STETEMENT REPORT

by Assoc. Prof. Maria Tonkova Vasileva-Chilibinova, PhD
University of Plovdiv „Paisii Hilendarski“
on the PhD dissertation of Dragomir Kolev Nedelchev
entitled: *Application of stochastic and optimization methods for risk management and pricing of financial instruments*
submitted for the award of the educational and scientific degree “**Doctor**”
in the field of higher education 4. Natural Sciences, Mathematics, and Informatics,
Professional field 4.5 Mathematics,
Doctoral Programme Probability Theory and Mathematical Statistics

By order № 90/18.11.2025 of the Director of the Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences (IMI–BAS), I have been appointed as a member of the Scientific Jury for the procedure for the defense of the PhD dissertation entitled *Application of stochastic and optimization methods for risk management and pricing of financial instruments* submitted for the award of the educational and scientific degree “**Doctor**” in the field of higher education 4. Natural Sciences, Mathematics, and Informatics, Professional field 4.5 Mathematics, Doctoral Programme *Probability Theory and Mathematical Statistics* (Financial Mathematics) . The author of the dissertation is Dragomir Kolev Nedelchev, a part-time PhD student at the Section of Operations Research, Probability and Statistics of IMI–BAS, with scientific supervisor Assoc. Prof. DSc Tsvetelin Zaevski. The present statement has been prepared in accordance with the requirements of of the Law on the Development of Academic Staff in the Republic of Bulgaria (LDASRB), the Rules for its implementation, the Regulations on the Conditions and Procedure for Acquiring Scientific Degrees and Holding Academic Positions at BAS, and the relevant regulations of the Institute of Mathematics and Informatics at BAS.

1. General characteristics of the dissertation thesis

The dissertation thesis is written in English and has a total length of 126 pages. It consists of a declaration of originality, an abstract, a table of contents, an introduction, eight chapters, concluding remarks and directions for future research, acknowledgements, a section on the scientific contributions of the dissertation, and a list of references comprising 196 titles. Lists of publications and conference presentations related to the dissertation topic are not included.

The dissertation complies with the generally accepted requirements for a work submitted for the award of the educational and scientific degree “Doctor”. A complete set of the required accompanying documents has also been submitted in electronic form.

2. Main scientific contributions

The dissertation contains significant theoretical, methodological, and empirical contributions in the fields of financial mathematics, stochastic modeling, and market risk management. The main scientific results can be summarized as follows:

- A unified framework has been developed for the application and comparison of classical and modern risk measures such as Value at Risk (VaR), Expected Shortfall (ES), Expectile Risk Measure (ERM), and Entropic Value at Risk (EVaR) within five contemporary stochastic return models: the Black–Scholes model, the exponential tempered stable model, the Heston model, the Bates model, and a stochastic volatility jump model. This comparative analysis substantially extends existing studies, which are typically limited to individual models or risk measures.

- The use of truncated expectation has been introduced and theoretically justified, derived via the characteristic function of the underlying stochastic process. On this basis, new formulas for the computation of Expected Shortfall and Expectile Risk Measure have been obtained, representing an original contribution both theoretically and computationally.

- A novel approach to the Heston model has been proposed, in which log-returns are treated as new random variables obtained by averaging over the stationary distribution of the volatility process. The abscissas of convergence of the corresponding moment generating functions have been identified, and all possible configurations of these abscissas have been analyzed. The approach has been successfully extended to more complex models such as the Bates model and stochastic volatility models with infinite-activity jumps.

- A comprehensive theoretical framework for Entropic Value at Risk (EVaR) in the context of market risk management has been developed. A formula for the acceptance set of the measure has been derived, a theorem for its computation via minimization of a function related to the moment generating function has been proved, and explicit EVaR formulas have been obtained for all considered stochastic models.

- An in-depth empirical study based on 23 years of historical data for the S&P500 index has been conducted, covering both tranquil market periods and periods of severe financial

crises. The results demonstrate the superior sensitivity and stability of EVaR under crisis conditions, as well as the better performance of stochastic volatility models with jumps in describing real market risk.

- It has been demonstrated that the volatility of the S&P500 index exhibits rough behavior, with the Hurst index being less than 1/2 and evolving over time in "packages" with transition periods between them. This result contributes to contemporary research on rough volatility modeling.

- The analysis of the relationship between the scaling factor and the Hurst index has been extended to several major market indices (S&P500, STOXX50E, FTSE, and KSE), showing that this relationship is linear only for S&P500 and nonlinear for the remaining indices.

3. Approbation of the results

The results presented in the dissertation thesis of Dragomir Nedelchev have been published in three scientific publications: two in journals with an Impact Factor and one in the proceedings of an international conference, as follows:

- International Review of Financial Analysis **(**IF 2023 7.5 Q1)
- International Scientific Conference IMEA'2024, 13 Nov – 15 Nov 2024, Pamporovo, Bulgaria
- Comptes rendus de l'Academie bulgare des Sciences (IF 2025 0.3 Q1)

The total Impact Factor is **7.8**, which is notably high for a PhD candidate. All publications are written in English and co-authored with the scientific supervisor. I consider the PhD candidate's contribution to the joint publications to be equal. A particularly strong impression is made by the number of citations of the publications related to the dissertation: **13** citations indexed in SCOPUS and/or Web of Science, as well as **11** additional citations.

The candidate meets the minimum national requirements for the award of the educational and scientific degree "Doctor" in Higher Education Area 4. Natural Sciences, Mathematics and Informatics, Professional Field 4.5 Mathematics, as shown in the table below:

A group of metrics	Submitted material of candidate	**Minimum number of points by law**	**Number of points to candidate**
A. Dissertation thesis	Dissertation thesis	50	50
C. Scientific publications (outside the habilitation thesis)	*Publications*: - 2 3 publications in journals with JCR quartiles: Q1 (1 pub.) ⇒ 1x75=75 points; Q4 (1 pub.) ⇒ 1x36=36 points - 1 publication without point contribution	30	111
	TOTAL	**80**	**161**

As a result, the candidate Dragomir Nedelchev meets and exceeds the minimum national requirements under the Regulations for the Implementation of LDASRB for the award of the PhD degree. The submitted documents do not include a separate report on conference presentations related to the dissertation topic. However, the overall evaluation for admission to the pre-defense shows that the PhD candidate has delivered three presentations at international conferences and four presentations at national conferences and seminars. I have not identified any plagiarism in the candidate's work within the meaning of the Law on the Development of the Academic Staff in the Republic of Bulgaria.

4. Critical comments and recommendations

I have no critical comments and recommendations. I hope the candidate will continue actively doing research in the area in the future as well.

5. Abstract

The abstract is presented in Bulgarian (34 pages) and in English (32 pages). It accurately reflects the content, results, and contributions of the dissertation thesis. The main scientific contributions are correctly presented in the author's summary.

6. Conclusion

Based on the presented scientific contributions and the submitted documents, I believe that all requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria (LDASRB), the Rules for its implementation, the Regulations of BAS, and the relevant regulations of the Institute of Mathematics and Informatics at BAS have been fully satisfied.

The analysis of the candidate's achievements gives me every reason to provide **a strictly positive** evaluation and to recommend to the Scientific Jury to prepare a report proposing the award of the educational and scientific degree "**Doctor**" of **Dragomir Kolev Nedelchev** in the field of higher education 4. Natural Sciences, Mathematics, and Informatics, Professional field 4.5 Mathematics, Doctoral Programme Probability Theory and Mathematical Statistics.

Plovdiv
05.01.2026 г.

Reviewer:
/ Assoc. Prof. Maria Vasileva-Chilibinova, PhD/