

## SCIENTIFIC OPINION

for awarding the educational and scientific degree “Doctor (PhD)”  
in the PhD programme “Finance, Monetary Circulation, Credit and Insurance”  
at D. A. Tsenov Academy of Economics – Svishtov

**Prepared by:** Assoc. Prof. Nadezhda Georgieva Blagoeva, PhD, member of the scientific jury pursuant to Order No. 1370/22.12.2025

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**Dissertation title:** “ASSESSMENT OF FINANCIAL RISK USING MACHINE LEARNING”

**Academic supervisors:** Assoc. Prof. Alexander Ganchev, PhD; Assoc. Prof. Krasimira Slaveva, PhD

### I. General Overview of the Dissertation

The topic of financial risk assessment using machine learning methods is highly relevant in the contemporary economic environment, characterised by high dynamism, increasing uncertainty, and substantial volumes of data. The digitalisation of the financial sector, the development of the fintech industry, and the automation of financial services generate new opportunities but also new sources of risk, thereby necessitating the use of more precise and adaptive analytical tools.

The research's relevance is further reinforced by regulatory requirements imposed on financial institutions for more robust risk management systems, early warning mechanisms, and stress testing frameworks. In this context, the development and adaptation of machine learning-based models constitute a significant contribution to both financial risk theory and the practice of financial institutions and supervisory authorities. For these reasons, the present dissertation is timely, relevant, and focused on a topic of high scientific and practical value.

The dissertation comprises 197 pages in total, of which 171 pages constitute the main text. It follows the classical dissertation structure consisting of an introduction, three chapters, a conclusion, a bibliography, and appendices. A precise logical sequence and strong coherence among the three main chapters are evident, with a slight emphasis on the first part.

To provide a more straightforward, more systematic presentation of the research, the doctoral candidate has included 34 figures, 43 tables, and 26 equations. Supporting empirical material in the form of tables and figures is provided in separate appendices. The author has reviewed and analysed 120 literature sources. The majority are in English, with some in Bulgarian. Most sources are recent, indicating that the candidate is well-versed in current academic developments. All sources are cited correctly in accordance with APA standards.

The introduction clearly formulates the research objective, the object and subject, the thesis, the research tasks, and the study limitations. **The object** of the research is defined as financial risk. **The subject** is the specific algorithms, tools, and methods of machine learning that can be used for quantitative modelling and for developing effective instruments to assess the main types of financial risk – credit, market, and operational.

**The study aims** to reveal the potential added value of applying machine learning to assess different types of financial risk. The approach to selecting algorithms and methods is based on a comparison of two groups of algorithms – the so-called traditionally established (classical) methods for financial risk assessment and algorithms based on machine learning.

To achieve success, he formulates seven **research tasks**. Through the sequential resolution of these tasks, the author substantiates his research thesis that the application of machine learning methods can significantly improve financial risk assessment by more easily uncovering otherwise hidden dependencies and interactions, enabling automated processing of large volumes of data, and enabling quick adaptation to dynamically changing conditions. In line with this, the doctoral candidate advances four sub-hypotheses, which are subsequently tested. The first states that machine learning tools play an increasingly essential and determining role in socio-economic life, including finance and risk management. The second posits that the added value and performance of ML and AI algorithms should be appropriately evaluated against simpler alternatives before implementation decisions are made. The third suggests that modern sophisticated algorithms typically achieve higher accuracy and performance than conventional methods. The fourth asserts that ML and AI methods pose integration challenges that require careful cost–benefit considerations.

A broad and well-selected methodological toolkit is applied. The author clearly specifies the purpose and stage of application for each method, demonstrating confident methodological competence. Methods include historical analysis, comparative analysis based on discrimination power, conservatism, precision, sensitivity, specificity, mean squared error, coefficient of determination, SHAP analysis, and others. Variable transformation and predictive power assessment employ feature engineering, WoE transformation, Information Value, grouping,

and related techniques. Risk modelling uses both classical and ML approaches, including logistic regression, CART, Gradient Boosting, XGBoost, FinBERT, and others. The chosen methodology aims to approximate real-world practice as closely as possible.

## **II. Evaluation of the Format and Content**

The selected research topic demonstrates high scientific relevance, practical significance, and strong dissertation potential. The timeliness of the dissertation is particularly pronounced in the context of the ongoing transformation of the financial sector. Increasing market complexity, extreme dynamics, and systemic risks are placing greater demands on risk management tools.

The digitalisation of financial services and the exponential growth of data create an environment in which traditional statistical models struggle to capture nonlinear relationships and behavioural dynamics. Machine learning methods offer fundamentally new opportunities for developing adaptive and predictive risk assessment models. The topic is therefore timely, socially significant, and relevant to contemporary financial research.

The dissertation demonstrates substantial theoretical and practical preparation and a strong command of the subject matter. A clearly articulated authorial position reflects analytical maturity and interpretative confidence. Structurally, the dissertation follows a classical, balanced, and logically coherent academic structure. It progresses from theoretical foundations to methodological analysis and finally to practical comparative evaluation.

In the concluding section, the author summarises his findings and reflections regarding the four sub-hypotheses tested in the study. Similar summaries are provided at the end of each chapter, enhancing the overall quality of the work and contributing to its clear structure and systematic organisation.

The argumentative strength of the exposition is further supported by numerous figures and tables that provide clear, systematic visualisation of the results. In their preparation, the author's viewpoint and his ability to extract and systematise information are clearly evident. The applied scientific style and terminological apparatus comply with academic standards and demonstrate a thorough, critical command of the specialised scholarly literature in the respective field.

The culmination of the doctoral candidate's work is presented in the dissertation abstract. It is developed in 31 pages. The individual compositional elements, as well as the qualities and merits of the research, are presented in a fully synthesised form. It fully complies with the accepted standards for the preparation and structuring of a dissertation abstract.

A statement of the scientific contributions of the study is also provided, and these are entirely the work of the doctoral candidate. I accept the stated contributions and consider them entirely consistent with the dissertation's content.

Four publications related to the dissertation topic fulfil the legally required minimum. Three are single-authored, and one is co-authored with the candidate as first author. Conference participation demonstrates dissemination and academic recognition. An originality declaration confirms the authenticity of the work.

### **III. Scientific and Applied Contributions**

The dissertation under review constitutes a fully completed scientific study with a clearly expressed authorial contribution. The doctoral candidate presents four contributions without explicitly distinguishing between scientific and applied scientific contributions, although elements of both categories are present. These contributions are entirely the work of the author and consistently substantiated throughout the course of the research. They are as follows:

**First.** A systematic analysis of the concept of financial risk assessment using machine learning tools has been carried out. As a result, the key risk categories have been identified, their role in building models for financial resilience has been established, and it has been demonstrated that machine learning acts as a key catalyst for innovation in the study of economic and financial processes.

**Second.** Through empirical analysis, it has been revealed that, in the majority of cases, risk assessment models based on machine learning demonstrate significantly better performance compared to those based on traditional methods. This, in turn, validates the expectations placed on machine learning-based tools.

**Third.** The dissertation delineates the applications, resource constraints, and scenarios in which machine learning-based financial risk assessment models are not sufficiently effective, including in comparison with classical models. This underscores the need for their highly precise contextual selection and application.

**Fourth.** Through extensive empirical analysis, key challenges and limitations in the practical implementation of machine learning-based financial risk management models have been identified. The study concludes that this toolkit is not a temporary technological trend, but a legitimate and, in practice, novel evolutionary stage in the development of quantitative methods in finance.

In conclusion, the dissertation's contributions may be classified into the categories of “advancement of scientific knowledge” and “application of scientific knowledge in practice.”

They are entirely sufficient for the purpose of awarding the educational and scientific degree of Doctor (PhD).

## **V. Questions Regarding the Dissertation**

The collaborative work between the doctoral candidate, Antonio Dichev, and his academic supervisors has enabled him to develop his dissertation to a commendable standard, turning it into a fully completed, in-depth, and engaging scientific study. The work is distinguished by a clearly constructed conceptual framework, a logical sequence of exposition, and a convincing link between the theoretical foundations of financial risk and the application of contemporary machine learning methods in empirical analysis.

The doctoral candidate demonstrates a high degree of independence in conducting the research, an excellent command of both financial risk theory and the analytical toolkit of machine learning, and the ability to select and apply appropriate models and algorithms. The empirical results are thoroughly and correctly interpreted, combined with a critical analytical perspective on the limitations and applicability of the models used.

For this reason, I do not have any substantial critical remarks, but rather the following question:

1. In your view, how can a balance be achieved between the high predictive accuracy of machine learning models and the transparency requirements imposed by the regulatory framework on financial institutions?

## **V. Summary Evaluation and Conclusion**

In conclusion, the dissertation “**Assessment of financial risk using machine learning**” represents an independent, comprehensive, and in-depth scientific study on a relevant and significant topic, particularly in the context of the modern digital environment. The thematic focus, depth of analysis, and achieved results demonstrate a high level of academic preparation and research competence.

The dissertation fully complies with the requirements of the Act for Academic Staff Development in the Republic of Bulgaria and the Regulation for its implementation in terms of scientific validity, structure, methodology, and contribution. The contributions expand existing knowledge and offer strong practical applicability.

The research objective has been fully achieved, and the central thesis and sub-hypotheses are convincingly supported. This provides grounds for concluding that the candidate possesses established skills in independent scientific research.

Based on the above, I give my **POSITIVE** evaluation and confidently vote **IN FAVOUR** of awarding the educational and scientific degree “Doctor (PhD)” to **Antonio Valentinov Dichev** in Higher Education Area 3. Social, Economic and Legal Sciences, Professional Field 3.8 Economics, scientific speciality “Finance, Monetary Circulation, Credit and Insurance.”

Date:

06.02.2026

Prepared by: .....

Assoc. Prof. Nadezhda Blagoeva, PhD