REPORT

by **Assoc. Prof. Andrey Andreev Vassilev, PhD**,

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on the competition for the academic position of Professor in Area of Higher Education 4. "Natural Sciences, Mathematics and Informatics", Professional Field 4.5. "Mathematics", Scientific Specialty "Operations Research" (Financial Mathematics) at the Institute of Mathematics and Informatics (IMI) at the Bulgarian Academy of Sciences (BAS), announced in State Gazette 63/10.07.2026

with the sole candidate **Associate Professor Tsvetelin Stefanov Zaevski, DSc**

This report has been prepared in my capacity as member of the Scientific Jury according to Order № 73/23.07.2026 of the Director of IMI-BAS. This report has been prepared in accordance with the requirements of the Act on Development of the Academic Staff in the Republic of Bulgaria (ADASRB), the Rules for Implementation of the ADASRB, the Rules on the Terms and Requirements for Acquisition of Scientific Degrees and Occupation of Academic Positions of BAS and the corresponding Rules of IMI-BAS.

1 Information about the candidate

The sole applicant in the competition is Associate Professor Tsvetelin Stefanov Zaevski, DSc. Associate Professor Zaevski obtained a Master's degree in Applied Mathematics, specialising in mathematical economics, from Sofia University St. Kliment Ohridski in 1999. In 2013, he was awarded a PhD by the Faculty of Mathematics and Informatics at Sofia University St. Kliment Ohridski with a thesis entitled "Combined Itô and Lévy Processes".

In 2014, Tsvetelin Zaevski joined IMI-BAS as assistant professor and was promoted to associate professor in 2021. From 2020 to 2024, he was secretary of the "Operations Research, Probability and Statistics" department, and has been serving as head of the department since 2024. In 2025, he defended his Doctor of Science (DSc) thesis entitled "A Method for Valuing American-style Derivatives" at IMI-BAS.

Associate Professor Zaevski is the author of 63 scientific publications with over 220 citations. He has participated in six research projects. Between 2004 and 2009, he led the seminars for the course "Theory of Finance 2" at the Faculty of Mathematics and Informatics, Sofia University St. Kliment Ohridski. Since 2019, he has been teaching the

course “Mathematical Theory of Financial Markets’ there. He has supervised one PhD student at IMI-BAS.

2 Compliance with the requirements for appointment to the academic position

According to the provided report on the fulfilment of the minimum requirements by a candidate for the competition for the academic position of Professor at IMI-BAS, the points for the materials submitted by Associate Professor Zaevski are allocated as follows:

- Group A (required minimum of 50 points):

  1. Dissertation for the award of the educational and scientific degree “Doctor” (PhD) – 50 points

- Group B (required minimum of 100 points):

  4. Habilitation work – scientific publications in scholarly publication venues indexed and abstracted in internationally recognized scientific databases – 150 points

- Group Г (required minimum of 220 points):

  7. Scientific publications in scholarly publication venues indexed and abstracted in internationally recognized scientific databases, excluding those included in the habilitation work – 406 points

- Group Д (required minimum of 140 points):

  11. Citations in scientific publications, monographs, edited volumes, and patents indexed and abstracted in internationally recognized scientific databases – 594 points

- Group E (required minimum of 150 points):

  12. Award of the scientific degree of Doctor of Science (DSc) – 75 points
  13. Supervision of a doctoral student who has successfully defended their dissertation – 50 points
  14. Participation in a national research or educational project – 30 points
  15. Participation in an international research or educational project – 20 points
  20. Published university-level teaching material or educational material used in schools – 6 points

      Total for Group E – 181 points

I assume equal contributions by all co-authors to the jointly authored publications.

There is no evidence of plagiarism in the submitted works. The additional requirements specific to IMI for candidates for the academic position of Professor in Area of Higher Education 4. "Natural Sciences, Mathematics and Informatics", Professional Field 4.5. "Mathematics", have been met.

On the basis of the materials submitted by Associate Professor Zaevski, it can be concluded that the candidate meets, and in some respects significantly exceeds, the requirements for the academic position of Professor in the relevant area and professional field.

3 General overview of the scientific works submitted for the competition

Associate Professor Zaevski submitted 16 scientific publications for consideration in the competition. All the publications submitted appear in scholarly publication venues indexed and abstracted in internationally recognized scientific databases, with 14 of them appearing in journals with an impact factor. The submitted publications are distributed across quartiles as follows: Q1 – 6 publications, Q2 – 6 publications, Q3 – 4 publications.

The submitted publications can be broadly divided into three groups. Publications numbered 1–5 investigate various issues related to the Kies distribution. Options for modifying the distribution are considered, and various characteristics of the proposed modifications are studied. For some of the modifications developed, empirical applications have been conducted using financial market data.

Publications numbered 7–16 are in the field of financial mathematics. The results obtained address issues in risk theory, the valuation of financial derivatives (American-style derivatives) and the modelling of the term structure of yields. These publications present both theoretical results and empirical applications.

Publication number 6 is in the field of dynamical systems and investigates the behaviour of variants of a system that can be interpreted as representing a specific epidemiological model. The conditions under which the system may exhibit chaotic behaviour are examined. The developed framework has potential applications in the theory of antenna diagrams.

4 Scientific and applied scientific contributions

In accordance with the grouping of the submitted scientific works, the candidate's contributions can also be divided into three research areas.

- **Modifications of the Kies distribution.** Corrections to results in the literature concerning a four-parameter generalization of the Kies distribution are presented. A modification of the Kies distribution is proposed and its properties are investigated, including an analysis of its tail behaviour using measures from financial risk theory and a derivation of the Hausdorff saturation of the distribution. A min-Kies distribution is defined and some of its properties are established. Mixtures of Kies distributions are investigated, with results obtained for the corresponding cumulative distribution

functions, probability density functions, and Hausdorff saturation. Cases involving trigonometric transformations of the Kies distribution are also examined. The various resulting distributions are tested against financial data.

- **Financial mathematics.** The behaviour of the classical risk measures VaR and ES, as well as an expectile-based risk measure, is investigated in the context of selected stochastic models (Black–Scholes, Heston, Bates, the exponential tempered stable model, and a stochastic volatility model with tempered stable jumps). An approach based on averaging over the stationary distribution of volatility is proposed as a way to address the unobservability of volatility in the Heston model and related models. The properties of the entropic VaR risk measure are investigated under various stochastic models. Results are obtained concerning the optimal boundary for American-style futures, including its numerical approximation and the pricing of the corresponding derivatives. Results are also obtained for the pricing of American-style power options. A definition of ϵ-optimality is introduced for American-style options, and valuation methods are developed for cases in which the option holder exercises the option within the corresponding neighbourhood of the optimal boundary. Variants of cancellable (game) American-style options with a three-component penalty are investigated, with results on the optimal boundary and on pricing established for call options, and a parametric analysis of the resulting option subtypes performed for different values of the remaining time to maturity and the coefficients of the penalty components. Put-call duality results are obtained for cancellable American-style options with a three-component penalty. A framework for constructing yield curves based on primary-market data for government securities is developed, with applicability to illiquid markets. An important contribution in this research area is the empirical work carried out on some of the models, which validates the practical applicability of the respective results.

- **Chaos in perturbed dynamical systems.** Modified variants of an SIQR-type epidemiological model are proposed, and the corresponding dynamical systems are investigated using Melnikov's approach to establish conditions for the occurrence of chaotic behaviour.

5 Critical comments and recommendations

I have no critical comments regarding the applicant. I recommend that he continue his active research work.

6 Conclusion

From the materials provided, I can conclude that Associate Professor Zaevski is an established scholar in the field of financial mathematics, as well as, more generally, in the field of

mathematical modelling and the applications of mathematics. This is evidenced by his publication record and the citations of academic works to which he has contributed. In addition, Associate Professor Zaevski is active within the academic community as a participant in projects, as well as a lecturer and research supervisor.

Associate Professor Zaevski fully meets the requirements of ADASRB, the Rules for Implementation of the ADASRB, the Rules on the Terms and Requirements for Acquisition of Scientific Degrees and Occupation of Academic Positions of BAS and the corresponding Rules of IMI-BAS concerning the appointment to the academic position of Professor in the relevant field.

On the basis of the above, I give my unequivocally positive assessment of the candidate and strongly recommend that the members of the Scientific Jury vote in favour of the appointment of Associate Professor Tsvetelin Stefanov Zaevski, DSc, to the academic position of Professor in Area of Higher Education 4. "Natural Sciences, Mathematics and Informatics", Professional Field 4.5. "Mathematics", Scientific Specialty "Operations Research" (Financial Mathematics) at IMI-BAS.

06.11.2026 *Member of the Scientific Jury:*

/Assoc. Prof. Andrey Vassilev, PhD/