REVIEW

by **Acad. Ivan P. Popchev** – BAS

of dissertation work for acquiring the educational and scientific degree

"**Doctor**"

in professional direction 4.5 "Mathematics"

Doctoral program "Theory of probability and Mathematical Statistics"

Titled "Application of Stochastic and Optimization Methods for Risk Management and Pricing of Financial Instruments"

by **Dragomir Colev Nedetchev**

By Order № 90/18.11.2025 of Corr. Member Prof. DSc. P. Boyvalenkov – Director of IMI – BAS in accordance with Art. 4, para. 2 of the Act of Development of the Academic Personnel of the Republic of Bulgaria (ADAPRB) and with the decision of the Academic Council of IMI (rec. of proceedings № 13 from 14.11.2025) for awarding of educational and scientific degree "doctor" in professional direction 4.5 "Mathematics", doctoral program "Theory of Probability and Mathematical Statistics" by Dragomir Colev Nedeltchev of dissertation work titled "Application of Stochastic and Optimization Methods for Risk Management and Pricing of Financial Instruments" I have been appointed as a member of the Scientific Panel.

What primes for assessing the dissertation work is the terms of the ADAPRB, the RAADAPRB (Decree № 26 of 13 February 2019) and the Rules for specific requirements of IMI-BAS for the application of the law and therefore they will be accurately delivered:

1. According to Art. 27 (1) of ADAPRB "the dissertation work shall contain scientific or applied research results that represent an original contribution to science. The dissertation shall show that the candidate has profound theoretical knowledge in the respective subject, as well as their abilities of independent scientific research."
2. According to Art. 27 (2) of ADAPRB "the dissertation work should be presented in a form and volume corresponding to the specific requirements of the primary unit. The dissertation work should contain title page; contents; introduction; presentation; conclusion – summary of the obtained results, accompanied by a declaration of originality; bibliography."

The scientific supervisor of the dissertation is **Assoc. Prof. Tsvetelin Zaevski, DSc.**

The **aim** of the dissertation is formulated on page 1 and it is "exploring the application of sophisticated market risk measures to asset log-returns models that capture various patterns of the market realities".

The dissertation pursues the **following tasks**:

- To present the assets via stochastic models and on this basis to derive the risk measures.

- To present the log-returns of the Heston model and the models that upgrade it as a new random variable via averaging the volatility process over its stationary distribution.
- To elaborate formula for the Entropic VaR via minimization of a MGF-related function.
- To derive patterns of risk measures behavior for the concerned models over a long time period that includes both normal market functioning and market crises.
- To derive the value of the Hurst index value for the log-volatility of leading market indices.

The dissertation is in English and consists of totally 134 pages, 11 figures, 9 tables, 196 references and it includes:

- Introduction (**Chapter 1**, 1-14);
- Preliminaries (**Chapter 2**, 15-22);
- Models for stock log-returns (**Chapter 3**, 23-26);
- Quantile-based Risk Measures (**Chapter 4**, 27-32);
- Expectile-based Value at Risk (**Chapter 5**, 33-46);
- Averaging over the volatility (**Chapter 6**, 47-56);
- Entropy-based Value at Risk (**Chapter 7**, 57-68);
- Computations and empirical results analysis (**Chapter 8**, 69-90);
- Rough Volatility: A New Stylized Fact (**Chapter 9**, 91-98);
- Concluding remarks and further works (**Chapter 10**, 99-104);
- Scientific Contributions (**Chapter 11**, 105-106);
- References (107-134).

3 publications on the topic of the dissertation are presented.

The analysis of these publications shows the following:

- 2 publications have IF/SJR (№ 1 - 7.5/Q1 and №3 - 0.3/Q4).
- One publication is in conference proceedings (№2).
- The three publications are co-authored with the scientific supervisor and are in English (NN№ 1, 2 and 3).

There are 23 citations for publication №1, of which 12 are in WoS or Scopus, 3 in other titles and 8 in deposit banks.

There is 1 citation in WoS or Scopus for **publication №2**.

The requirements of the ADAPRB, the RAADAPRB and the specific requirements of IMI – BAS for acquiring the educational and scientific degree "doctor" in professional direction 4.5 "Mathematics" are fulfilled.

Chapter 11 (pp. 105-106) contains six groups of scientific contributions without estimation according to Art. 27 (1) RAADAPRB whether **they constitute original scientific contribution**.

The obtained results can be briefly summarized in the following way:

1. The application of five famous stochastic models results in the presentation of four risk measures: Value at Risk, Expected Shortfall, Expectile Risk Measure and Entropic Value at Risk.
2. There are formulas to calculate the Expectile Risk Measure and the Expected Shortfall via the truncated expectation.
3. The averaged log-returns of the Heston model are presented as a new random variable and this approach is applied to the Bates model and the model with stochastic volatility and tempered stable jumps.
4. Derived are formulas for calculating the Entropic Value at Risk for the following cases:
    - the Black-Scholes model,
    - the Heston model,
    - the Bates model,
    - the exponential model with tempered stable process,
    - the model with stochastic volatility and jumps with tempered stable process.
5. Subject to research are the risk measures of five models for S&P500 index during the last 23 years and the Hurst index for the momentous log-volatility of indexes: S&P500, STOXX50E, FTSE, and KSE

Critical notes:

1. The dissertation does not cover “application of … optimization methods … and pricing of financial instruments”.
2. There is no definition for the following terms: risk, market risk, risk management, and financial crisis.
3. Some citations in deposit banks contain gaps like: the author (bank), the year, pages, publishing house, etc.
4. Only the abstracts but not the dissertation propose “further researches to create eco-system of the volatility-related stylized facts”.

Questions on the dissertation work:

1. For which scientific contributions there are proofs they constitute original contribution to the science? What criteria are applicable for an original scientific contribution?
2. A good match is found between the theoretical and the empirical values of the VaR, the ES, and the ERM. Why such good match is not found for the Black-Scholes model?
3. Which factors determine the better EVaR reaction to financial crises? How exactly is the reaction measured?
4. Which criteria were applied to select the four market indexes: S&P500, STOXX50E, FTSE, KSE, instead of Dow Jones and NASDAQ?
5. What are the supposed “conclusions of academic and practical benefits” from creating an “eco-system of volatility-related stylized facts”?

A generalized "**scientific-metric profile**" of the doctoral student Dragomir Nedeltchev can be built on data available in world scientific databases like:

- Scopus: 2 documents, 12 citations, h-index 1;
- Web of Science: 2 publications, 12 citing articles, h-index 1, sum of times cited 12;
- Scholar.google: 24 citations, h-index 1, i10-index 1;
- Researchgate: Research Index Score 19.0, 22 citations, h-index 1.

The Abstracts are in Bulgarian and English, respectively including totally of 40 and 38 pages and present the dissertation.

CONCLUSION

The dissertation work fulfils the requirements of ADAPRB, RAADAPRB and the specific requirements of the IMI-BAS.

I give a **positive conclusion** for acquiring the educational and scientific degree **"Doctor" to Dragomir Colev Nedeltchev**.

I propose to the Scientific Panel to unanimously vote for Dragomir Colev Nedeltchev the educational and scientific degree "Doctor" on 4.5 "mathematics", doctoral program "Theory of probability and Mathematical Statistics".

04 December 2025

Sofia