OPINION

by Nelly Andreeva Bencheva-Professor at the Academy of National and Information Security /ANIS/, Doctor

of dissertation work for awarding the educational and scientific degree "Doctor"

in the Field of Higher Education 3. Social, Economic and Legal Sciences

Professional Field 3.8. Economics

Author: Anna Malgorzata Jatchak

Topic: Application of mathematical models in the activities of banks in Poland

1. General description of the submitted materials

By order No. 297 of 15.07.2026 of the Rector of the University of Insurance and Finance, Corresponding Member, Prof. Dr. Boris Velchev, I am appointed as a member of the scientific jury for ensuring a procedure for the defense of a dissertation on the topic "Use of mathematical models in the activities of banks in Poland" for the acquisition of the educational and scientific degree "doctor" in the Field of Higher Education 3. Social, Economic and Legal Sciences, Professional Direction 3.8. Economics.

The author of the dissertation is Anna Malgorzata Jatchak - a doctoral student in independent training at the University of Insurance and Finance.

The materials submitted under this procedure include the following documents in order: dissertation, abstract (in Bulgarian and English), Certificate of fulfillment of the minimum national requirements for acquiring the ONS “doctor”, List of scientific publications, scientific publications, declaration of originality and authenticity, full report of the dissertation regarding the presence of plagiarism – autobiography, copy of the diploma for the acquired educational and qualification degree “master”, etc.)

The doctoral student has attached publications - 0 studies, 1 monograph, 5 publications.

I accept that the doctoral student presents the materials required under the procedure for preparing the opinion and meets the minimum national requirements under Art. 2b, para. 2 and 3 of the Act on the Development of the Academic Staff in the Republic of Bulgaria.

2. Brief biographical data of the candidate

Doctoral student Anna Jatchak graduated from the Faculty of Mathematics and Computer Science at the Maria Curie Skłodowska University of Mathematics and Physics in Lublin. In 1990, she received a master's degree in mathematics, majoring in "Applied

Mathematics". She completed postgraduate training in "Organization and Management" at the University of Humanities and Natural Sciences in Sandomierz.

She developed her professional career in the field of mathematics, as a teacher. She obtained a first degree in professional specialization as a mathematics teacher.

I believe that her solid preparation in the field of applied mathematics in economics has greatly assisted the conduct of the scientific research in this dissertation.

3. Characteristics and evaluation of the dissertation work

The dissertation work is developed in a volume of 177 standard pages. Regarding the structure and content of the dissertation work, we should point out that a good and logical presentation of the material has been achieved. The work is structured as follows: introduction, three sections, conclusion, and bibliography. The results of the empirical research are illustrated in 22 tables, 29 figures, and 1 graph.

The first chapter is developed in two independent thematic subsections. They include the development of basic theoretical aspects, conceptual and methodological approaches to the application of mathematical models in the activities of banks.

In the first subsection, a systematized analysis of the basic definitions, formulas, and theorems, interpreted through the prism of mathematical essence and logic, is made. As a result of a thorough analysis of the legal and regulatory framework of the environment in which banks operate in Poland, a successful attempt has been made to define one's own understanding and attitude to the use of mathematical models and formulas as an immanent part of banking supervision, with a view to reducing price risk (interest rate and currency). In this context, the importance of the problems of monitoring operational risks and those related to IT systems and subjective human activity has also been raised. Particular attention is paid to supervisory instruments for regulating bank equity. The view is upheld of developing capital requirements to cover the risks that banks assume. It is proposed that the ratio between equity and the risk assumed be determined by using mathematical models and formulas. In this regard, the basic principles on the basis of which the adequacy of bank capital should be assessed given the scale and risk profile of banking operations have been summarized. In this regard, the system for classifying credit risks and creating the necessary reserves has been outlined.

A thorough analysis is made of the Bank Deposit Guarantee Fund and the monitoring system. The opinion is advocated that the Deposit Guarantee Fund can also act as a supervisory authority. All these elements are given their own interpretations and conclusions.

Strong emphasis is placed on revealing the characteristic features and specificity of basic theoretical statements and models related to the form and status of the functioning of

banks in a market environment. In this regard, from a theoretical point of view, the variety of mathematical models that banks can use to evaluate the diverse operations and actions is revealed.

Based on the analysis of the theoretical aspects of the banking system and its characteristics, the doctoral student in the second subsection offers a synthesis of mathematical models for use in the banking system.

The second section is devoted to the financial analysis of the activities of selected banks in Poland. In essence, this section develops the methodology and tools for studying the application of mathematical models in the banking sector. The proposed conceptual framework (Table II.1.1. Table II.1.2. Table II.1.3. Table II.1.4.) for financial analysis of bank activities, developed on the basis of her own research, is particularly original. The research includes an analysis of bank performance based on numerical data reflecting the obtained operational results. Access to these sources varies depending on the organization performing the analysis and the type of bank. In the first subsection, the doctoral student develops and presents the results of applying quantitative tools for analyzing bank operations.

A special contribution is made by the developed detailed analysis of the coefficients that assess the financial condition and operational efficiency. The remaining subsections analyze the specific results of the activities of specific banks, with the emphasis on the credit and deposit activities of banks. The in-depth analysis of inflation and how it affects the value of money, expenses and savings is particularly impressive. The features of inflation and the role of mathematical models for identifying potential threats, as well as limiting factors and barriers to the development of banks, are revealed.

Based on this research technology, the doctoral student very successfully applies it in the third section of the dissertation, which reveals the specific application of mathematical models and their practical application in banking activities, through the developed simulations, mainly in two models

The objectivity, accuracy of the results obtained and the assessments of the financial condition, the development trends of the flexibility of banking operations are based on own research, as well as on studies of official bank documents. Numerous secondary sources of information have also been studied.

We can summarize that the dissertation research contains specific results and empirical evidence that objectively reflect the real achievements of the conducted scientific research.

4. Contributions and significance of the development for science and practice

Regarding scientific contributions:

• A systematized analysis of theoretical models and methodological approaches to studying the use of mathematical models in the banking system of Poland has been made;

• A methodology and toolset have been developed to study the application of mathematical models in the banking sector of Poland;

Regarding contributions with practical application:

• A thorough mathematical analysis of the coefficients of the collected empirical data has been made, which shows the significance of the role of mathematical models in the formation of the credit supply of banks, which leads to improved operational efficiency.

• It has been established that an attractive banking product leads to an increase in the number of clients, which in turn leads to revenue growth and improved operational efficiency. A working hypothesis has been confirmed that the use of mathematical models significantly improves the operational efficiency of the bank.

• It has been proven that the use of models supports the process of understanding the real financial situation by making a comprehensive analysis of specific processes such as inflation from a mathematical point of view.

• It has been proven that calculations performed using mathematical tools present the dynamics of inflation in Poland from 2010 to 2025. This knowledge is crucial for the development of a banking strategy, which should be aimed at maximizing profits while minimizing costs - i.e. achieving the best possible operational results.

I believe that the dissertation also contains valuable ideas, results, and insights for practice, which can be successfully used by bank managers developing policies in the field of flexible forms of lending and depositing monetary resources. The proposed flexible practices have a universal nature and are of practical importance for increasing the flexibility and efficiency of bank operations in Poland.

5. Evaluation of the publications on the dissertation work

The results of the dissertation work have been published in three independent articles in English. No citations of these articles in the works of other authors have been presented. The results presented in these scientific publications are part of the original research of the doctoral student. The conclusions and findings made in them can be used in scientific and social practice.

6. Assessment of compliance with the minimum national requirements

A certificate has been submitted by the doctoral candidate, which proves compliance with the minimum national requirements for acquiring the educational and scientific degree "Doctor" in the professional field 3.8. Economics.

7. Abstract

The abstract correctly and accurately reflects the structure and content of the dissertation work. It includes the main sections, results of the research, conclusions and scientific and applied contributions.

8. Critical remarks and recommendations

I have no significant critical remarks on the dissertation. I recommend that the results of the research be published in scientific journals in Poland, with a view to their use by scientific practice and the Polish banking system.

CONCLUSION

The dissertation contains scientific, scientifically-applied and applied results that represent an important contribution to science and meet the requirements of the Act on the Development of the Academic Staff in the Republic of Bulgaria (ADSRB) and the Regulations for the Implementation of the ADSRB. The presented materials and dissertation results fully comply with the specific requirements of the Regulations for the Admission and Training of Doctoral Students at the University of Insurance and Finance.

The dissertation shows that the candidate Anna Malgorzata Jatchak possesses in-depth theoretical knowledge and professional skills in Professional Field 3.8. Economics, demonstrating qualities and skills for independent conduct of scientific research.

Due to the above, I confidently give my positive assessment of the conducted research, presented by the above-reviewed dissertation, abstract, achieved results and contributions, and I propose to the esteemed scientific jury to award the educational and scientific degree "doctor" to Anna Malgorzata Jatchak in the Field of Higher Education 3. Social, Economic and Legal Sciences; Professional Field 3. 8. Economics.

6.08 2026. Reviewer:

/Prof. Dr. Nelly Bencheva/