. The layout of the dissertation is excellent. The abstract contains the based information and well reflects the achieved results and contributions.

Conclusion

The presented dissertation fully corresponds to the set of criteria and indicators for the acquisition of educational and scientific degree "Doctor", in accordance with the Law for the development of the academic staff in the Republic of Bulgaria, the Rules for its implementation and the Rules for the conditions and procedures for the acquisition of scientific degrees and academic positions at BAS. ***I strongly recommend that the scientific jury award Krassimira Doneva Stoyanova-Chokova the Doctorate degree in professional field 4.6 Informatics and Computer Science.***

Date: 25.06.2020   JURY MEMBER:

Assoc. Prof. PhD Desislava Ivanova